



# THE USE OF GREEN INFORMATION TECHNOLOGY GOVERNANCE MODEL TO DETERMINE CAPABILITY MATURITY LEVEL IN DKI JAKARTA PRIVATE HIGHER EDUCATION INSTITUTIONS

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## ABSTRACT

Defined as the use of eco-friendly system and information technology, green Information Technology (IT) has been adopted in most world class universities worldwide. Meanwhile, DKI Jakarta as the capital city of Indonesia has a total of 325 private higher education institutions. Green IT term is quiet well known in these areas, although its implementation is still sporadic. However, information technology (IT) gives fully support toward the learning process at the campus area. As its project scope, this research was focused in DKI Jakarta, but it is applicable for others. Many research on green IT or green computing have been conducted, however none of them focusing on Private Higher Education Institutions in Indonesia. Based on the previous research done by various Private Higher Education Institutions, IBM and Green Computing Methodology by GTYS, the Green IT Governance Model for Private Higher Education Institutions in DKI Jakarta area was developed. However, further researches are expected in order to 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:** *Private Higher Education Institution, Green IT, Green IT Model*

## 1. 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 occurred. 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 centers emit over 150 metric tons of CO<sub>2</sub> per year, and the volume is increasing rapidly [6]. Meanwhile, in order to try to capitalize on the ongoing environment sustainability movement, many organizations have started to reinforce their green credentials by making green initiatives counterfeit claims that their products and operations are carbon neutral, fuel-efficient or environmental friendly [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" [6]. 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 [11].

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 [7]. Meanwhile, having an eco-friendly campus has been expected for many education institutions 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 activities.

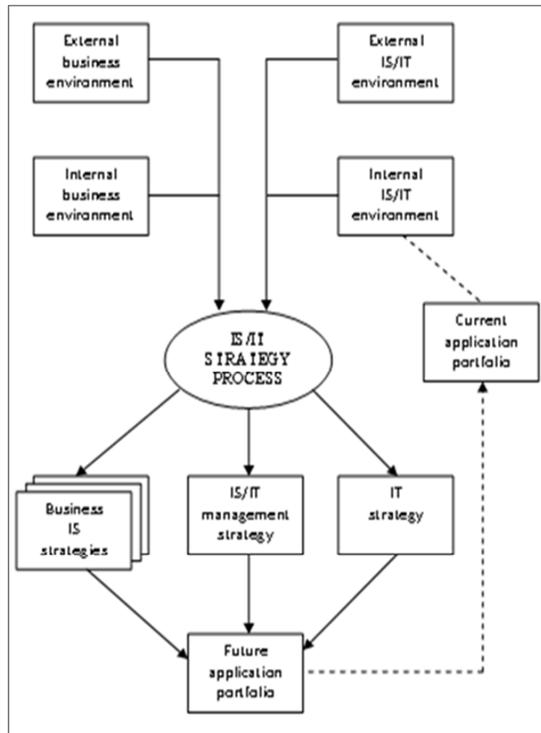


Figure 1 Strategic System Plan and Information Technology Model[7]

Indonesia as a country with the fourth largest population in the world is having approximately 3.216 higher level education institutions [9], 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].

Budiastuti 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, Green IT Governance Model that can be applied to other Private Higher Education Institutions in DKI Jakarta area was developed as well as the used of this model to determine the maturity level of each respondent. The methodology for this research based on literature studies, observations and surveys. Observations and surveys were being conducted towards private higher education institutions in DKI Jakarta area.

2. GREEN IT METHODOLOGIES

Jason Harris studied 2(two) methods that can help a company save resources, which are: Virtualization, a technology that can help organizations save both hardware and software resources by creating a “similar environment” like an operating system or a peripheral device using present resources. Another method is the use of Power Management. By using the power management feature which can actually disable some features of the system, the consumable of battery can be reduced [8]. The implementation of Power management method, not only will save electric charging fee but also saving the battery from easily 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 and cost-effective green computing status[1]. Figure 2 depicts the Method-G life cycle. It has 4(four) phases that develop a sustainable green computing plan. Those 4(four) phases contain: recycle, make environmentally sound purchase decision, review paper consumptions and conserve energy. Towards the continuous improving its plan, the company can achieve its eco-friendly working environment.

Furthermore, San Murugesan has proposed green IT dimensions (figure 3), which contains of the efficient and effective design, manufacture, use an disposal of computer hardware, software as well as other communication systems with no or minimal impact on the environment. Second dimension

involves the use of IT and information systems to empower – that is support, assist and leverage – other enterprise-wide environmental initiatives. The last is the harnessing of IT. This is importance, in order to help the creation of awareness among stakeholders and promote the green agenda and green initiatives [12].

