

Association for Information Systems AIS Electronic Library (AISeL)

AMCIS 2008 Proceedings

Americas Conference on Information Systems
(AMCIS)

2008

An Exploratory Study on Environmental Sustainability and IT Use

Luftus Sayeed

San Francisco State University, lsayeed@sfsu.edu

Sam Gill

San Francisco State University, sgill@sfsu.edu

Follow this and additional works at: <http://aisel.aisnet.org/amcis2008>

Recommended Citation

Sayeed, Luftus and Gill, Sam, "An Exploratory Study on Environmental Sustainability and IT Use" (2008). *AMCIS 2008 Proceedings*. 55.

<http://aisel.aisnet.org/amcis2008/55>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2008 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

An Exploratory Study on Environmental Sustainability and IT Use

Lutfus Sayeed

San Francisco State University
lsayeed@sfsu.edu

Sam Gill

San Francisco State University
sgill@sfsu.edu

ABSTRACT

The present paper explored the relationship between environmental sustainability and the use of IT. Based on interviews with seven “Green IT” experts and evangelists, we constructed a questionnaire for CIOs on this important issue. After collecting interview data from CIOs in ten organizations, we found that organizations are at different levels of maturity regarding environmental sustainability and IT use. The maturity levels ranged from an awareness of the sustainability issue to implementation of specific practices to promote environmental sustainability through IT use.

Keywords

Environmental Sustainability, Green IT, Chief Information Officer.

INTRODUCTION

Continued growth in the use of Information Technology (IT) for information processing by organizations has environmental consequences. As more and more paper based tasks migrate to electronic data processing, the demand for energy and material resources increases as well. In addition to information processing tasks related to data processing, pervasive use of IT in all facets of organizational operations (such as communication networks) requires further resources. Moreover, disposal of depreciated electronic equipment used in information processing tasks necessitates environmentally responsible handling processes. It is clear that as we continue to increasingly migrate toward an online and electronic work environment, we affect the physical environment around us. In this paper, we gauge the durability and maturity of the consequences of IT use on the environment as a corporate issue and recommend organizational actions to implement measures that address environmental impacts of IT use.

Despite the significance of this issue, academic researchers in Information Systems (IS) have paid little or no attention to the relationship between IT use and environmental sustainability. IS practitioners, on the other hand, are very much aware of this issue (Brill, 2007). In the last few years there have been a few industry consortiums and initiatives established to address this issue. The Green Grid (www.thegreengrid.org), Energy Star (www.energystar.gov), Standard Performance Evaluation Corporation (www.spec.org), and Climate Savers (www.climatesaverscomputing.org) are examples of such initiatives. Moreover, IS practitioner publications and web sites are rife with coverage of “Green IT”. Some sample publications are Conner (2007), Varon (2008), and King (2008). After HIPAA, Web 2.0 and SOX, Green IT is the rage in the IT industry at the moment. One IT consultant commented, “We have seen dot com era and dot bust era. Now we are in the dot green era.” Further, the US government also has recently paid attention to the environmental impacts of IT use. A recent Environmental Protection Agency report (2007) has investigated the environmental consequences of IT use in organizations.

Although academic researchers have not addressed sustainability issues related to IT use, a considerable body of research has developed around the relationship between environmental sustainability and corporate strategy (e.g., Anderson and Bateman, 2000; Bansal and Roth, 2000; Florida, 1996; Marshall and Brown, 2003; Rugman and Verbeke, 1998; Russo and Fouts, 1997). The present paper will base our theoretical framework on these past investigations as a starting point to explore the relationship between IT use and environmental sustainability.

The paper is organized as follows. First, we describe the methodology of our data gathering and analysis activities. Second, we describe our findings on six issues examined in this paper. In order to capture the current state of Green IT activities in enterprises, we investigated: (1) the range of initiatives that can be defined as Green IT, (2) the reasons for organizations to adopt Green IT measures, (3) the relationship between organizational resources and Green IT, (4) the potential for IT

governance as a vehicle to promote Green IT, (5) readiness for implementing Green IT measures, and finally, (6) maturity levels of organizations with respect to Green IT adoption.

