Towards Sustainable Green IT: Motivations, Issues And Challenges

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ABSTRACT
Climate change, carbon omission and other environmental issues such as footprint and resource constraint are becoming the world's major concerns and need to be solved. Green Information Technology (IT) or by adapting IT appropriately has been suggested to reduce those problems and bring greater efficiency. It is important to analyses the awareness of IT Personnel about Green IT in order to measure whether they are ready to implement a Green IT strategy. Aimed using a qualitative case study research approach we seek to understand the motivations, issues and challenges for green IT initiatives and its usage from the context of government agencies in Malaysia. Interviews were conducted with several IT personnel from government agencies. A specific green IT initiative has being investigated with the implementation of data center cooling, virtualization, network and email consolidation. The study established that awareness level of green IT in Malaysia is low when compared with developed nations. The current findings suggest that although IT personnel In Malaysia have already some concerns about climate change and the power consumption of IT, there is still a lack of implementation and action dimensions. Therefore, further studies need to be carried out to find key success factors to increase the awareness level and strategy to implement Green IT.

Keywords: Green IT initiative, Green IT Strategy, Awareness,

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INTRODUCTION
Over the years, the use of IT has exploded in several areas, improving our lives and work and offering convenience along with several other benefits. However, IT has been contributing to environmental problems, which most people don't realize.

Computers and other IT infrastructure consume significant amounts of electricity, placing a heavy burden on our electric grids and contributing to greenhouse gas emissions. Additionally, IT hardware possesses severe environmental problems both during its production and its disposal, Jenkin, McShane & Webster, (2011) also believes that green IT provides IT system design solutions that will minimize the used of materials, minimize waste and also improve energy efficiency as well as performance. Many as just lowering of energy consumption have viewed Green IT and cost reduction within data centers, but environmental sustainability should have a greater consideration than just data efficiency (Molla, 2008).

Green IT could be seen as just a way to reduce what McKinsey research (2008) estimates will be 3% of worldwide greenhouse gas (GHG) emissions in 2020. IT is now accepted as a key tool for reducing the overall organization footprint, sometimes to the extent that can justify increased IT investments. IT is a significant and growing part of the environmental problems we face today. We are obliged to minimize or eliminate where possible the environmental impact of IT to help create a more sustainable environment Murugesan (2008).

Use of information and communication technologies promises a lot of gains to business settings however it is not without its side effects especially the environmental impact. IT has both positive and negative impact in its use and production. It can also be used to realise reduction of emission of greenhouse gases that have strong negative impact on the climate in the business chain system. In order for IT to be applied to minimise its negative impact and maximize its positive impact in a manner that ensure achievement of sustainable resource utilization, the IT personnel have to be aware of and how to employ IT sustainably. To achieve sustainability green IT has emerged to be used in reducing the direct environmental impact of designing, manufacturing, using and disposing of computer, servers and associated sub-systems Franklin, Gregory, Stanley, and Stephen (2013).

Esty and Winston (2006) revealed how companies generate lasting value – cutting costs,reducing risks, increasing revenues and creating strong brands – by building environmental thinking into their business strategies. According to a 2009 Green IT report surveying 426 companies in North America and a total of 1052 worldwide, 86% of companies stated that it is somewhat/significantly important that their IT organization implement Green IT initiatives. The report also found that 97% of companies are at least discussing a Green IT strategy (Symantec, 2009). In addition, a CIO magazine survey of IT executives revealed that cost-cutting and social responsibilities are the two main factors driving Green IT initiatives (CIO, 2008).To seek for the importance in applying Green IT strategies and practices toward environment sustainability. It is expected Green IT to be the most important strategic technology in the imminent future, as there lies a IT value paradox (Thatcher and Pingry, 2007) where IS has become not only an inseparable strategic weapon augmenting organizations' business sustainability and also inevitably ushers social, economical, and ecological significances with its demand for ever increasing energy consumption. Given the above mentioned

practical advantages for Green IT, many organizations are keen to understand how to accept and initialize Green IT schemes and further harness them toward competitive advantages (Esty and Winston, 2006; Velte et al., 2008; Watson et al., 2010).

Green IT Initiatives

According to Takayuki (2008), the Green IT Initiative is being developed to create a 21st century society where "environmental Summary of Green IT Initiative 21st-protection and economic growth are compatible" and to make changes in every aspect of production, society, and national life using technologies for "manufacturing" and for the "environment and energy saving," in which Japan has a high level of proficiency.

