

A FRAMEWORK OF GREEN IT CAPABILITY MATURITY FOR IT PRODUCT
LIFECYCLE IN UTM

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A dissertation submitted in partial fulfillment of the
Requirements for the award of the degree of
Master of Science (Information Technology- Management)

Faculty of Computing
Universiti Teknologi Malaysia

JANUARY 2014

This dissertation is dedicated to my beloved father Abdulqadir Adam and mother
Salamah Muhammadzen for their endless support.

To my supporter, Faculty of Science and Technology, Fatoni University.

ACKNOWLEDGEMENT

First and foremost, thanks to Allah S.W.T, the Almighty, on whom ultimately we depend for sustenance and guidance for the blessing and opportunity for me to finish my dissertation and thesis writing. I also want to take this opportunity to give my special thanks to Universiti Teknologi Malaysia (UTM), because an opportunity as a part of them about a year in doing degree of Master of Computer Science (Information Technology Management).

First and foremost, I would like to express heartfelt gratitude to my supervisor Associate Professor Dr. Azizah Abdul Rahman for her constant support during my study at UTM. She inspired me greatly to work in this project. Her willingness to motivate me contributed tremendously to my project. I have learned a lot from her and I am fortunate to have her as my mentor and supervisor.

Finally, my deepest thanks to my parents because of their influence and support have made me realize the importance of education from a very early age. Indeed, their sincere love throughout my life cannot be replaced by anything. Besides that, I also want to dedicate my truly thanks to my green IT research group Hidayah and Rabiah who are motivate and encourage me during the completion of the research.

ABSTRACT

In the last few decades, Information and Communication Technology (ICT) has featured prominently in transforming business practices. It has redefined our social existence. A huge number of IT devices such as computers, monitors, printers, scanners, copiers and fax machines, digital duplicators, multi-function devices, and mailing machines are increasingly produced everyday to support and fulfill operational needs of the organization. These IT devices contribute to global warming by producing CO₂ emissions and contributing to the greenhouse effect. This is due to the fact that all phases on the IT product lifecycle produces an environmental impact. This research develops a green IT framework to implement and sustain green IT implementation and to apply this framework to UTM faculties/unit to assess the current capability maturity level of green IT practices for IT product lifecycle. The framework covers the green IT best practices in three phases of IT product lifecycle, namely procurement, usage, reuse/disposal, and the level of capability maturity. The framework was developed by reviewing previous green IT capability maturity frameworks and green IT best practices of IT product lifecycle. The framework was then verified using online card-sorting and interviews with three experts, namely IT and lab managers. The framework provides UTM faculties/unit with a holistic guideline to implement and sustain green IT practices throughout the IT product lifecycle with the help of capability maturity level; level 1 is the initial level, and level 5 is the optimal level. The framework was applied to four UTM faculties and the School of Postgraduate Studies to assess their current capability maturity level of green IT practices for IT product lifecycle.

