Barriers to Green IT Service Management: A Case Study

Research-in-Progress

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Abstract

This paper focusses on the barriers and factors affecting Green IT Service Management (ITSM) implementation and practices. To contribute to the body of knowledge on Green ITSM innovation, we performed an exploratory case study with the primary IT service provider of an Australian State Government, the Center of Information Technology and Communication (CITEC). A systematic literature review included the IT Infrastructure Library® (ITIL®v3) framework to identify its coverage of Green ITSM concepts. Structured interviews with CITEC's Subject Matter Experts (SMEs) are underway to gather experts' perceptions on the Green ITSM implementation related issues. This research-in-progress paper proposes that Green ITSM can deliver a competitive advantage to businesses over traditional ITSM frameworks. The insights gained in this study highlight the technology, institutional and individual factors that can help and hinder an IT organization's goal to contribute in a positive way to the environment.

Keywords

Green IT, IT Service Management, ITIL, case study.

Introduction

The aim of this research is to explore barriers and factors that affect the implementation of Green IT Service Management (ITSM) practices. The exponential growth in the energy consumption of IT resources forces ITSM to play an important role in the struggle against global climate change. To contribute to the body of knowledge on Green ITSM innovation and generate new ideas, an exploratory case study is performed with the primary IT service provider of an Australian State Government, the Center of Information Technology and Communication (CITEC). As most large organizations base their ITSM on the IT Infrastructure Library (ITILv3), a systematic literature review included the ITILv3 framework to identify its coverage of Green ITSM concepts. Structured interviews with CITEC's Subject Matter Experts (SMEs) are underway to gather experts' perceptions on the Green ITSM implementation related issues. This research effort has received CITEC executive management's endorsements and cooperation from the workforce.

In the field of IT, the terms 'green' and 'sustainable' are often used interchangeably and their recent surge in interest is claimed to be directly associated with budgetary concerns (Winniford et al. 2009). Modern businesses rely heavily on their ITSM processes to deliver their customers' value-based outcomes (Pollard and Cater-Steel 2009). Gartner predicts that by 2016, sustainability-related corporate expense will be the fastest-growing enterprise compliance cost worldwide (Gartner 2010). Large organizations spend between four and ten percent of their IT budget on energy (Gershon 2008). The economic aspect of sustainability raises the question of potential bias where IT organizations with a specific economy-focus stumble on cost challenges and drift away from their framework's recommendations (Butler and Daly 2009). Fujitsu's 2011 IT sustainability Global Benchmark report shows Australia as a midrange Green IT performer with the lowest End User Index (EUI) component in the seven nations report (Fujitsu 2011). The responsibility to contain the exponential growth of Greenhouse Gas (GHG) emissions rests with both government and business sectors alike (TCG 2009). The IT industry accounts for more than two percent of total GHG emissions worldwide and is estimated to touch the three percent mark by 2020 (Gartner 2007). United Nations directives are to keep greenhouse gases such as carbon dioxide (CO_2) emissions under control in

order to restrict the global temperature rise to less than 2°C of pre-industrial temperature levels by 2020 (UN 2002).

Practice is leading academia with limited perspectives and advice to IT managers on the practical relevance and importance of Green ITSM (Cater-Steel and Tan 2010). The lack of academic research has generated gaps in transforming Green ITSM concepts to the business level technical realities (Jenkin et al. 2011). This research paper conforms to the unbiased approach taken by the two principal sources, namely the work of Cater-Steel and Tan (2010) on the role of IT Service Management in Green IT, and the publication of Schmidt et al. (2009) towards a Procedural Model for Sustainable Information Systems Management.

This research-in-progress paper proposes that Green ITSM can deliver a competitive advantage to businesses over traditional ITSM frameworks, and explores the perceptions, barriers and factors affecting Green ITSM implementation. The insights gained in this study will provide validation of existing sustainability guidelines, along with suggesting new artifacts that could be developed for future Green ITSM research to help ITSM practitioners and researchers in their environmental contributions.

Systematic Literature Review

Our Green ITSM research follows mapping of existing knowledge in the ITSM and IS field with a systematic literature review to gather and evaluate topic-based evidence to answer research questions (Kitchenham et al. 2008). The review protocol used by Biolchini et al. (2011) is followed to compare different ITSM studies to avoid duplication and potential bias in the literature search. The literature review initially identified 121 peer reviewed journal articles and papers from the EBSCOhost suite of journals, search engines, conferences, reports, and books, published between January 2000 and January 2014. Of these 78 papers were selected for the research systematic literature review on the following topics: Green IT, Sustainable IT, Green ITSM, Sustainable ITSM, ITIL and ITILv3. The literature review concluded with five research questions, the theoretical foundation and conceptual model.

History of Sustainability Research

The concept of environmental sustainability has deep roots in human history. HRH Charles the Prince of Wales observed that different civilizations were involved in sustainable practices during the course of ancient and medieval history, citing an example of saving water even near a flowing river (Majah 2010; OCIS 2010). President Nixon launched a 20th century sustainability drive in 1969 with the creation of the Environmental Protection Agency (EPA) in the USA. The Stockholm Conference in 1970 created the United Nations Environmental Program (UNEP) for global environmentally-sound future developments (EPA 2012). The IT sustainability research works are traced as early as 1994, dealing with energy consumption, energy efficiency and toxic hardware disposal policies (Dedrick et al. 2010). The real breakthrough came in 2007 with Gartner's estimate that IT accounts for two percent of the global CO_2 emission (Gartner 2007).

Green Concepts in IT Industry

The terms sustainability and Green IT are widely used under the corporate social responsibility (CSR) banner in the scientific and practitioner literature (Bose and Luo 2011; Montiel 2008). Sustainability has been best defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Walsh 2007). Green IT has been referred as an oxymoron, with suggestions to rename it 'Greener IT' (Ferris 2011). Murugesan (2008) defines Green IT as the practice of designing, manufacturing, usage, and disposal of IT hardware with minimal or no impact on the environment. The itSMF-USA Sustainable 360 Special Interest Group (SIG) initiative identifies green opportunities in IT departments as ITSM process-based practices (Dubey and Hefley 2010). An exploratory survey analysis of the relationship between ITSM and Green IT observed limited guidance available in the ITIL framework to support Green IT programs. The use of ITILv3 framework was common in all the survey respondents' organizations (Cater-Steel and Tan 2010).