Based on Info-tech research group (2008), Green IT initiatives can be classified under FOUR categories:

Virtualization & Consolidation:

Initiatives in this area include server virtualization and consolidation, storage consolidation and desktop virtualization. These projects typically improve cost and energy efficiency through optimized use of existing and new computing and storage capacity, electricity, cooling, ventilation and real estate.

Energy Efficiency:

Initiatives in this area include server room upgrades and new builds, IT energy measurement, printer consolidation, and PC power management. These projects have energy efficiency or reduction as a major cost savings benefits.

Travel Reduction:

Initiatives in this area include remote conferencing & collaboration and telecommuting. These projects are typically associated with reductions in travel, fuel and commuting costs.

Asset Disposal:

IT equipment recycling is the lone initiative in this category.

Malaysian Green IT Initiatives

According to Md Farid (2010), in Malaysia Ministry of Energy, Green Technology and Water (MEGTW) are embarking towards the development of green IT. Initiatives implemented at the ministry with include launching of MEGTW's Green Practices, upgrading the existing data center into a Green Data Centre. Initiative

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is were also implemented by other ministries with the Launching of Guideline on the Usage of ICT towards Green ICT in Public Sector by Malaysia Administrative Modernisation and Management Planning Unit (MAMPU).

1) MEGTW GREEN PRACTICES

Under the MEGTW Green Practices, it is divided into categories which are energy conservation, water conservation, Reuse, Recycle and Reduce (3R), produce eco-friendly products, cafeteria and also transportation. Some of the practices relate to green IT are configure personal computers into sleep mode when not in use, ensure all the equipment are turned off before leaving the office and print or make copies only when needed.

2) GREEN DATA CENTRE

The Information Management Division under the ministry is currently upgrading their data center into green data center. The objective of the project was to upgrade the current conventional data center to become one of the first green data center in the public sector to implement green technology with the aim to reduce power consumption and minimize environmental impact. This green data center was launched on 13th January 2011. This process involves a modification of Server Room Layout; the room is divided by partitions based on the equipment inside the room and to provide effective air conditioning system throughout the room. Air conditioning system, using of Cold Aisle/Aisle Capping layout for more efficient heat management, this layout will cool down the server rack directly instead of the entire room and the temperature of the server room will be set at 24 deg. C +/- 1 deg.

Lighting system Installation of energy efficient bulb – LED. Installation of motion sensor to automatically control the lighting system and power supply system install sub-meter to monitor energy consumption of the room server. As of today, the Power Usage Effectiveness (PUE) measurement unit of data center efficiency is now 1.48. It complies with the Leadership of Energy Environmental Design (LEED) and currently is the best data center's PUE in Malaysian public sector.

3) GREEN ICT WORKING GROUP

Green IT Working Group has been established recently by an ICT Consultant, NFE Consulting Sdn. Bhd. supported by Malaysian Communication and Multimedia Commission (MCMC). The members comprise of representatives from Telecommunication service providers, higher education institute, government agencies. The objective of this working group is to actively promote the Green IT concept in relation to ICT industry, to set up a minimum Green IT guideline that can be used across industries and also the community and continuously seeking to establish a sustainable ICT industry through eco-friendly technology.

4) GUIDELINE ON THE USAGE OF ICT TOWARDS GREEN ICT IN PUBLIC SECTOR

by Malaysia Administrative Modernisation and Management Planning Unit (MAMPU)

As a developing country, Malaysia also has guideline in Green IT initiative that is conducted by The Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) through Malaysia' Government's Green ICT Initiative: Towards Sustainable Environment. Through green IT it could reduce the amount of energy consumed by ICT equipment and peripherals, reduce paper consumption, work with the change management programs to identify the impact of the changes they propose and enhance public education and awareness on Green Technology and encourage its widespread use. Reducing the burden of ICT is implemented by using the equipment wisely to reduce power saving, data center, network and email consolidation improvement. Government agencies are viewed as a single integrated entity, well-coordinated, well-informed and client-friendly.

According to Nathalia, Minsani and Karen (2011) Green ICT concerns have grown beyond being just a trend, to becoming a priority, especially for the government which needs to achieve considerable reductions of carbon emissions and cost savings. Some of the examples of international countries that already implemented Green ICT are described below:

International Background

1) Europe

As stipulated by the European Commission in its Code of Conduct on Data Centers Energy Efficiency (2008): "Many data centers operators are simply not aware of the financial, environmental and infrastructure benefits to be gained from improving the energy efficiency of their facilities. Even awareness does not necessarily lead to good decision making, simply because there is no framework in place for the operators to aspire to. Making data centers more energy efficient is a multidimensional challenge that requires a concerted effort to optimize power distribution, cooling infrastructure, IT equipment and IT output." This code of conduct takes into consideration two dimensions of data centers. Firstly IT Loads which concerns the energy consumption of IT equipment itself, and secondly facility loads which concerns those elements supporting the IT equipment; such as cooling systems and air conditioning. It aims to minimize the energy consumption of ICT by committing the data centers owners and operators as well as the suppliers and service providers.

