Green IT Governance Model: Enhancing the Efficiency and Eco-Friendly of Private Higher Education Environment in JABODETABEK

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Abstract—**Green computing simply defines as the use of eco-friendly system and information technology, which is rarely to be applied around University in Indonesia. Whereas, information technology (IT) give fully support toward the learning process at the campus area. As its project scope, this research was focused in the area of Jabodetabek only, although it is applicable to others. Many research on green computing have been conducted, however none of them found the green computing governance that are really suitable to the private universities in Indonesia. Based on the previous research done by University of Michigan, and Green Computing Methodology by GTYS , the Green IT Governance Model for Private Higher Education in Jabodetabek area was developed. However, further researches are expected in order to measure and develop the best practice. Furthermore, Energy saving, waste management systems and information technology will be controlled accordingly and the threat of toxins that can harm our health can be avoided.**

Keywords- Green IT;Green Computing; Green IT Governance Model

I. INTRODUCTION

The complexity problem causes by global warming has been discussed frequently among the world leaders. Recently on October 2012th, Sandy Hurricane featured a scary extra twist implicating climate change. Climate scientists Charles Greene and Bruce Monger of Cornell University, provided evidence that Arctic ice melts linked to global warming contribute to the very atmospheric pattern that sent the frigid burst down across Canada and the eastern U.S [2]. This condition happened causing by the increasing of the earth temperature since people keep escalate their activities and facilities of life. The huge amount of modern technology has been giving large contribution for the global warming to be occured. It is supported by R.A. Sheikh & U.A. Lanjewar who stated that "Information Technology energy demand is growing 12 times faster than the overall demand for energy" and "Data centres emit over 150 metric tons of CO2 per year, and the volume is increasing rapidly [10]. Therefore, the needs to implement the Green IT method is substantially conducted in order to increase the economic viability and improved system performance and

use, while abiding by our social and ethical responsibilities" [10]. However, since 1992, the US Environmental Protection Agency (EPA) launched Energy Star, a voluntary labeling approach to recognize electronic equipment's energy-efficiency characteristics. It was where the idea of green computing founded [9].

Towards the context of Strategic System Plan and Information Technology purposed by John L. Ward & Joe Peppard (Figure 1), it is depicted the importance of research on Green IT as its one of the external technology factor to produce future application portfolio for the organization [14]. Meanwhile, having an eco-friendly campus has been expected for many education institution as well as the people involved. The negative impact of the use of Information System and Information Technology should be reduced or preferably avoided even if its serves as the main support of the research and daily teaching activity.

Indonesia as a country with the fourth largest population in the world is having approximately 3.216 high level education institution [8], while, 97,24% of its role are dominated by private institutions [3]. However, while possessing these numerous numbers, none of them developed its own Green IT strategic nor eco-friendly used of Information System /or Information Technology Strategic Plan. As a matter of fact, around 325 private higher education institutions in DKI Jakarta are being contributed toward poor education performance. It is caused by the average growth of -3,42% of new applicants and the average growth of 0,09% of new students [3]. DKI Jakarta is the lowest among Kopertis in Java Island.

Budiastuti (2013) highlighted its condition into strategic map of higher education performance achievement, and considered lower cost strategy as one of the importance variable [3]. Higher education institutions need to reduce their cost in order to provide affordable tuition fees. Green IT becomes the priority solution, for reducing day-to-day operational cost. Therefore, responding to those needs, a team from School of Information System and School of Computer Science at Bina Nusantara University has been developed a Green IT Governance Model that can be applied to other Private Higher Education in Jabodetabek area.

Despite of the fact that the measurement phase is still ongoing process, but this model is legitimately can be used.

The methodology for this research based on literature studies and observations. Observations were being conducted towards private universities in Jabodetabek Area.
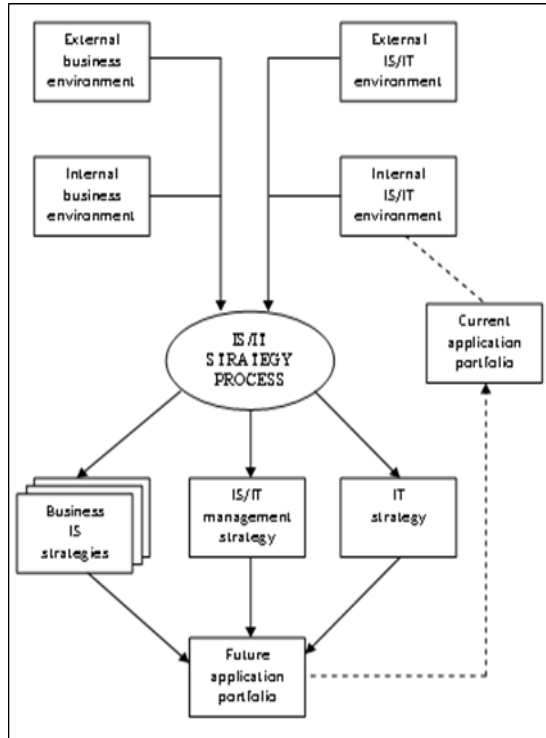