Information Technology Infrastructure Library (ITILv3)

ITIL® Version 3 is a set of comprehensive documentation of best practices on business delivery of IT services, fit for purpose and fit for use (OGC 2011). Figure 1 shows the five ITILv3 lifecycle phases and associated processes. ITILv3 can accommodate Green IT in each phase:

- Service strategy phase sets sustainability goals for CSR oriented organizations in the form of value creation offerings and financial incentives such as green services catalogues and portfolios (Soomro and Hesson 2012).
- Service design phase allows the Green IT champions to create realistic power saving targets in their service level agreements (SLAs).
- Service transition phase controls infrastructure sites and manages GHG footprints reduction through central configuration management database (CMDB).
- Service operation phase manages the IT Business as usual (BAU) activities which can be used to create green incidents and problem management tools for CRC commitments (Montiel 2008).
- The continuous service improvement (CSI) phase runs the continuous alignment of service portfolios which can be utilized for GHG emissions controls with the help of the Deming cycle (plan, do, check, act) and the 7-step improvement process tools (O'Neill 2010).

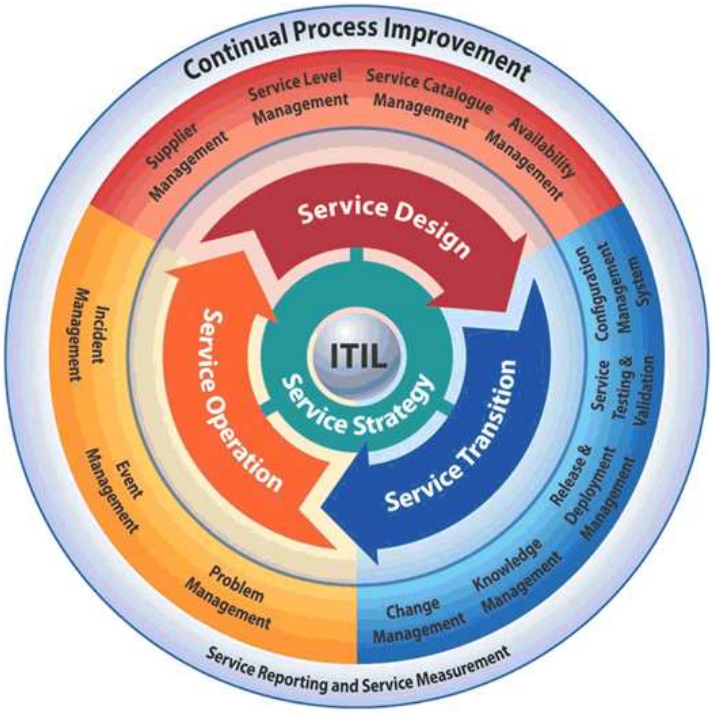

Figure 1. ITILv3 Phases and Processes

Source: (APM 2009)

The corresponding Green options in the ITILv3 processes are shown in the Table 1.

Process	Green IT Options
Phase: Service Strategy	
Financial Management (FM)	Value creation; financial incentives; carbon credits; carbon offsets
Service Process Management (SPM)	Green service catalogues creation
Demand Management (DM)	Demand management portfolios and service automation trade-offs
Phase: Service Design	
Service Level Management (SLM)	Green service levels
Capacity Management (CM)	'Follow the Moon' service provision
Availability Management (AM)	Facilities Management FM (24x7) support Standard FM (8AM-6PM) support
Supplier Management (SM)	Supplier control with a central database to enable checks for adherence to Restriction of Hazardous Substances (RoHS), Waste Electrical and Electronic Equipment (WEEE) and Australian Directives
Phase: Service Transition	
Service Access and Configuration Management (SACM)	Reuse or recycling of decommissioned configuration items
Change Management (CM)	Change management database and Change Advisory Board following Green Practices
Phase: Service Operation	
Event Management (EM)	Control carbon reduction commitments by power consumption analysis
Problem Management (PM)	Control data center building & hardware temperature threshold
Service Desk (SD)	Use of virtual helpdesk systems
Phase: Continuous Service Improvement	
Service Review	Continuous alignment of Green Service Portfolios
Process Evaluation	Use of Deming Cycle to consider Green options at every phase
Monitoring of CSI Initiatives	Use of 7-Step Improvement Process to evaluate Green options at every phase

Table 1. ITILv3 Processes and Green Options

Green IT Service Management (Green ITSM)

Green ITSM covers the purchase of energy efficient computing equipment, and management of power to reduce energy consumption of data centers with the help of data center design, service consolidation, virtualization, recycling and waste disposal to reduce heating and cooling costs (Belady et al. 2008). The SMART 2020 report by McKinsey & Company states that whilst IT's own sector footprint will almost double by 2020, IT's unique ability to monitor and maximize energy efficiency could cut CO_2 emissions by up to five times this amount. This corresponds to a saving of 7.8Gt CO_2 equivalent by 2020, representing a value of US$872.3 billion savings in energy and fuel, and the ability to create 15 million green jobs globally by the year 2020 (TCG 2008). The recent 2012 SMARTer 2020 report has elevated this figure to 9.1 $GtCO_{2e}$ corresponding to US$1.9 trillion savings by the year 2020 (GeSI 2012).

Theories Related to Green ITSM

A number of theories relevant to Green ITSM implementation are considered to formulate the research questions and theoretical framework.