2) USA

In the United States, The Environmental Protection Agency has launched its Environmentally Preferable Purchasing Program (EPP) since 1993. As explained on the EPA website (2010): "EPP helps the federal government "buy green," and in doing so, uses the federal government's enormous buying power to stimulate

market demand for green products and services." As far as IT is concerned, EPP supports IT equipment suppliers who have fulfilled the green standards applied by EPA and promotes Software to measure the energy consumption and efficiency of data centers and IT supplies.

3) Australia

Closer to Southeast Asia, Australia is a good example of Green IT integration. The government has taken serious initiatives to position Australia as one of the most proactive nations in terms of Green ICT. Based on the information shared by the Department of Finance and Deregulation on the website of the Australian government (2010), the Australian government has developed some guidelines for the private and public sector. The main priorities listed include some basic changes like the usage of black screens or static screen savers instead of active screensavers or the necessity to provide automatic shutdown of desktop and laptop fleet after hours. Moreover agencies are encouraged to measure power consumption of ICT as a component of total power use as well as using tools and practices to assist employees in reducing the number of printed pages per employee per month. Finally, agencies are advised to replace inefficient monitors at the end of their life cycle with more energy-efficient models (e.g. replace CRT monitors with more energy efficient alternatives) and finally they are requested to undertake a telephone refresh to consider technologies that optimize energy use efficiency and minimize duplication of handsets per employee. Long term goals provide a realistic idea of the future steps to follow for a successful Green IT implementation.

RESEARCH APPROACH

To meet the research purpose, to understand the motivations, issues and challenges for green IT several set of interviews were conducted with En Mansor Bin Omar, Chief Secretary Assistant from the Ministry of Energy, Green Technology and Water (KeTTHA) and En Wan Rosdi Bin Wan Dolah Chief of Consultant ICT (technical) from The Malaysian Administrative Modernisation and Management Planning Unit (MAMPU). Being in the technical ICT department that manages the ins and outs of the public network system, and has direct controls to the design, implementation and adoption, the Chief of Consultant ICT (technical) insights, knowledge and beliefs provide useful inputs to the study.

The interview with the green IT initiatives that implement by KeTTHA and MAMPU was conducted to answer following questions.

1. What are the motivations for the Green IT initiatives?
2. How could the related agency promote for a healthier Green IT culture?
3. Is there any barrier in implementing Green IT practices?

Case Description

Ministry of Energy, Green Technology and Water (KeTTHA)

Question 1: What are the motivations for the Green IT initiatives?

In meeting our government requirement in going green, green IT is as one initiative in ensuring acceptance of the adoption of green IT in Malaysia. Green IT initiatives have implemented with data center guidelines, for examples for ICT department in KeTTHA already have guideline in producing green data center. KeTTHA have do some cooperation with Malaysia Green Technology Corporation (MGTC) regarding the guideline but KeTTHA still do not have legal guideline on Green IT practices. Other than that, deploying compartments that are environmental friendly and implementing measurement on footprint are also practiced. It would help KeTTHA to identify whether their objective to reduce footprint is successful over the years.

Through Green IT practices it could save the environment by reducing the omission of footprint, climate change and the main achievement in saving of energy. In KeTTHA Green IT practices are applied like using desktops that can be hibernated when not in use, using printer that can save energy and hardware that only use 9 watt and not exceed 150 watt.

Question 2: Is there any barrier in implementing Green IT practices?

In implementing Green IT practices the barriers faced is lack of experts. To solve this problem, tender will be opened for producing services and products that comply with green requirements. Problems arise after storage needs to be shared and centralized and it will burden the capacity of storage. Suppose bandwidth for storage will be stand for 5 years but in reality it can be stand for 2 years only because it involves output and input processing of information. To solve this problem other agencies need to apply more advanced system such as virtual server that is environmentally save space but occupies limited space.

Lack of awareness among staff in KeTTHA also becomes the barrier in implementing Green IT practices. In KeTTHA there are who staff are still not aware and do not shut down their desktop when they not use it. To solve this problem, KeTTHA using software in each personal computer that can do automatic safe mode, should the PC exceed 15 minutes will of idle state. Staff also needs to reduce print paper works that are not important and not necessary. Green IT practices will be measured through the changes that happen before and after the system used.

Question 3: How could the related agency promote for a healthier Green IT culture?