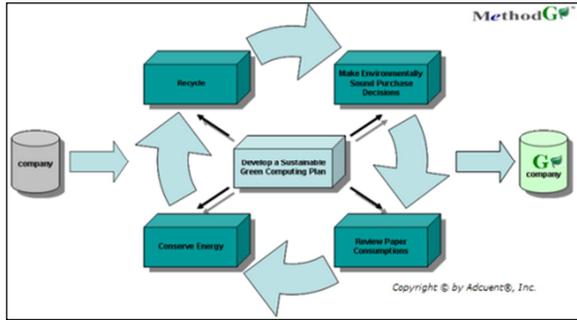


Figure 2 Computing Methodology [1]

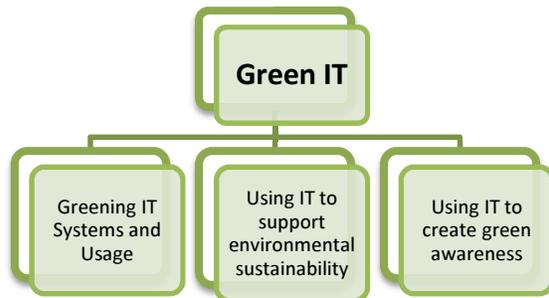


Figure 3 Green IT Dimensions [12]

### 3. 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 [11]. Claimed as the forefront of research, technology, and products and invests in continuous improvement of processes and methods, IBM through its expertise developed green data center techniques. Aims of this project are to help 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 show 3(three) types of efficiency techniques which are: IT techniques, facilities techniques and integration techniques. Organizations may combine each technique or use them separately. Each technique has a level of complexity for implementation and use and has an associated playback.

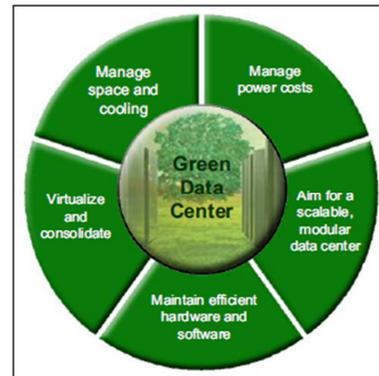


Figure 4 Key Elements of Green Data Center [4]

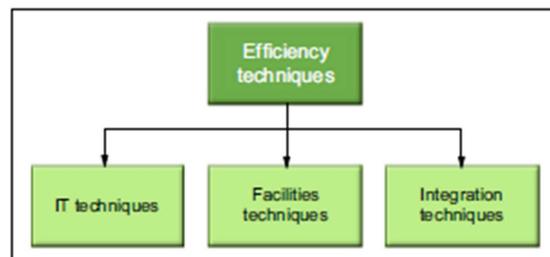


Figure 5 Type of Efficiency Technique [4]

### 4. CAPABILITY MATURITY LEVEL

As discuss later in this paper, according to Adcuent green computing methodology, organization must continuously improves its performance (sustainability) in order to achieve greater result (figure 2) [1]. In order to assist organizations to understand the maturity of their green computing capability or performance, a capability maturity framework, developed by Curry, Guyon, Sheridan and Donellan was applied (figure 6) [13].

The framework defines a maturity curves with five levels, which are: initial, basic, intermediate,

advanced and optimizing. These levels perform sustainable IT capabilities including strategy and planning, processes management, people and culture, and governance [13]

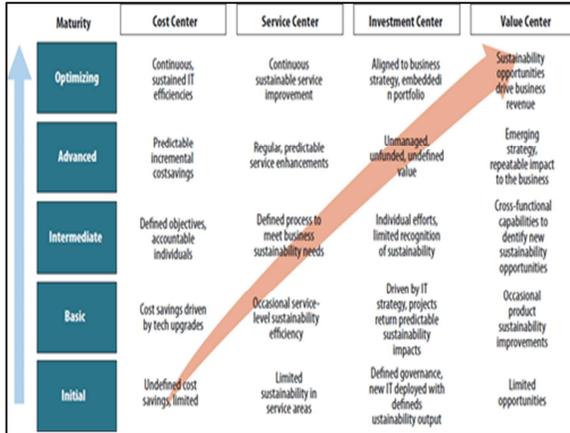


Figure 6 Green IT Capability Maturity Framework[13]

### 5. GREEN IT GOVERNANCE MODEL FOR PRIVATE HIGHER EDUCATION INSTITUTIONS IN DKI JAKARTA AREA

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

#### Push Model (Vertical Activity)

The green IT governance model for Private Higher Education Institutions in DKI Jakarta uses push and pulls paradigms. Push model was adopted from the Material Resource Planning (MRP) system in manufacturing industry. Push model uses calculation and production schedule for every level, based on sales forecast. During the production process, sub-assemblies are pushed to the following level without perceiving the requirement of them. In IT context, future technology will be based on push technology. Whereas, businesses and organizations may come to their customer to “push” various information, product and service based on customer profile [14].