Figure 1. Strategic System Plan and Information Technology Model[14]

II. GREEN IT METHODS

Jason Harris studied 2(two) methods that can help a company save resources, which are: Virtualization, a technology that can help us save both hardware and software resources by creating a "similar environment" like an operating system or a peripheral device using our present resources, and Power Management, by using the power management feature which can actually disable some features of the system that consumes too much battery usage [5] From using the power management method, not only will save electric charging fee but also saving the battery from easiy being worn out.

Another Green IT method developed is the Method-G. The Method-G is the Green Computing Methodology followed by GoToGreenPlanet in partnership with Adcuent Consulting Technology. This methodology was designed to help the clients from both organizations achieve rapid, cost-effective Green Computing Status [1] . Figure 2 depicts the Method-G life cycle that develop a sustainable green computing plan from continously improving 4(four) phases: recycle, make environmentally sound purchase decision,

review paper consuptions and conserve energy. Towards the continous improving its plan, the company can achieve its eco-friendly working environment.

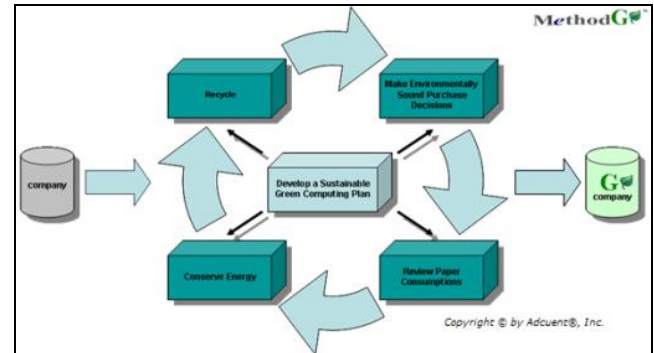
Figure 2. Computing Methodology ([1]

San Murugesan (2008) in San Murugesan & G.R. Gangadharan concepted holistic approach to greening IT [12]. Based on his theory, in order to comprehensively and effectively address the environmental impacts of IT, organizations must adopt a holistic approach that addresses the problem along 6(six) complementary directions (figure 3).

Green use of IT systems deals with reducing the energy consumption of computers and other information systems, and use them in an environmentally sound manner. While green IT strategies and policies will add value and focus on both short and long-term benefits. These are aligned with business strategie and practicessm and are key components of greening IT. Furthermore, green standards and metrics are required for promoting, comparing and benchmarking sutainability initiatives, products, services and practices. Green manufacturing deals with manufacture electronic components, computers and other associated subsystems with minimal or no impact on environment. Green design, design energy-efficient and environmentally sound components, computer, servers and cooling equioment. Lastly, green disposal that refurbish and reuse old computers, and properly recycle unwanted computers and other electronic equipment [12]
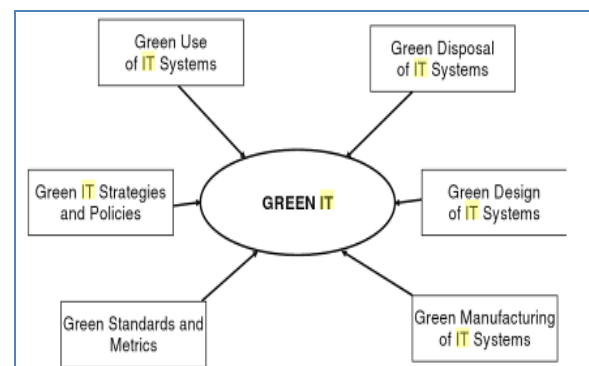

Figure 3 Holistic, Multipronged Approach to Greening IT [12]

A.   Green Data Center

Data center energy and emissions costs are major concern in green IT analysis because more than half of all IT-related electrical there, from small installations to massive facilities with thousands of servers and tens of thousands associated workstations [9]   Claimed as the forefront of research, technology, and products and invests in continuous improvement of processess and methods, IBM through its expertise developed green data center techniques. Aims of this project are helping   IBM customers make optimal investments in energy-efficient data centers, as well as helping them consolidate IT assets and cut costs.