Finally, based on the analysis of the interviews of ten CIOs, we propose a Green IT Maturity model. The CIOs represented seven publicly held corporations, two private businesses and a large public university in California.

METHODOLOGY

We used a qualitative approach in our data gathering and analysis efforts. Qualitative methodology is appropriate for exploratory investigations (Chua 1986). For analyzing the data, we used inductive analysis (Bansal and Roth, 2000). We interviewed seven industry experts on this topic to construct a set of questions that would be appropriate for eliciting Chief Information Officers' (CIO) opinions regarding the relationship between environmental sustainability and IT use. Three of our experts were consultants who have a significant track record of working on Green IT related projects. The other experts were Green IT evangelists who worked for enterprises that were suppliers of Green IT technologies. The first evangelist was the point person for the largest utility company in the West Coast, two evangelists worked for two global software and equipment manufacturers whose offerings included Green IT products and services, and the other evangelist worked for one of the largest co-location/hosting company in Northern California. The goal of the interviews with the seven industry experts was to construct a set of questions suitable for IT executives in order to assess the importance of sustainability and IT use as a corporate issue. Following are the questions for the CIOs interviewed in this study.

1. Tell us about your company: revenue, number of employees, size of IT (number of servers and employees), IT centralized/decentralized, CIO reporting to CEO/CFO, type of company?
2. Is there an environmental /sustainability action plan in your company? If yes, does this action plan include Green IT (GIT)?
3. Is there a sustainability manager or an equivalent in your company?
4. Is GIT a corporate issue or just an IT issue?
5. Is there a restructuring of capital costs and operating costs as a result of GIT? If yes, does the restructuring involve the CFO or only the IT department and facilities/operations department?
6. Do you have any policy to encourage GIT to your users? If yes, what are the policies?
7. What is the size of your data centers? ___ sq ft, How many? ___ Mid Tier; ___ Enterprise
8. Does GIT influence your purchasing/procurement decisions (e.g., buy Energy Star)?
9. What metrics are being used to measure power consumption in data centers? Do you plan to use these metrics for benchmarking purpose?
10. Have you set specific targets for data centers to be achieved by your GIT initiatives?
11. Which of the following GIT measures have you adopted? See table 1 below for list of these measures.
12. Do you consider GIT in your evaluation of outsourcing/collocation facilities?
13. When and under what circumstances did you adopt the GIT measures above?
14. Has the EPA played any role in your GIT adoption?
15. Do you think GIT measures impact your company's profitability/bottom line?
16. What are the broader organizational advantages of GIT beyond financial reasons?

17. Has GIT led to the redesign of your data centers or other physical facilities?
18. Did the implementation of GIT measures require or engender cooperation from other departments?
19. Has GIT influenced your human resource capabilities?
20. Does GIT have any impact on your firm’s reputation?
21. Do you seek a leadership position on GIT within your industry?
22. What are the organizational barriers or resistance to GIT?
23. How committed are your upper management to GIT?
24. What role do you see standards or regulations having on adoption of GIT (innovation)?
25. Are you aware of any incentives from Federal/State governments or public utilities encouraging GIT?
26. Can you tell us how your organization’s IT governance structure helps or hinders GIT? Any conflict with Sarbanes and Oxley Act?

RANGE OF GREEN IT INITIATIVES

In order to initiate a discussion of Green IT, we need to begin with an unambiguous definition. We suggest the following:

Green IT initiatives are organizational activities that aim to engender environmentally sustainable consequences in the conduct of information processing tasks of an enterprise.

Based on this definition, we researched IT practitioner publications, web sites and academic journals to prepare a list of technologies and organizational activities that can be considered as Green IT initiatives. In our interviews with the seven experts, we sought to compile a comprehensive list of these initiatives. In addition, through our interviews with the CIOs we confirmed these initiatives. Our findings indicate two broad categories of initiatives. The first category of Green IT initiatives is relevant to data center operations while the second category of initiatives included activities that involve the entire organization. The following table provides a list of these two categories of Green IT initiatives. Please note that implementation of Virtualization servers can be an organization wide and/or exclusively data center based **initiative**.