Push model in green IT governance model for Private Higher Education Institutions in DKI Jakarta, depends on material elements, which are: printing-paperless, reuse-recycle and rules-policy (figure 7). University may transform its materials

into green material by reducing the amount of paper they used, continuously reusing and recycling its IT equipment and establishing rules and policy for green IT purpose (table1) [15]. Top-down (centralization-decentralization) strategy is being used towards this paradigm.

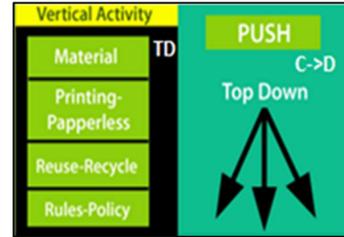


Figure 7 Push Model

Table 1. Material Components[15]

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

#### Pull Model (Horizontal Activity)

Meanwhile, pull model has been adopted from Just in Time (JIT) system in the manufacturing industry. In JIT, the production is being conducted as a trigger from the customer demand. The units are being pulled into the system, based on demand. Within IT context, users are being able to find and request any information through the usage of internet technology. Literally, users are pulling everything they want [14].

Pull model in figure 8, depends on the element of data center, proposed by Martin Ceron’s types of efficiency technique (figure 5)[4]. In order to build eco-friendly data center, Private Higher Education Institutions lean on 3(three) types of efficiency technique. As mention earlier, these types of efficiency technique (IT efficiency technique, facility efficiency technique and integration efficiency technique) may be applied separately or simultaneously, in order to achieve best result.

Table 2, depicts various components in green IT data center that must be put into various efficiency techniques. However, bottom-up strategy (decentralization-centralization) is being used to support pull model [15].

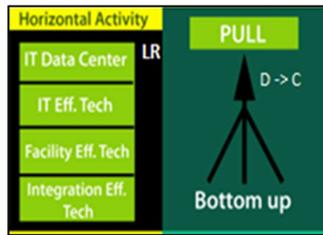


Figure 8 Pull Model

Table 2. Green IT Data Center Components[15]

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

Capability Maturity Level

In furtherance of identifying and enhancing the implementation of green IT for Private Higher Education Institutions in DKI Jakarta area, they need to evaluate current green IT performances. Capability maturity level, adopted from capability maturity framework in figure 6, has been combined into this model (figure9).

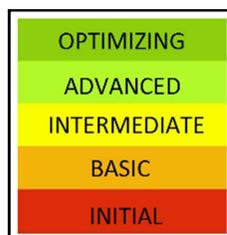


Figure 9 Green IT Capability Maturity Level

In the initial level, education institution has inadequate knowledge toward green IT/computing area. Green IT policy has insufficient found or none. Green computing is not being applied yet into university's life cycle system.

Basic level captures green computing strategy in the minimum level. The awareness of green computing is increasing. However the accountability

of it is not yet defined. Few policies are made, but none of them are being applied consistently.

The intermediate stage emphasizes the association between its green computing strategies with green computing plan. Private Higher Education Institutions establish priority level toward green IT or computing implementation. They develop the ability and expertise to advance each individual in the institution to contribute in this sustainable program.

Meanwhile, in the advanced level, sustainability has become major component in the business-planning and IT life cycle. Education institution realizes that green computing has been giving significant contribution. Various green IT or computing policies are designed to achieve best practice for each individual in its institution.

In the optimizing level, education institution not only applies green computing in its internal environment but also toward its partners. Institution is being awarded as sustainability leader in the green computing area and becomes role model for other education institutions.

The Green IT Governance Model for Private Higher Education Institutions in DKI Jakarta

Associated with push and pull model as well as its capability maturity level, the green IT governance model for Private Higher Education Institutions in DKI Jakarta area was developed (figure 10).