Martin Ceron proposed 5(five) key elements of Green Data Center (figure 4) [4]These key elements are served as organizations/firms consideration, when they   wish to implement a green data center. The key elements are managing space and cooling, managing power costs, aiming for a scalable, modular data center, maintaining efficient hardware and software and virtualizing and consolidating. Organizations may select the options that fit with their data center based on key criteria.

Aside from the key elements of green data center, Martin Ceron developed efficiency   techniques that are based on green technology. Figure 5 shows 3(three) types of efficiency techniques which are: IT techniques, facilities techniques and integration techniques. Organizations may combine each techniques or use them separately. Each technique has a level of complexity for implementation and use and has an associated playback.
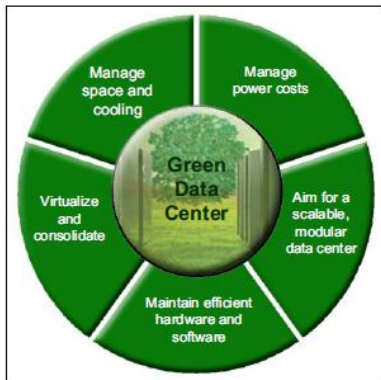

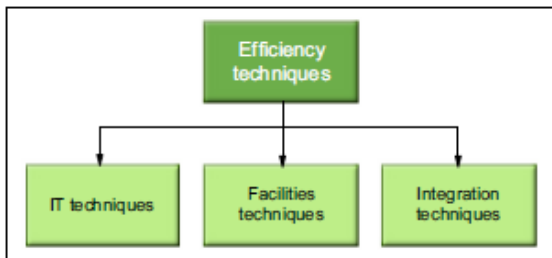*Figure 4. Key Elements of Green Data Center [4]*

Figure 5. Type of Efficiency Technique
[4]

Previous researches were conducted from many institutions, particularly in high level educations   are discussed in this paper.   Furthermore, the combination between Green Computing Methodology and the Green IT model were obtained in order to develop the Green IT Governance Model for high level education in Indonesia.
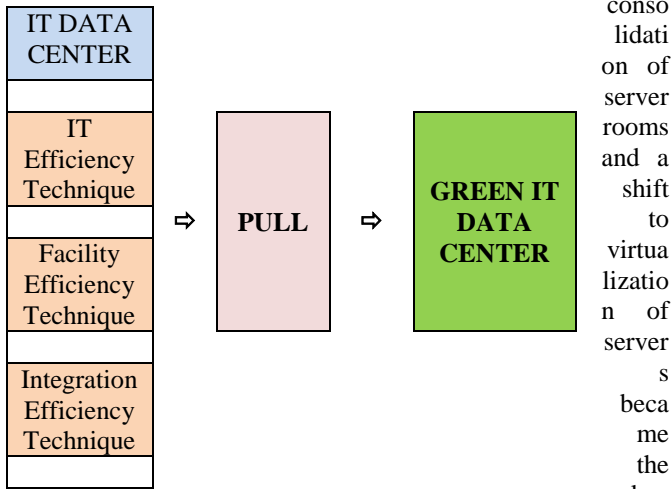
III.   GREEN IT BEST PRACTICES AT THE UNIVERSITY OF MICHIGAN

The Green IT best practices at the University of Michigan, initially came from the idea of one of Google founder as well as the alumnus at the University of Michigan, Larry Page. He established the Climate Savers Computing Initiative (CSCI).   CSCI strives to promote the development, deployment and adoption of smart technologies. This practices can both improve the efficiency of computer's power delivery and reduce the energy consumed [13] Additionally, University of Michigan also made a commitment to influence other universities and the IT industry to follow its lead in adopting green practices by engaging with other universities on sustainability issues and levering the purchasing power with major IT vendors [11].