ABSTRAK

Dalam beberapa dekad yang lalu, Teknologi Komunikasi Maklumat (ICT) telah jelas terbukti dalam menyokong transformasi perniagaan. Sebilangan besar peranti IT seperti komputer, monitor, pencetak, pengimbas, mesin fotostat dan mesin faks, duplikator digital, peranti pelbagai fungsi, dan mesin surat-menyurat semakin meningkat penghasilannya setiap hari demi untuk memenuhi keperluan operasi organisasi. Alat-alat IT menyumbang kepada pemanasan global dengan menghasilkan pelepasan karbon dioksida (CO₂) dan menyumbang kepada kesan rumah hijau. Ini disebabkan oleh fakta bahawa semua fasa pada kitaran hidup produk IT memberi kesan kepada alam sekitar. Penyelidikan ini telah membina satu rangka kerja IT hijau demi untuk melaksanakan dan mengekalkan pelaksanaan IT hijau dan untuk di aplikasikan kepada fakulti UTM / unit supaya dapat menilai tahap kematangan keupayaan IT hijau mereka dari segi amalan penggunaan IT untuk kitaran hayat produk IT. Rangka kerja ini merangkumi amalan terbaik tentang IT hijau dalam tiga fasa kitaran hayat produk IT, iaitu perolehan, penggunaan, penggunaan semula / pelupusan, dan tahap kematangan keupayaan. Rangka kerja ini telah dibangunkan dengan mengkaji semula rangka kerja sebelumnya iaitu kematangan keupayaan IT hijau dan amalan terbaik tentang IT hijau untuk kitaran hayat produk IT. Rangka kerja tersebut kemudian disahkan dengan menggunakan talian kad menyusun dan temu bual bersama dengan tiga pakar, iaitu IT dan pengurus makmal. Rangka kerja ini telah menyediakan satu garis panduan menyeluruh kepada fakulti UTM / unit demi untuk melaksanakan dan mengekalkan amalan IT hijau sepanjang kitaran hayat produk IT melalui bantuan tahap kematangan keupayaan; tahap 1 adalah tahap awal, dan tahap 5 adalah tahap optimum. Rangka kerja ini telah digunakan terhadap empat fakulti UTM dan Sekolah Pengajian Siswazah untuk menilai tahap kematangan keupayaan IT hijau mereka dari segi amalan IT hijau untuk kitaran hayat produk IT.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Over the past few decades, Information and Communication Technology (ICT) has completely transformed global business and social practice. With the help of technology, economies and businesses have transformed to e-economies and e-business. ICT provides transformation capabilities that offer any number of economic opportunities. ICT helps create greener and more sustainable environments. However, ICT industries cause global warming and contribute approximately 2% to climate change by producing CO₂ emissions (Molla & Cooper, 2009). This is not an outstanding rate of emissions when compared to other industries such as the aviation industry for example. Molla and Cooper added that this rate of CO₂ emissions is due to the fact that all phases of an IT product's lifecycle has an environmental impact.

The increasing number of IT devices along with their increased usage impacts on the environment, not to mention their disposal. Given the growing global awareness of green technologies and green business practices, organizations are facing growing pressure to introduce sustainable solutions to these environmental challenges. Sustainability can be considered a means to reduce cost and raise income. Businesses should engage in ecologically sustainable practices to achieve sustainable competitive advantage (Curry & Donnellan, 2012). As a result, many enterprises are now increasingly aligning business strategy with environmental sustainability to help

them better manage environmental issues and pursue new opportunities (Murugesan and Gangadharan, 2012).

Given the importance of achieving environmental sustainability and its many benefits to both the environment and business, a great deal of research has focused on green IT resulting in the proposal of numerous 'green' frameworks. Implementation of environmental sustainable in IT is known as green IT or green computing. Watson et al., (2010) defined Green IT as the efficient use of computing device (design product, procurement, usage, reduce/disposal). This comprises of the triple bottom line of the economy, social response, and environmental impact. Green IT uses ICT to manage organizational operations and resources towards becoming more environmentally friendly (Mingay, 2007).

There is a sustained rise in the adoption of green IT strategies and practices among organizations and businesses. These strategies promote environmentally sustainable business practices. Although there are many existing green IT capabilities and frameworks, they do not provide a comprehensive evaluation of existing practices and fail to effectively measure efforts to implement green IT (Alemayehu et al., 2010). Martine (2008) pointed out that the reason for resistance in organizational environmental implementation is because of a nonexistent integrative framework that can assist them to monitor a firm's IT capability maturity level and performance.

Capability maturity level is a solution offering benefits internally and cross enterprise because it provides a comprehensive growing of business processes. In each maturity level, the business process has a predefined objective, goal, and process areas. The goal achievement in each process area is the measurement indicator in each level (Jacobs and Trienekens, 2002). As a result, many frameworks apply capability maturity level such and Sustainable Information Communication Technology-Capability Maturity Framework (SICT-CMF), Information Technology Capability Maturity Framework (IT-CMF), and Generic Maturity Model of COBIT.