Diffusion of Innovation Theory. An innovation is a unique idea to apply a new solution to an existing need with five distinct characteristics differentiating it from an invention (Rogers 2003). Green ITSM has

relative advantage as a non-serious Green IT attitude can be extremely damaging to the business reputation (O'Neill 2010). Green ITSM's *compatibility* is evident from Y generation's heightened interest in buying environmentally friendly products compared to other age groups (GreenBiz 2005). Some of the green options of ITILv3 are *trialable* in the lab environment (Yanga and Liub 2006). Green ITSM innovation's *observability* is evident through Stanford University's Green IT drive in their Strategic Plan 2012-2014 (Stanford 2012). Green ITSM implementation can be *simple* as well as *complex* (O'Neill 2010).

Resource Based View of the Firm Theory. This theory views a firm from its bundle of tangible or non-tangible resources rather than the long dominant market-based view (Barney et al. 2011; Peteraf 1993). The Green ITSM resources can be divided into technology, processes and people which are required to meet a firm's business challenges in a green environment (Kraaijenbrink et al. 2010).

Sustainability in Australian Business Theory. The higher level of bonding between ITSM and sustainability is directly associated with an organization's performance and profitability (Linnenluecke and Griffiths 2010; Schmidt 2011). Australian organizations are uncertain about environmental sustainability beyond their regulation compliance and competitive advantage (Dunphy et al. 2007). The Australian Government Information Management Office (AGIMO) has developed a Data Center Strategy 2010-2025, a Green IT Scorecard, and a checklist for sustainability awareness among the government agencies (AGIMO 2010).

Competitive Advantage. Competitive advantage is the ability to excel and occurs when a business develops an attribute that allows it to outperform its competitors (Dierickx and Cool 1989; Peteraf 1993). The Five Forces theory proposed by Porter discusses the ways competitive forces shape business strategy (Porter 1986).

Research Questions

The main research question is formulated to explore SMEs' perceptions on the barriers and factors affecting Green ITSM implementation. The main research question is broken down to four sub-questions. The first research sub-question is about SMEs' perceptions of Green ITSM; the second is to validate the use of existing government sustainability regulations and energy metrics; the third is to explore the sustainability aspects of the case study's ITILv3 framework resources; and the fourth research sub-question is to deliberate on the Green ITSM assisted organizational competitive advantage. Table 2 shows the list of research questions and the associated theories.

Research Questions	Foundation Theories
Research Question (Main): *What are the barriers to Green ITSM implementation of Green IT targets in a large IT Service provider?*	Rogers's Diffusion of Innovation Sustainability in Australian Businesses Resource Based View of the Firm Porter's Five Forces
SubRQ1: *What are the perceptions about Green ITSM in Australia and how are they reflected in IT Business?*	Rogers's Diffusion of Innovation
SubRQ2: *What are the common features in CITEC ITILv3 framework implementation and the AGIMO's green guidelines and checklists?*	Sustainability in Australian Business
SubRQ3: *What is the relationship between ITILv3 resources and Green ITSM's competencies in terms of sustainability?*	Resource Based View of the Firm
SubRQ4: *What role do the Green IT goals set in an ITILv3 framework-based business strategic plan play in that business's overall competitive advantage?*	Porter's Five Forces Theory

Table 2. List of Research Questions and Relevant Theories

Summary of Literature and Theoretical Framework

The reviewed literature reveals a gap in research to date. Although guidelines and advice have been provided to facilitate Green IT, the barriers to adoption have not been studied. This research project aims to address that gap. At this stage, only two academic studies are found which directly approach the Green aspects of IS and ITSM implementation, namely the work of Cater-Steel and Tan (2010) on the role of IT Service Management in Green IT, and the publication of Schmidt et al. (2009). Rogers's DOI theory (2003) has emerged as providing a theoretical framework to the study as shown in Figure 2.