TABLE 1: GREEN IT INITIATIVES

Data Center Green IT Initiatives	Organization Wide Green IT Initiatives
Implementing Virtualization servers, Server consolidation in data centers, Efficiency improvement in electrical distribution, Improvement in cooling distribution, Advanced Configurations and Power Interface (ACPI), Networked storage, Brocade Communications switches, Airflow optimization, Sealing of cable cutouts, Inserting blanking plates and clearing under floor obstructions, Rewiring under floor, Redesigning the return air plenum, Placing perforated tiles in the cold aisles, Installing variable fan speeds, Retrofitting fans, Replacing battery backed UPSs with rotary.	Implementing Virtualization servers, Recycling of hardware, Managing E-waste, Implementing a green procurement policy, Implementing thin client end user environment, Implementing flexible telecommuting

In our interviews with the ten CIOs, we found that all organizations have adopted some of the measures. All ten firms recycled their hardware and nine used a systematic E-Waste management policy. Furthermore, Implementation of virtualization was quite pervasive as eight of the CIOs reported its adoption in their data centers. Of the remaining two organizations, one was testing the feasibility of implementing virtualization in its data center.

The adoption of the remaining green initiatives listed in table 1 was not uniform across the ten organizations.

REASONS FOR GREEN IT INITIATIVES

Academic research indicates that companies go green for mainly three reasons: profitability, legitimation, and social responsibility (Bansal and Roth, 2000). The profitability motive to green arises when companies perceive these activities as either a cost saving or a profit enhancing measure. Legitimation refers to companies' efforts to implement Green policies to meet government environmental regulations. Social responsibility refers to the motivation of organizations when they incorporate green policies in their corporate mission and view themselves as contributors to a society's overall well being.

While there is no direct environmental regulation that addresses Green IT, several initiatives are on the way. These include the "Climate Savers Computing Initiative" (www.climatesaverscomputing.org) with the goal of significantly increasing the energy efficiency of computers and servers at data centers; and H.R. 2635, The Carbon-Neutral Government Act of 2007 that would reduce the Federal Government's contribution to global warming through measures that promote efficiency in management and operations, in particular those of its data centers. These efforts are currently voluntary and have yet to become binding. Therefore, we do not consider legitimation as a reason for businesses implementing Green IT initiatives. All three consultants and one of our evangelists opined that companies are going green in IT because of profitability. In contrast, three of the evangelists who worked for the manufacturers of Green IT products and the co-location/hosting company, mentioned social responsibility as their firms' motivation for implementing Green IT. We found corroboration of this assertion from CIOs as well. All ten CIOs mentioned cost cutting and energy conservation as the reasons behind adopting the initiatives in table 1.

RELATIONSHIP TO ORGANIZATIONAL RESOURCES

Environmental sustainability actions of organizations have had impacts on physical assets, human resources and organizational skills/capabilities, and intangible resources (Russo and Fouts, 1997). Porter and van der Linde (1995) provide examples of innovative restructuring of organizational relationships as a result of implementing environmentally responsible practices in businesses.

The seven experts all agreed that Green IT initiatives will have impacts on the three organizational resources mentioned above. The evangelists suggested that the implementation of Virtualization servers requires less support by the IT department. Such implementation also requires new technical skill sets in IT personnel. As a result, they foresee smaller IT departments which can support a virtualized end user environment rather than a desk top dominated end user environment. One evangelist was of the opinion that there is still a need to "sell" IT departments on the virtues of virtualization, energy efficient servers, and energy efficient power supplies. All four evangelists saw the efficiency in data center real estate use as a primary factor in moving to virtualization. One evangelist mentioned that he believed that virtualization alone as a GIT measure would lead to a reduction in the number of servers by a factor of eight (8)!

However, in our interviews with the CIOs, seven indicated that they did not foresee a reduction in IT workforce as a result of implementing Green IT measures. One of the CIOs commented that Green IT initiatives are cost cutting measures leading to doing more with less. However, three CIOs opined that adoption of Green IT will eventually lead to a smaller support group in the IT department. All CIOs mentioned that adoption of Green IT will require new skills set in their personnel.