To achieve sustainable business practice, the study of IT product lifecycle is important. IT product life cycle consists of designing, manufacturing and facilitating, packaging and transportation, usage, and reuse and disposal (Ashok and Sateesh, 2012; Eric, 2010). Some of these phases are managed by the manufacturer, while others are managed by the organization or consumer.

In this research, organizations that procure, use, reuse or dispose of IT products are considered IT consumers. In order to achieve sustainable business practice, it is important to study the practice of each phase of the IT product lifecycle that concern consumers and map them onto the capability maturity level to stabilize the maturity of an organization's processes and its implementation.

The IT product lifecycle focuses on consumer perspectives including procurement, usage, and reuse/disposal phases. The IT product in this research focuses on office equipment, which is categorized as IEEE1680, namely computers and monitors, and image equipment (printer, scanner, copier and fax machine, digital duplicator, multi-function device, and mailing machine).

Green IT purchasing refers to the practice of purchasing products after due consideration of the environment (Lettemieke, nd, retrieved on 6/04/2013). Such considerations pertain to the environment and the impact the purchase of a product and/or service will have on human life.

Green IT product usage has minimal impact on the environment. Many IT devices consume a large amount of energy. This increases a device's carbon footprint (Ashok and Sateesh, 2012; Eric, 2010). Green IT seeks to reduce energy consumption. In addition, green IT reuse/disposal refers to the refurbishment, reuse, and recycling of old computers and other IT devices (Ashok and Sateesh, 2012; Eric, 2010).

1.2 Background of the Problem

Nowadays IT has become an inseparable part of every organizations or industries. These IT devices cause environmental impact where organizations and industries have to green it. In this regard, UTM is not exceptional and they should go through Green practices to be such leading centers in current Green wave as scientific places and also align themselves with what are happening in outside world and gain value.

Fortunately, UTM has launched the Green Campus trying to make its practices Green and be a pioneer in Green projects. In this regard, UTM has done several projects by chemical faculty and research center such as making the mosque's water usage efficient or measuring CO₂ emission of Faculty of Chemical Engineering and suggesting a specific kind of lighting bulbs which consume less energy. It also runs some contests such as Green buildings and Green offices to get involve others' opinions and have some other creative suggestions (Parastoussadat, 2012).

Since UTM has launched Green Campus, green IT has been considered. CICT is in charged of designing green IT policy and all UTM faculties unit is responsible to implement green IT practice. In fact, green IT is very new for CICT and recently just due to launching the Green Campus of university. Currently CICT has initiated some green practices for UTM faculties such green IT laboratory, green office and energy reduction. These green IT initiatives should be done and it is expect to be done by UTM faculties/unit.

As result, UTM faculties begun to pay attention to the matter of Green IT. It has some planning but not yet any special policies or strategies for supporting the green IT practices in each faculty.

For green office, UTM faculties/units have implemented green IT in their faculties by reducing paper usage, electrical power and save energy. Green IT practice in this section seems it has done more than other sections.

In laboratory section, CICT has set Green technology policy to make sure that all activities that evolving in laboratory must be under Green technology policy, and UTM faculties should implement this policy. Laboratory activities rank from purchasing IT device and IT device life cycle (Parastoussadat, 2012). In term of Green purchasing, UTM faculties consider the Green technology policy but they do not have proper implementation. It can be said that in the life cycle of IT devices, they try to follow the Green technology policy, but it seems that they have some shortcomings in managing the life cycle of IT assets especially for recycling and disposing.