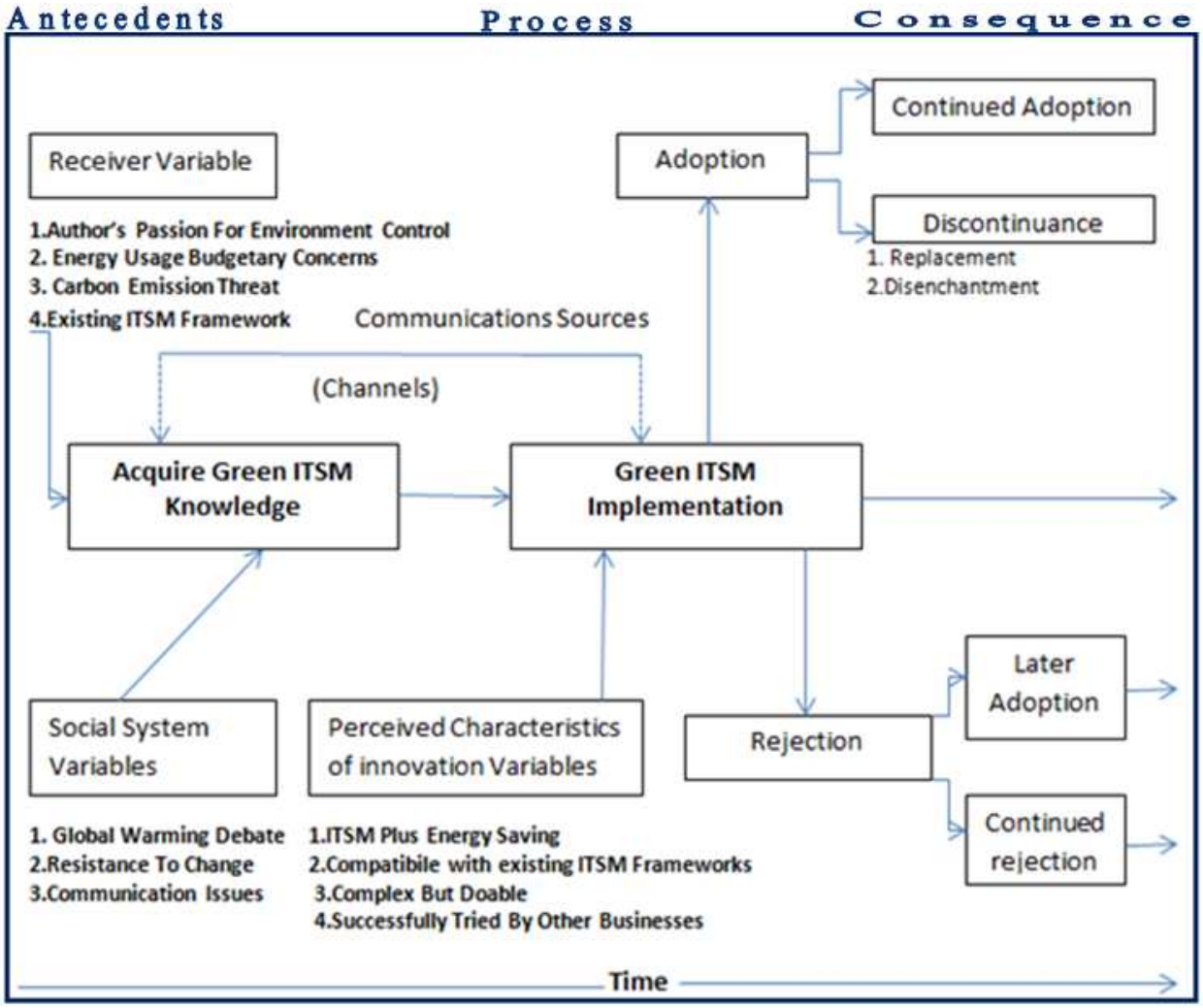

Figure 2. Green ITSM adoption framework

Source: Based on Rogers's DOI theory (Rogers 2003)

The initial DOI stage in the theoretical framework is acquiring Green ITSM knowledge. The innovation receivers' variables, social system variables and their perceived characteristics belong to the Green ITSM knowledge acquisition. The decision stage is where the pros and cons of Green ITSM are weighed. The implementation stage employs all the acquired Green ITSM knowledge and the confirmation or rejection stage settles the decision either to continue with or reject Green ITSM implementation.

The conceptual model shown in the Figure 3 is the outcome from the Green ITSM systematic literature review. Green ITSM research has found that changes in the technology and changes in the organizational behaviors are two of the most important factors affecting Green IT implementation. The ITILv3 framework knowledge, conceptual model, sustainability guidelines and IT energy metrics have constituted

planning for the Green IT targets. The sociological, technological and environmental factors and barriers are responsible for the gaps between the planned Green ITSM targets and the actual Green ITSM processes, defining the core objective of this research.

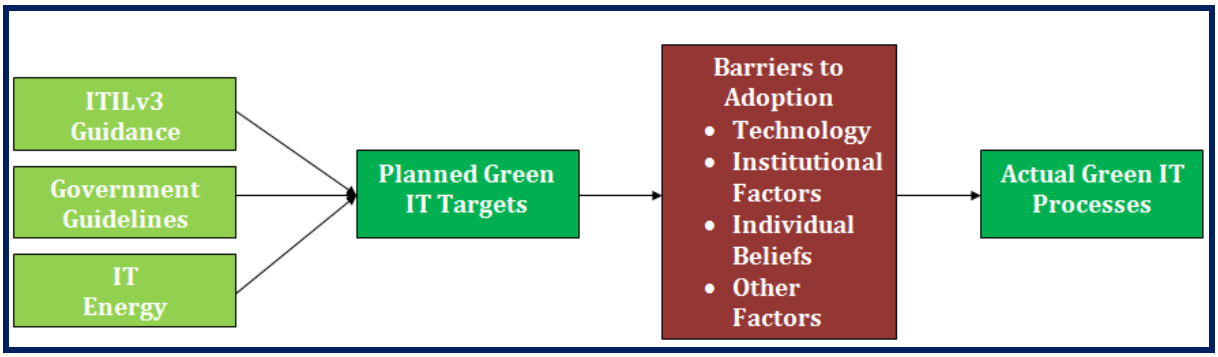

Figure 3. Green ITSM Conceptual Model

Research Methodology

A single exploratory case study method has been selected for this research project to articulate Green ITSM theories and frameworks (Stake 2005; Yin 2011). System requirements and constraints are social constructs and they change as their users' perceptions change. We recognize that the exploratory case study has the limitation of generalization (Hirschheim et al. 1995).

The boundaries between Green ITSM phenomenon and context are not yet clearly evident due to the lack of available hypothetical formulation (Streb 2010). The exploratory case study method follows its own methodology, and uses multiple sources of topics and evidences to develop a valid case study paradigm (Stake 2005). The paradigm includes Green ITSM theoretical propositions combining sustainable activities, events, and structures from theories to produce intricate patterns and valuable findings (Yin 2011). A set of valid Green ITSM hypotheses is formulated through flexible research design, data collection and data analysis methods (Benbasat et al. 1987). A single case study design for Green ITSM research is shown in Figure 4.

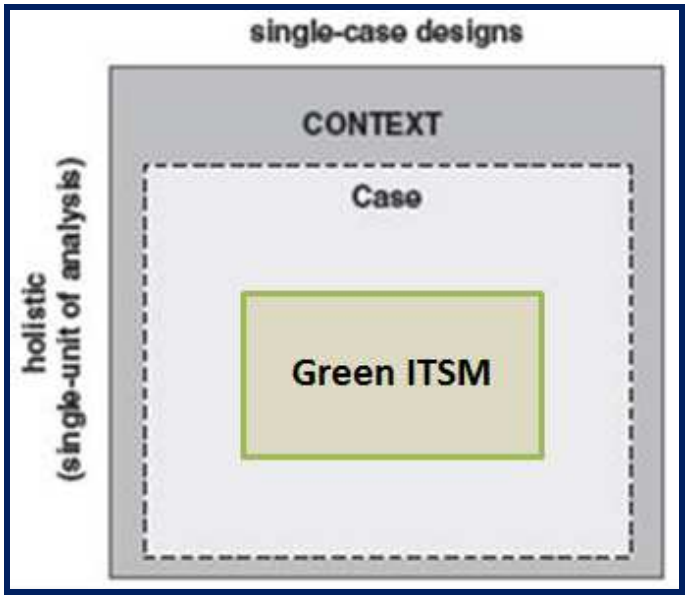

Figure 4. Green ITSM Single Case Study Design

Source: Based on COSMOS Corporation (Streb 2010)