ROLE OF IT GOVERNANCE

Only one of the consultants mentioned that Green IT will not be implemented for applications that require maximum redundancy. He also mentioned that these initiatives may hinder Sarbanes and Oxley (SOX) requirements. However, other experts did not see SOX compliance as a hindrance. All our experts agreed that IT governance is the vehicle to implement Green IT initiatives. They suggested that implementation of Green IT requires substantial capital and operating costs reorganization. Such reorganization will necessitate attention of executives at the highest level of the organization which would mean highly centralized IT organizations would be more likely to initiate successful Green IT projects. One evangelist suggested that the IT industry should take on voluntary measures for Green IT rather than have the government step-in and impose arbitrary measures.

The CIOs also did not perceive SOX as an impediment to implementing environmentally sustainable measures regarding IT use. They all opined that IT governance is the most effective tool to introduce environmentally responsible practices.

READINESS FOR GREEN IT

All seven experts agreed that Green IT as an organization initiative is in its infancy and lacks a formal structure and focus to make a difference. The experts agree that increasingly executives are realizing that there is more to Green IT than simply employing technology. Of the eight CIOs, only two were actively implementing Green IT measures. Among the other six CIOs, the awareness regarding environmentally responsible initiatives was beginning to emerge.

Based on our interviews with the ten CIOs, we conclude that there is a need for a comprehensive, strategic approach to Green IT, addressing technology as well as people, processes, and organizational culture. The lack of a Green IT strategy is resulting in inconsistent Green IT initiatives in organizations. The inconsistency in turn is leading to difficulties in managing, implementing and supporting initiatives that span multiple departments. A lack of standardization of methodologies, definitions, processes, tools and technologies as well as insufficient relevant Green IT skills are further impeding systematic consideration of Green IT initiatives. Three of the experts and eight of the CIOs suggested that it is very difficult to convince organizations to undertake elaborate Green IT measures within their existing data centers. However, business executives are more inclined to consider these measures when building new data centers. However, our interview with one evangelist and one of the CIOs, indicated an opposite trend. In both of these organizations, a significant amount of Green IT initiatives are being planned and implemented in the company’s current data center.

THE GREEN IT MATURITY MODEL

Based on our interviews with the seven experts/evangelists and the ten CIOs, we defined a maturity model for Green IT with four levels: oblivious, sporadic, focused, and ubiquitous. In order to categorize organizations into one of the levels of the Green IT Maturity Model, we need to examine five critical dimensions: the datacenter Green IT initiatives, the organization wide Green IT initiatives, the reasons for the Green IT/Culture, the relationship of the Green IT efforts to the organizational resources, and the role the corporate and IT Governance plays in the Green IT effort. Table 2 displays the Green IT maturity model.

TABLE 2: GREEN IT MATURITY MODEL

Dimension	Oblivious	Sporadic	Focused	Ubiquitous
Data Center Green IT Initiatives	None to minimal	Some server consolidation	Selected initiatives adopted or planned	Majority of initiatives adopted
Organization Wide Green IT Initiatives	None to minimal	Some recycling	Selected initiatives adopted or planned	All organization wide initiatives in place including thin client and flexible telecommuting
Reasons for Green IT	None	Profitability, Operational GIT initiatives	Legitimation, Tactical GIT initiatives	Social responsibility, Strategic GIT initiatives
Relationship to Organizational Resources	None	Cost	Capital with short term ROI	Capital with Long Term ROI
IT Governance	Not Relevant	Decentralized	Regionalized	Centralized

“Oblivious” firms reflect little or no awareness about the environmental consequences of IT use. Only one of the organizations in our sample could be classified as “oblivious”. The CIO of the company mentioned that supporting the company’s manufacturing process was the only priority of his department. Because his company was located in California, he had to subscribe to standardized hardware recycling as per the state law. That was the only initiative that was adopted by this company.

Companies in the “sporadic” category have adopted a few data center and organization wide initiatives. They undertake these initiatives aiming to reduce cost of IT operations and enhance profit margins. These companies use their IT governance structure in a decentralized manner to implement these initiatives. Based on our interviews with the CIOs, four of the firms in our sample could be classified in this category.

“Focused” firms implement selected green initiatives in their data centers and entire organization. They adopt these selective measures to either deal with impending regulations or for cost reduction in a specific IT operation. These firms invest capital in adopting the initiatives with a short term return on investment (ROI) requirement. IT governance is used in a regionalized manner by these firms in order to implement their green measures. Based on our interviews with the CIOs, four of the firms in our sample could be classified in this category.