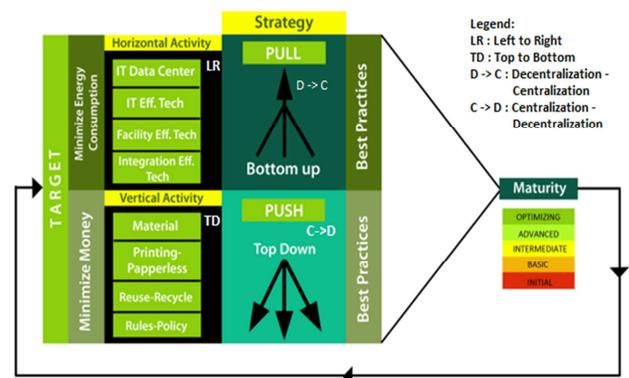


Figure 10 Green IT Governance Model in DKI Jakarta Private Higher Education Institutions

The evaluation of greencomputing in various private higher education institutions in DKI Jakarta was being conducted. Checklist questioner was made in order to simplify the data collection process. Both horizontal and vertical activities,



resulted some guidelines (also known as best practices).

Table 3. Green Computing Checklist

Reduce Printing – Paperless Best Practices	Reuse – Recycle Best Practices	Rules – Policy Best Practices	IT Efficiency Technique Best Practices	Facility Efficiency Techniques Best Practices	Integration Efficiency Techniques Best Practices
Email Usage	e-waste evenet	Turn monitor off during idle	Green algorithm	Structured cable management	Telecommuting
No e-mail printing	Recycle old computer	Unplug electrical equipment	Energy efficiency UPS	Autonomic cooling adjustment	
Paperless Report	Recycle ink&toner	Turn off printer, scanner	Vmware	Free cooling	Branch circuit monitoring
Preview doc.	Recycle unwanted electronics	Closed unused app.	Data storage virtualization	Alternative power	Integrated facility & IT dashboard
No double printing	Recycle notebook batteries	Shut down at the end of the day	Power management software	High DC voltage	Integrated facility and IT reports
Final copies printing only	Donate unwanted electronic	Dark screensaver	Green software usage	High or low-density zone conf.	Asset data access from environmental analysis
Duplexing	Turning e-waste into profit	Computer sleep mode	Asset level power & thermal monitoring	In-row cooling	Alert and event management
Narrower margins, reduce font	e-waste warehouse	Incentive program	Asset IT utilization monitoring	Scalable, modular data center	Data and service association monitoring
Eliminate cover during faxing	Upgrade old pc	Punishment for not implementing green IT	High efficiency hardware	Direct rack duct cooling	Intelligent Power Distribution Unit level
e-doc usage	Reusable pc parts	Green technology	Rear Door Heat eXchange	Environmental condition analysis	
Low print quality	Collecting paper for recycling	Green policy, SOP	Cloud Computing	Hot/cold aisle in optimum conf.	
Recycle paper usage	Ensure responsible recycling	Green partner/IT vendor	Replace CRT with LCD	CRAC air flow	
Soft copy usage	Reuse paper for draft doc.	Green purchasing policy	Replace PC with Notebook	Employ leak-detection systems and reaction plans	
Lower grammage paper usage	Buy recycled-content paper	Green certified	Buy "green"	Lighting consumption	
Print envelopes without labels		New server replacement policy	Use a two-way server		
Use latest version of word processing		Data center colocation policy	Replace an old server with blade		

		Data center design policy	Replace a dual processor server with single		
		Join green community	Use a two-way dual-core server in place of a four-way server		
		Chief Green Officer (CGO)			

This guidelines contain of some green computing exercise (checklist) based on activities in the push and pull. 5(five) categories depicted from capability maturity level were measured across each list as it is shown in table 3 above. For further evaluation process, each level of maturity has its range of score. Initial level is ranged between 0-1.49. While, basic level is set between 1.5-2.49. 2.5-3.49 is considered in the intermediate level. Advanced level is arranged between 3.5-4.49. 4.5-5 is the maximum level of the maturity (optimizing).

6. THE EVALUATION PROCESS

Hence, the data analysis, resulted from several Private Higher Education Institutions in DKI Jakarta Area. In terms of reduce printing – paperless best practice, has given result 3.45 means. According to capability maturity level, it is on the intermediate phase. While the reuse – recycle best practices, scored 3.4 means (intermediate level). As well as rules – policy best practice, several Private Higher Education Institutions (3.25 means). IT efficiency technique best practices, has given higher results than vertical activities. Private Higher Education Institutions scored 3.6 means, which relates to advanced level in their capability maturity. Meanwhile, facility efficiency technique best practices resulted 3.17 means (intermediate level). Lastly, although it is still considered as intermediate level, the integration of efficiency technique best practices has given the lowest result, 2.9 means.

7. CONCLUSION

Green IT private higher education institutions model faced with the challenge of realigning institutional practices, processes and resources to fully institute sustainability on campus environment. Current 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 metrics and measurement tool such as calculator for successful implementation.

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