Marybeth Stuenkel elaborates some steps which were formed as guidelines of the implementation of Green IT Best Practice at University of Michigan [11]The first step was charged 2(two) volunteer groups, the Desktop Technologies team and Data center/Server Room Team. The Desktop Technologies team targeted development of energy-saving computing parctices for students, faculty, and staff. They were asked to research, deliberate, and then create and maintain a series of best practice guides to decrease energy used on and off campus. Meanwhile, The Data Center/Server Room team was charged to define best practices for green IT computing centers and server rooms and to recommend actions units can take to reduce energy use by those facilities. This team began by compiling university specific benchmark data on data center and server room locations on campus in order to project potential savings. The second step was to make the campus community aware of the best practices. By using advertised website, e-mail newsletter and making Desktop Best Practices poster for students, faculties, and staffs, it would spread the importance of having eco-friendly environment at their campus. The following step was to evaluate purchasing decision. Through using "right-size", they carefully considering energy efficiency as a factors when purchasing, and not buying bigger or faster than is really need.

Further step was to use several thin-clients to produce savings in hardware costs and in power consumption. Another important aspect included into this intiative was E-Waste management. Through adopting the 3R's – Reduce, Reuse, Recycle, they arose the awareness and helped users

to find the right destination for their e-waste. Lastly, the consolidation of server rooms and a shift to virtualization of servers became the key components of its green IT plans.
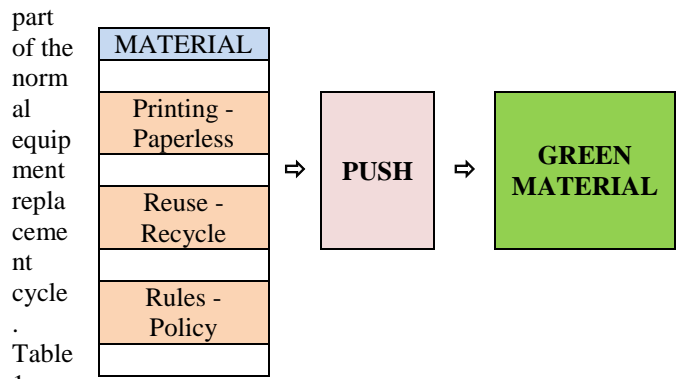

Since the beginning of the CSCI @ U-M program, there were some impacts: campus acceptance of a new virtualization service, inclusion of the best practice recommendations in a standard Vista image, rapid adoption of a new campus computer power and patch management service, investagion of a virtual desktop sevice, initiation of a data center consolidation project. Other advantages included the savings to the university of more than $90,000 per year in energy costs and upon the CPPM service adoption of around 12,000 workstations, it is expected to save over 2 million kilowatt hours per year for a savings of around $180,000.

IV. THE PROPOSED MODEL OF GREEN IT GOVERNANCE FOR PRIVATE UNIVERSITIES IN JABODETABEK

Based on data and information gathered, new model was developed in order to create the model of green computing governance for Private Universities in Jabodetabek. This model is very simple, logical, easy to apply and measure during the implementation phase.

There are 2(two) model proposed by using push and pull paradigms. The push model depends on material elements, which are: printing-paperless, reuse-recycle and rules-policy (figure 6). University may transforms its materials into green material by reducing the amount of paper they used, continously reusing and recycling its IT equipments and establishing rules and policy for green IT purpose.

Figure 6. Push Model

Reuse and recycle elements rely on procurement activity. It covers the energy efficiency level, product lifecycle, and the level of waste associated with any procured equipment as its important purchasing factors. In order to reduce waste level, organizations may purchase the IT equipment from the trusted supplier. Meanwhile, the disposal activity focuses on unused IT equipment. Organizations may dispose, destroy, sell or give them to other individuals or organizations as well.

Rules-policy enforces organization to establish its own green IT framework. It is must be done to ensure green IT becomes a business-endorsed program of work rather than a discreet IT project. Practice refers to techniques and behavior. There are many practices that individuals and organizations can adopt in order to help the greening of the IT function. Some of the practices are simply the alteration of habits and mindsets. It does not involve the purchase of any new hardware or software. Example, turning off PCs when not in use, recycling printer paper and printing less, and using IT equipment for longer rather than replacing it when it is still useful. In terms of technology, people often concentrate of the purchase price of the technology. It is leading to a belief that Green IT costs money. By far the best way in most cases to approach the issue of Green IT technology is to take Green IT principles into account as part of the normal equipment replacement cycle. Table 1

shows variety of material components that should be transform into green materials.

Meanwhile, pull model captures the elements of IT data center adopted from Martin Ceron's type of efficiency techniques in figure 5 (2012). In order to build green IT data center, university must lean on toward IT effciency technique, facility efficiency technique and integration efficiency technique (figure 7).