“Ubiquitous” implementation of green initiatives takes place when a firm adopts majority of the data center and organization wide Green IT initiatives. Social responsibility towards and strategic relevance of the environment are the reasons for adoption of these measures. In order to implement the green initiatives, these firms invest capital with long term ROI as the goal. Based on our interviews with the CIOs, only one firm in our sample could be classified in this category. The company designated a manager whose responsibility was to promote environmental sustainability issues within the organization. Under the sustainability manager’s supervision, the company had conducted a study to assess the carbon footprint of the whole firm. Based on the findings of the study, the corporate management implemented green initiatives to minimize and reduce the environmental consequences of their IT use.

CONCLUSION

We can draw several conclusions from the present study. First, we found the Green IT evangelists and consultants were very enthusiastic about implementing IT initiatives that will engender environmentally responsible consequences. However, the organizations in our study did not reflect the same level of enthusiasm. Most of the CIOs in our sample were preoccupied with operational efficiency in their departments. It was clear to us that the awareness level about the environmental consequences of IT use need to be enhanced among CIOs and senior management.

Second, the present study was exploratory in nature. The data collected in the study should be supplemented by interviews of facilities or physical plants managers and other individuals knowledgeable about Green IT in the ten organizations. The interviews of the CIOs and these additional interviews will allow us to use a case study approach in the investigation. A case study methodology will provide further insights into challenges of Green IT adoption in organizations.

Third, we used convenience sampling to select the CIOs in this study. This lowers the ability to generalize our findings. We recommend a future study with a large sample suitable for rigorous quantitative data analysis techniques.

Finally, Green IT is currently in its infancy. For an organization to scale the Green IT maturity model, there needs to be more awareness about this important issue. More academic research and industry initiatives are necessary to underscore the impact on pervasive IT use on our environmental resources. We conducted an exhaustive electronic search of major IS and management journals on the issue of environmental sustainability and IT. Various search terms did not result in a single relevant scholarly work in this important area. A manual search of the journals corroborated the end result of our electronic search. The lack of scholarly investigation underscores the need for systematic rigorous research on this important topic.

REFERENCES

1. Anderson, L.M. and Bateman, T.S. (2000) Individual environmental initiative: Championing natural environmental issues in U.S. business organizations, *Academy of Management Journal*, 43, 4, 548-570.
2. Bansal, P. and Roth, K. (2000) Why companies go green: A model of ecological responsiveness, *Academy of Management Journal*, 43, 4, 717-736.
3. Brill, K. G. (2007) Data center energy efficiency and productivity, *The Uptime Institute*, www.uptimeinstitute.org/whitepapers.
4. Chua, W. F. (1986) Radical developments in accounting thought, *The Accounting Review*, 61, 601-632.

5. Connor, Deni (2007) Five easy, inexpensive ways to save power in your datacenter, *Network World*, October, <http://www.networkworld.com/news/2007/100807-save-power-data-center.html>.
6. Florida, R. (1996) Lean and green: The move to environmentally conscious manufacturing, *California Management Review*, 39, 1, 80-105.
7. King, Julia. (2008) Top 12 Green IT Users, *Computerworld*, February, <http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=312485>.
8. Marshall, R.S. and Brown, D. (2003) The strategy of sustainability: A systems perspective on environmental initiatives, *California Management Review*, 46, 1, 101-126.
9. Porter, M.E. and van der Linde, C. (1995) Green and competitive, *Harvard Business Review*, September-October, 120-134.
10. Rugman, A.M. and Verbeke, A. (1998) Corporate strategies and environmental regulations: An organizing framework, *Strategic Management Journal*, 19, 4, 363-375.
11. Russo, M.V. and Fouts, P. A. (1997) A resource-based perspective on corporate environmental performance and profitability, *Academy of Management Journal*, 40, 3, 534-559.
12. U.S. Environmental Protection Agency (2007) Report to congress on server and data center energy efficiency public law 109-431.
13. Varon, Elana (2008) The Greening of IT, *CIO*, March, http://www.cio.com/article/196450/The_Greening_of_IT.