The research approach is limited to a single exploratory case study at CITEC, with Green ITSM serving as the case, and research questions, theoretical framework, and conceptual model as artifacts and constructs. The research questions have been prepared from Green ITSM theories to obtain SMEs' responses and to conduct the analysis (Stake 1995; Streb 2010). Document-based evidence, direct observation and interviews are used as data collection sources to gather narrative qualitative data (Patton 2002). The triangulation of evidence is performed for consistency of the findings to differentiate actual practices and perceptions (Yin 2011). Document-based evidence includes the literature review and transcripts of SMEs' interviews. One member of the research team is a CITEC employee. Direct observation of his workplace Green ITSM practices are recorded in a journal as narrative notes. The SME interview participants are selected to represent the five phases of ITILv3 and include the IT manager, senior IT consultants, and IT staff. Semi-structured interviews are conducted to determine participants' construct reality for Green ITSM activities and situations.

Word processing and qualitative analysis software programs are employed to analyze the interview transcripts. Nvivo10 (2014) is used to code and label the transcripts to extract themes. Figure 5 represents the Green ITSM exploratory case study research process. The research efforts begin with the identification of the Green ITSM-related research gaps in the academic and practitioner fields, which sets the research objectives. The end result in the form of research and practice contributions are reported back to the existing practice and academia journals, conferences and industry reports to kick start future research efforts.

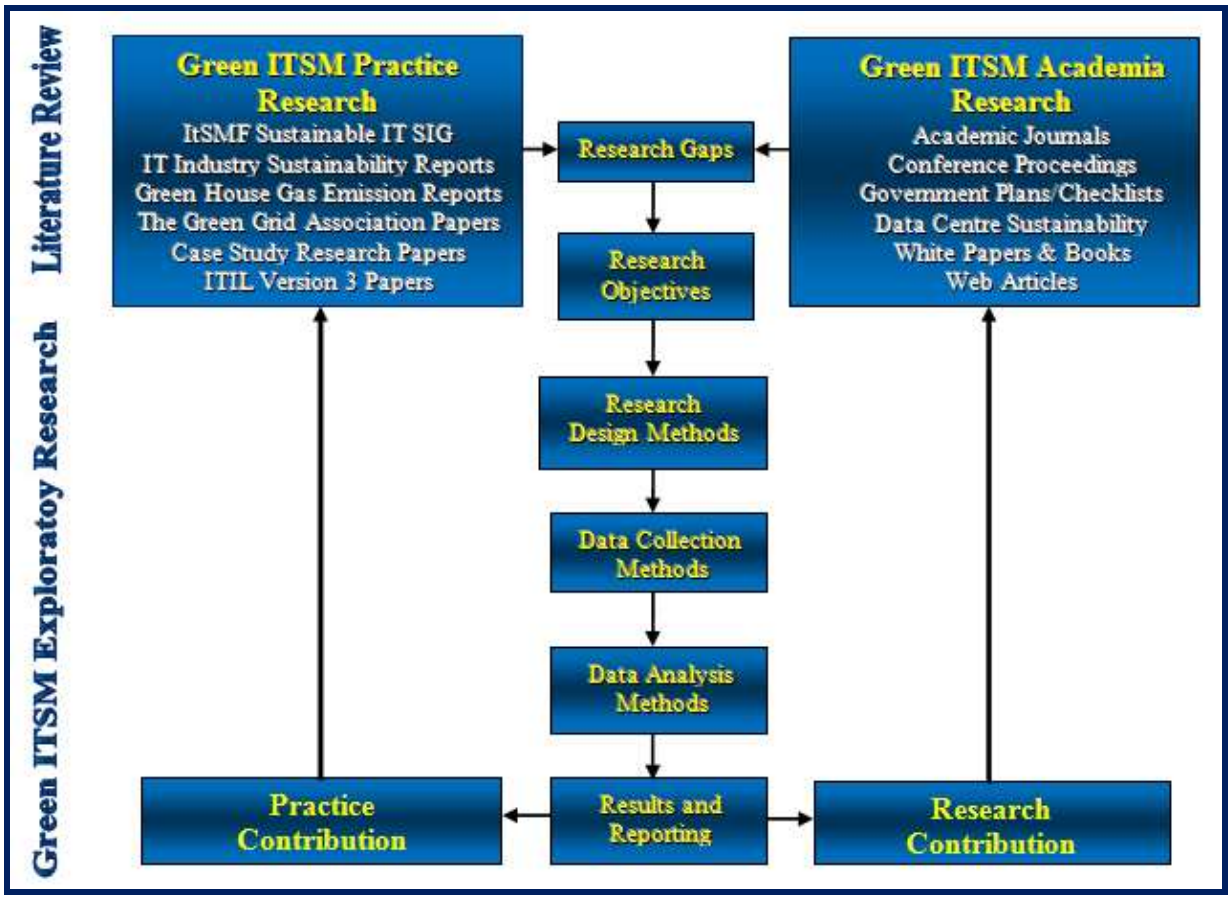

Figure 5. Green ITSM Research Approach

Green ITSM Case Study

For the past 40 years, CITEC has served as the Queensland Government shared services provider, with more than 600 IT staff running IT operations from the two Tier 3 plus data centers. CITEC's hybrid business strategy is driven by early technology adoption with cloud-based customized and innovative products such as infrastructure as a service (IAAS), and platform as a service (PAAS). CITEC's Strategic Plan 2012-2015 includes a mention of Green IT policy development focusing on technical design, IT procurement, and environmental assessment. The commercialized business environment of CITEC service provision to multi-national commercial enterprises, local businesses and government agencies has considerable challenges ahead and the key conditions in the CITEC Strategic Plan 2012 – 2015 are shown in Figure 6 (CITEC 2012).