In the case of energy, the energy management community of each faculty is in charge of reporting the energy usage of their faculties but not the energy usage of IT assets. So the energy usage of specific IT devices is not specified while it should be measured and cleared. As a result, the carbon emission of IT assets is not been measured and reported. Significantly, the energy consumption of IT devices should be managed and tracked seriously and each faculty should be aware of the energy consumed by their faculties which will lead to lower carbon footprint while they are using IT devices. This matter has not been done by UTM faculties yet and there is no software to track energy consumption of IT devices.

In fact, UTM has decided to start some strategic projects such as low carbon technology and automotive engineering with Imperial College as well as low carbon society project with Kyoto University and moreover, has joined the low carbon society for Iskandar Malaysia. Therefore, each faculty should not neglect the importance of this issue and must strive as much as possible to be a leading faculty in the university.

Therefore, there is a need to develop a comprehensive framework of green IT implementation to improve the efficiency of managing IT device over IT product lifecycle in UTM faculties.

1.3 Problem Statement

Given the problem mentioned above, this research investigates the implementation of green IT strategies in UTM towards defining a sustainable implementation capability maturity level associated with IT hardware life cycle. Such an effort is a means to provide a sustainability guideline. To this end, this research seeks to answer the following questions:

1. What are the criteria to define the capability maturity level?
2. What are the best practices in the IT product lifecycle from the consumer perspective?
3. How can a capability maturity framework on IT product life cycle be developed to assess sustainable IT implementation in UTM?

1.4 Research Objective

Research objective helps the research to set the goal to facilitate the research study. In this research, there are four objectives:

1. To identify the criteria of each capability maturity level.
2. To identify the best practice of IT product lifecycle.
3. To develop the framework of capability maturity on IT product lifecycle.
4. To assess the capability maturity level on IT product life cycle in UTM based on the proposed framework.

1.5 Scope of the study

Universities are equipped with a great number of IT devices such as computers, printers, monitors, projectors, and scanners to name a few. These devices produce CO₂ emission. According to the Higher Education Sector in UK, 500,000 metric tons of carbon dioxide were produced annually by universities in UK, much of which is produced from campuses and data centers (Retrieved from: <http://www.sussex.ac.uk/its/about/greenit>). Research universities are among the worst culprits in terms of CO₂ emissions. This number is equal to 10% of CO₂ in the USA (Retrieved from: <http://green-broadband.blogspot.com/2009/01/uk-government-to-link-funding-to.html>, 2009).

This research develops a framework of green IT capability maturity for IT product lifecycle in the educational context. Faculties/unit in UTM form the scope and sample of the study in order to assess the capability maturity level on IT product life cycle base on the proposed framework.

The IT product lifecycle will focus on consumer perspectives including procurement, usage, and reuse/disposal phases. Green IT purchasing refers to the practice of purchasing products after due consideration of environmental issues (Lettemieke, nd, retrieved on 6/04/2013). Green IT product usage is the level of green IT product usage that has less impact on the environment (Ashok and Sateesh, 2012; Eric, 2010). Green IT reuse/disposal refer to the ways in which old computers and other IT devices are refurbished, reused, and recycled (Ashok and Sateesh, 2012; Eric, 2010).

This research focuses on office equipment categorized as IEEE1680, namely computers and monitors, and image equipment (printer, scanner, copier and fax machine, digital duplicator, multi-function device, and mailing machine).

1.6 Significances of study

This research discusses the significance of developing a framework of capability maturity on IT product lifecycle. This framework significantly assists organizations to implement and monitor their green IT implementation over the IT product lifecycle. Through such a means, organizations are able to initiate, implement, and sustain their green IT implementation.

The findings of this research are intended to assist UTM assess their green IT capability maturity level on IT product lifecycle. UTM can also obtain some guidelines to sustain green IT implementation over IT product life cycle based on their capability maturity level.

1.7 Chapter Summary

This chapter described the research introduction; background of the problem, problem statement, project objective and scope of the study, significant of the project and also the structure of the thesis. The expectation is that, by conducting the project successfully, the objectives of the project can be achieved.

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