Green ICT community will be announcing to other government agency to join it. Collaboration with MAMPU, MGTC for the Green ICT to design guideline that can be implemented to all government agencies in Malaysia. It was also highlighted for university for conduct more research regarding Green IT practices and impacts to environment in Malaysia. The university also can collaborate with the government in promoting the Green IT practices and provide training on it. By sharing the information about Green IT practices with other agency and shows that by applying Green IT practices could reduce cost, it would be more efficient and achieve the target of environment friendly.

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The Malaysian Administrative Modernisation and Management Planning Unit (MAMPU)

Question 1: What are the motivations for the Green IT initiatives?
In becoming the country of going green and environmental friendly, Malaysia need to change and go for it. With Green IT initiatives it could help in becoming green for all companies in Malaysia and motivates in cost cutting and social responsibility to staff and environment. In applying the Green IT initiatives on networking in MAMPU, it is done with almost all paper work will be send through online, all staff communicate and be informed through email and there is no to print unnecessary paper work. Developing cooling data center and using network within the department and authorized for MAMPU staff only are also practiced.

Question 2: Is there any barrier in implementing Green IT practices?
The barrier faced by MAMPU when cannot monitor on Green IT practices because no legal guideline from government, but for social, Green Technology more responsible on it and MAMPU more focusing on environment and ICT. For developed countries like United Kingdom, Green IT applied more actively as compared to Asian countries like Malaysia, Indonesia, Thailand and China. However Malaysia is more advance in Green IT initiatives compared to other Asian countries like Indonesia and China.
Lack of concerns about environment effect makes them not alert with what MAMPU try to achieve in reducing footprint. Attitude is the issue. For instance although reminder and regulations have been established on printing, such regulations are not adhered fully. However, MAMPU still can implement Green IT initiatives with more focus in developing data center cooling that does not involve with direct human involvement.

Question 3: How could the related agency promote for a healthier Green IT culture?
The strategies on Green IT initiative still need to be implemented in monitoring and making Green ICT as a mainstream in Malaysia. This would give the other agency be more concern about safety environment at the same time with applying Green IT practices also will reduce footprint, save cost and work will more efficient.
Green Technology Corporation is driving for Green IT in Malaysia and other agency can get the information regarding Green IT initiatives that they can comply in their company. Training and seminar also can be conducted in ensuring all agencies understand about the Green IT initiatives.

DISCUSSION

Based on the case study findings, we find lacking of awareness, lack of staff with necessary expertise in handling Green IT initiatives and low on support from top management will affect the successful of Green IT initiatives in Malaysia. Green

Technology Corporation as the driver is also responsible for ensuring the goals and objective of Green IT initiatives are met. The discussion of the factors is offered below.

Increasing the Awareness and Reducing Inhibiting Factors

Based on the study, there are gaps between awareness and action; therefore, further studies need to be carried out to find key success factors to increase the awareness level and strategy to implement Green IT.

Expertise staff

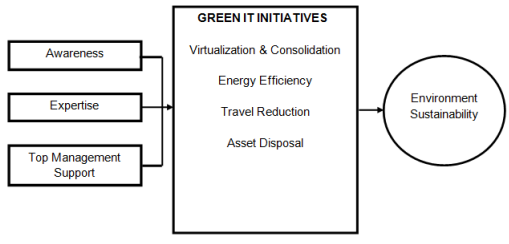
In ensuring to sustain the Green IT initiatives the expertise staffs are important in ensuring all the systems run smoothly, costs could be reduced as there will be less budget to be spent in paying for outsourcing services.

Top management support

The factor is one of the most important determinants for the green IT initiatives because without strong top management support strategies and policies will not be implemented and infrastructure will not be available as there is lack of collaboration with other agencies in acceptance greening information technology in Malaysia. Top management can encourage change by communicating and emphasizing values over an articulated vision for the organization (Thong, 1999).

Based on the discussion, we have propose a model as depicted in figure 1 that reflects the responsibility of the green it initiatives in making the mission become reality. We then suggest for the factors that will have influence to the use of the Green IT initiatives for both government agencies. With efficiency of Green IT practices it would succeed the environmental sustainability.

Figure 1: Model of factors and Green IT Initiatives in meeting environment sustainability



CONCLUSION

Implementing the Green IT initiative is important because it will give the benefits to the staff and government agencies in their financial and performance. However the implementation of Green IT initiative is a complex and a costly process as it requires more expert personnel to handle IT issues. As the model is developed based on a set of interviews, we suggest validating the model via survey. Such investigation will produce statistical evidences that can be generalized across studies.

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