IT Data Center Components		
UPS	Switch Gear	Chillers
Computer room AC	Direct Expansion Units	Pump
Cooling Tower	Generators	Distribution loosses external to racks
Power Distribution Units (PDUs)	Batteries	Lighting
Storage		

Table 2. IT Data Center Components

Figure 7.Pull Model

Figure. 8 Results on Push and Pull Model

Those 3(three) elements cover the most simple, affordable and proven techniques to increase data center effciency without major infrastructure changes or sacrificing protection. Hence, by adopting them, university may save money, enhance sustainability and ease compliance with environmental regulations. Table 2 shows the IT data center components which could be simplified into 3(three) major components, which are: (1) eliminate the PDY and raise voltage, (2) employ high-efficiency UPS hardware, and (3) use DC power distribution (table 2).
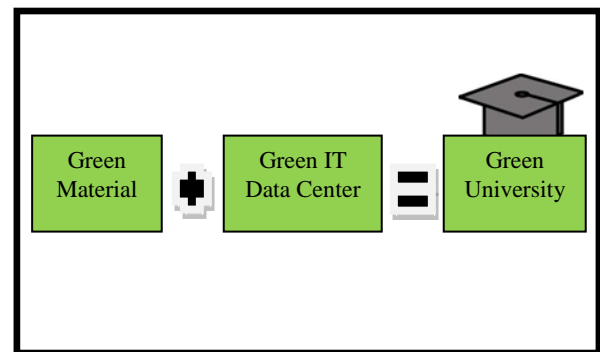
Table 1. Material Components

Material Components		
Computer	Laptop	Paper
E-Waste	Regulations	Printer
Monitor	Vendor	Scanner
Gadget	Fax	Cell phones

With energy costs representing the single largest component of IT operations, the benefits of these strategies can be substantial. Even a small data center can save tens of thousands of dollars a year in utility bills by making a few changes, and larger data centers could potentially save millions over time without ever compromising data center performance or reliability.

By combining both push and pull model, university may enhance efficiency as well as eco-friendly environment and transform its paradigm into green university (figure 8).

V. CONCLUSION

Green university model faced with the challenge of realigning institutional practices, processess and resources to fully institute sustainability on campus environment. This green IT model still need an innovative guide around which to hinge the development of sustainable institutional practices, structure progressive action and foster meaningful change. However, further research will be conducted in other to develop best practices checklists for successful implementation.

VI. REFERENCES

[1] Adcuent, *Method-G™: Green Computing Methodology*. Retrieved 10/30/12, World Wide Web, http://www.gotoyoursite.com/MethodG/tabid/4024/Default.aspx (2010)

[2] P.M. Barrett, P. M. *It's Global Warming, Stupid.* Retrieved 10/30/12 World Wide Web, http://www.businessweek.com/articles/2012-11-01/its-global-warming-stupid (2012)

[3] D. Budiastuti, *Managing Knowledge & Innovation in University*, Doctorate Dissertation (2013)

[4] M. Ceron , *A Green IT Approach to Data Center Efficiency*, An IBM Reedbooks Point of View publication by the IBM Academy of Technology (2012)

[5] J. Harris, *Green Computing and Green IT Best Practices: on Regulations and Industry Initiatives, Virtualization, Power Management, Materials Recycling and Telecommuting.* (Emereo Publishing, Queensland,2008.

[6] J. Lamb *The Greening of IT : How companies Can Make a Differences for the Environment (*Pearson Education Inc, Boston, 2009)

[7] S.,Murugesan & G.R. Gangadharan *Harnessing Green IT : Principles & Practices (*John Wiley & Sons, West Sussex, 2012)

[8] D. Rustam, *Moratorium PTS Berlaku untuk Kampus Asing.* Retrieved 2/12/12 , World Wide Web, http://www.dikti.go.id/?p=5248&lang=id (2012)

[9] S. Ruth, IEEE Int. Comp **13,4** (2009)

[10] R.A. Sheikh & U.A. Lanjewar , Int. J. Comp. App.   **10,4** (2010)

[11] M. Stuenkel , *Green IT Best Practices at the University of Michigan.* Retrieved 4/9/12. World Wide Web, http://www.educause.edu/ero/article/green-it-best-practices-university-michigan (2009)

[12] B. Tomlinson, *Greening through IT: Information Technology for Environmental Sustainability,* (MIT Press, Massachusetts, 2010)

[13] University of Michigan, *Sustainable Computing*. Retrieved 2/12/2012, World Wide Web, http://sustainablecomputing.umich.edu/ (2012)

[14] J.L. Ward, & J. Peppard, *Strategic Planning for Information System* (3rd ed.) (John Willey, West Sussex, 2002)