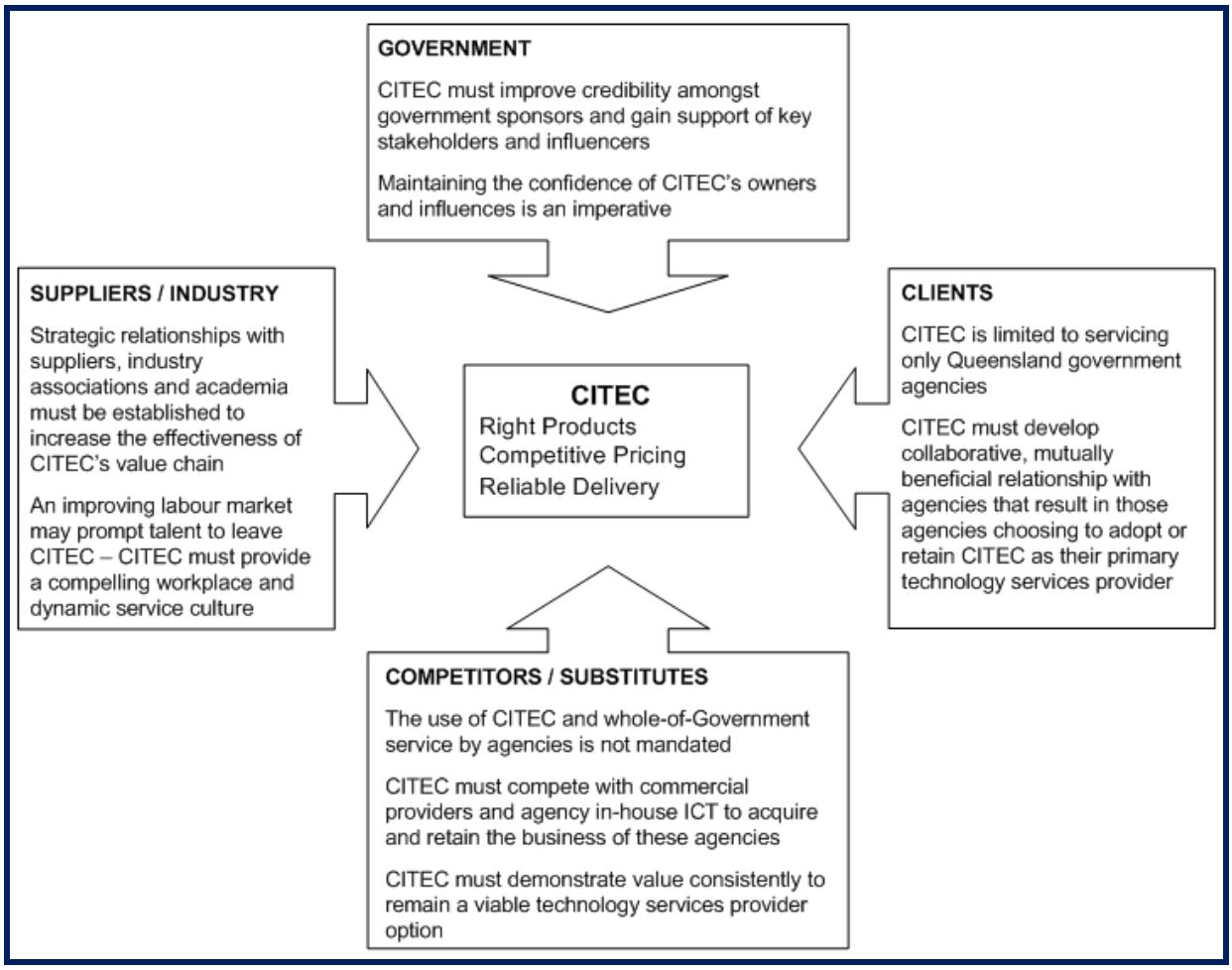

Figure 6. The Case Study Operating Environment

Source: (CITEC 2012)

Semi-Structured Interviews

Semi-structured interviews are in progress with the case study organization SMEs and IT staff. Their observations are audio recorded for interview transcription, analysis and verification. SMEs are asked fourteen open ended interview questions; four based on Rogers's Diffusion of Innovations theory, four from the Sustainability in Australian Businesses theory, three from the Resource Based View of the Firm theory, and the remaining three from Porter's Five Forces theory. The sample size of ten interviewees has been drawn from the five operational technical groups responsible for the two datacenters.

Analysis of Case Study Interviews

To date, four interviews have been conducted between December 2013 and February 2014. A further six interviews are scheduled in the near future. The interview analysis shows trends that CITEC staff lack awareness and education about Green IT policy due to insufficient communication and leadership. Higher management controls strategic plans, IT policies and their Green IT related directives are either not present or have not been disseminated to the operational technical groups. The guidelines are missing from daily checks and balances on common green measures such as duplication of service.

The majority of interviewees see Green ITSM innovation as an enhancement to build sustainable design capabilities in the ITILv3 framework. Their responses are showing a trend that the managers who took the decision to adopt the ITILv3 framework made it without any communicated sustainability rationale.

SMEs are showing their interest to know more about the AGIMO guidelines and checklist. They observe that the green legislation is not enforced at CITEC and there is no ITILv3 framework-related waste disposal policy. However, there are different types of recycling bins for charities or recyclers in use, and an ongoing specialist contractor's service to recycle hard disks and other digital media.

Interviewees consider CITEC's sustainable business resources as virtual servers, switches and firewalls. They acknowledge the ITILv3 framework as a valuable resource to start building a sustainability profile. They are slightly aware of datacentre power metrics and recognize the managed IT resources as the easiest to set a sustainability profile as compared to the client-managed and housed-only resources.

SMEs are not sure if a Service Level Agreement, an incident or problem resolution can be green or sustainable. They observe that time and cost savings are made by conducting incident resolution informal meetings across team cubicles, and avoiding official meetings. They acknowledge the CMDB is a worthwhile tool to save time and cost with the correlation of software and hardware replacement, and that the CMDB enables accurate managerial decisions associated with the CI-based CPUs, memory and data disks analysis. The majority of the SMEs tend to see themselves as green-minded and prefer suppliers that prove the sustainability aspect of their products.

SMEs describe Green ITSM benefits as the contribution to business competitive advantage, the reduction in the carbon footprint, and an altruistic environmental concern for the country's wellbeing. Although interviewees are positive about the need for Green ITSM, implementation of sustainable practices is largely limited to procurement and disposal.

Conclusion and Future Research

This research has highlighted that the scarcity in Green ITSM-related research literature in the academic and practitioner fields have created research gaps. The systematic literature review and the exploratory case study research have established Green ITSM as an innovative concept, a green resource and an innovative tool for organizational competitive advantage. The research has explained ways in which the case study organization's SMEs perceive and apply Green ITSM processes and frameworks. The responses to the interview questions have highlighted the perceptions surrounding the barriers and factors affecting the implementation of Green ITSM in a large IT service provision organization, and the ways to validate the use of existing government sustainability regulations and energy metrics.

Relating the preliminary analysis of the initial interviews to the Green ITSM conceptual model (Figure 3), we have found that technology, institutional factors, individual beliefs and other factors may impact on the implementation of planned green ITSM initiatives:

- virtual servers and the CMDB can have a positive effect and can assist in Green ITSM (technology);
- it is not sufficient to include Green IT in the strategic plan; senior management needs to articulate their commitment to Green IT (institutional factor);
- IT staff are motivated to embrace Green ITSM (individual beliefs);
- data center power metrics could be used to compile a profile of energy consumption (other factors).

The research has further highlighted the sustainability aspects of the case study's ITILv3 framework resources and their competencies against Australian IT firms, while asserting the view that Green ITSM contributes to organizational competitive advantage.

Although this paper demonstrates that some guidelines and advice have been provided to facilitate Green ITSM, the barriers and factors affecting its implementation have not been studied in depth. When the planned interviews have been completed, detailed analysis will be undertaken to answer the main and sub-research questions. In the future, similar studies on different ITSM frameworks could validate the research findings. In addition, there is a broad scope for research on specific Green ITSM topics such as desk audits, data center energy audits, computer equipment lifecycles, and pilot studies on Green software and similar IT sustainability related fields. Another future research avenue is the exploration of how IT could be used to monitor and maximize energy efficiency in agriculture, manufacturing and business environments.

Acknowledgements

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References

AGIMO. 2010. "Australian Government Data Centre Strategy 2010-2025." Retrieved 10 April, 2013, from **http://agimo.gov.au/policy-guides-procurement/data-centres/data-centre-strategy/**

APM. 2009. "What is ITIL?" Retrieved 15 March, 2012, from **http://www.itil-officialsite.com/AboutITIL/WhatisITIL.aspx**

Barney, J.B., Ketchen, D.J., and Wright, M. 2011. "The Future of Resource-Based Theory. Revitalization or Decline?," *Journal of Management* (37:5), pp. 1299-1315.

Belady, C., Rawson, A., Pflueger, J., and Cader, T. 2008. "Green Grid Data Center Power Efficiency Metrics: PUE and DCIE" Retrieved 11 April, 2012, from **http://www.thegreengrid.org/Global/Content/white-papers/The-Green-Grid-Data-Center-Power-Efficiency-Metrics-PUE-and-DCiE**

Benbasat, I., Goldstein, D.K., and Mead, M. 1987. "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly* (11:3), pp. 369-386.

Bose, R., and Luo, X. 2011. "Integrative framework for assessing firms' potential to undertake Green IT initiatives via virtualization – A theoretical perspective," *Journal of Strategic Information Systems* (20), pp. 38–54.

Butler, T., and Daly, M. 2009. "Environmental responsibility and Sustainable IT: An institutional perspective," in: *Paper presented at the 17th European Conference on Information Systems Verona, Italy*.

Cater-Steel, A., and Tan, W. 2010. "The Role of IT Service Management in Green IT," *Australasian Journal of Information Systems* (17:1), pp.105-125.

CITEC. 2012. "The Centre of Information Technology and Communication." Retrieved 14 September, 2012, from **http://www.qld.gov.au/dsitia/about-us/business-areas/citec**

Dedrick, J., Erek, K., Kolbe, L.M., and Zarnekow, R. 2010. "Green IS: Concepts and Issues for Information Systems Research," *Communications of the Association for Information Systems (27:11)*.

Dierickx, I., and Cool, K. 1989. "Asset stock accumulation and sustainability of competitive advantage," *Management Science* (35:12), pp. 1504-1511.

Dubey, S., and Hefley, W.E. 2010. "Greening ITIL: Expanding the ITIL Lifecycle for Green IT," *University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA 15260, USA*.

Dunphy, D., Griffiths, A., and Benn, S. 2007. *Organisational Change for Corporate Sustainability* (2nd ed.). London: Routledge.

EPA. 2012. "History of Sustainability." *Creation of EPA and NEPA* Retrieved 14 March, 2012, from http://yosemite.epa.gov/r10/oi.nsf/8bb15fe43a5fb81788256b58005ff079/398761d6c3c71849882564fc40078499b!OpenDocument

Ferris, K. 2011. "Turning service management green - How to embed sustainability into processes and workflow."Retrieved 13 May, 2012, from http://www.cio.com.au/article/379018/turning_service_management_green_-_part_1/

Fujitsu. 2011. "Green IT: The Global Benchmark." Retrieved 1 March, 2012, from https://www-s.fujitsu.com/au/whitepapers/greenit_global_benchmark.html

Gartner. 2007. "Gartner Estimates IT Industry Accounts for 2 Percent of Global CO2 Emissions." Retrieved 7 March, 2012, from http://www.gartner.com/it/page.jsp?id=503867

Gartner. 2010. "Gartner Identifies Seven Major Projects CIOs Should Consider During the Next Three Years." Retrieved 15 July, 2013, from http://www.gartner.com/newsroom/id/1465614

Gershon, P. 2008. "The Australian government's use of information and communication technology." http://www.finance.gov.au/publications/ict-review/index.html.

GeSI. 2012. "SMARTer 2020: The Role of ICT in Driving a Sustainable Future," Global e-Sustainability Initiative (GeSI), Brussels, Belgium.

GreenBiz. 2005. "Consumer Survey Finds Doing Good Is Good for Business." Retrieved 12 April, 2012, from http://www.greenbiz.com/news/2005/09/13/consumer-survey-finds-doing-good-good-business

Hirschheim, R., Klein, H.K., and K. Lyytinen, K. 1995. " Information Systems Development & Data Modelling: Conceptual & Philosophical Foundations," *Cambridge UK: Cambridge University Press*.

Jenkin, T.A., McShane, L., and Webster, J. 2011. "Green Information Technologies and Systems: Employees' Perceptions of Organizational Practices," *Business & Society* (50:2), pp. 266-314.

Kitchenham, B., Brereton, P., Budgen, D., Turner, M., Bailey, J., and Linkman, S. 2008. "Systematic literature reviews in software engineering – A systematic literature review," *Information and Software Technology,* (51), pp. 7-15.

Kraaijenbrink, J., Spender, J.C., and Groen, A.J. 2010. "The Resource-Based View: A Review and Assessment of Its Critiques," *Journal of Management* (36 1), pp. 349-372.

Linnenluecke, M.K., and Griffiths, A. 2010. "Corporate Sustainability and Organizational Culture," *Journal of World Business* (45), pp. 357-366.

Majah, I. 2010. "Sunan Ibn Majah." *Hadith no: 425, Chapter No: 2* Retrieved 12 March, 2012, from http://ahadith.co.uk/chapter.php?page=16&cid=147

Montiel, I. 2008. "Corporate Social Responsibility and Corporate Sustainability: Separate Pasts, Common Futures," *Organization & Environment* (21:3), pp. 245-269.

Murugesan, S. 2008. "Harnessing Sustainable IT: Principles and Practices," *IT Pro (IEEE Computer Society)*, pp. 24-33.

Nvivo. 2014. "An overview of NVivo: Software to support qualitative and mixed methods research." Retrieved 12 January, 2014, from http://www.qsrinternational.com/products_nvivo.aspx

O'Neill, M. 2010. Green IT for Sustainable Business Practice: An ISEB Foundation Guide.

OCIS. 2010. "Islam and the Environment." *A speech by the HRH Prince of Wales at Oxford College of Islamic Studies* Retrieved 15 March, 2012, from http://www.princeofwales.gov.uk/speechesandarticles/a_speech_by_hrh_the_prince_of_wales_titled_islam_and_the_env_252516346.html

OGC. 2011. "ITIL® v3 - The Official ITIL Lifecyle Publication Suite." Retrieved 21 March, 2012, from http://www.itgovernance.co.uk/itilv3.aspx

Patton, M.Q. 2002. *Qualitative Research & Evaluation Methods* (3rd ed.). London UK: Sage Publications Inc.

Peteraf, M.A. 1993. "The Cornerstones of Competitive Advantage: A Resource-Based View," Strategic Management Journal (14:3), pp. 179-191.

Pollard, C., and Cater-Steel, A. 2009. "Justifications, Strategies, and Critical Success Factors in Successful ITIL Implementations in U.S. and Australian Companies: An Exploratory Study," *Information Systems Management* (26:2), pp. 164-175.

Porter, M. 1986. "Changing Pattems of International Competition," *California Management Review* (28:2), pp. 9-40.

Rogers, E.M. 2003. *Diffusion of innovations*, (5th ed.). New York: NY: Free Press.

Schmidt, N.-H. 2011. Environmentally Sustainable Information Management: Theories and Concepts for Sustainability, Green IS, and Green IT. Göttingen Wirtschaftsinformatik Cuvillier.

Schmidt, N.H., Erek, K., Kolbe, L.M., and Zarnekow, R. 2009. "Towards a Procedural Model for Sustainable Information Systems management," *HICSS, Hawaii*.

Soomro, T., and Hesson, M. 2012. "Supporting Best Practices and Standards for Information Technology Infrastructure Library," *Journal Of Computer Science* (8:2), pp. 272-276.

Stake, R.E. 1995. *The art of case study research*. CA USA Sage.

Stake, R.E. 2005. "Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (Eds.)," *The Sage Handbook of Qualitative Research* (3rd ed).

Stanford. 2012. "Sustainable IT Strategic Plan 2012 - 2014. Sustainability in Information Technology." Retrieved 12 April, 2012, from **http://sustainablestanford.stanford.edu/sites/sustainable.stanford.edu/files/documents/SustainableIT_StrategicPlan_2012-2014.pdf**

Streb, C.K. 2010. "Exploratory Case Study." Retrieved 10 July 2012, from **http://srmo.sagepub.com/view/encyc-of-case-study-research/n139.xml**

TCG. 2008. "SMART 2020: Enabling the low carbon economy in the information age," Global e-Sustainability Initiative (GeSI), Brussels, Belgium.

TCG. 2009. "Breaking the climate deadlock." Retrieved 11 March, 2012, from **http://www.theclimategroup.org/_assets/files/Breaking-the-Climate-Deadlock-Newsletter-Dec-2009.pdf**

UN. 2002. "United Nations World Summit for Sustainable Development Implementation Plan." *A/CONF.199/20* from **http://www.un-documents.net/jburgpln.htm**

Walsh, K. 2007. "Environmentally Sustainable IT Definition and Solutions." Retrieved 13 May, 2012, from **http://www.cio.com/article/149651/Environmentally_Sustainable_IT_Definition_and_Solutions**

Winniford, M., Conger, S., and Erickson-Harris, L. 2009. "Confusion in the Ranks: IT Service Management Practice and Terminology," *Information Systems Management* (26:2), pp. 153-163.

Yanga, J., and Liub, C.-Y. 2006. "New product development: An innovation diffusion perspective," *The Journal of High Technology Management Research* (17:1), pp. 17–26.

Yin, R.K. 2011. *Applications of Case Study Research*, (3rd ed.). London UK: Sage Publications