Assessing Green IT Maturity and Recommendation of Improvement for Government Agencies in Thailand

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***Abstract*— Role of Information Technology (IT) in responsible for environmental and sustainability matters has been approaching to IT & Non-IT Executives, policy makers, practitioners and business consultant's interests. Green IT is one of the keys to becoming a green low-carbon society. This study presents a model for assessing the level of Thailand Green IT Maturity. The study applies Korea National Information Society Agencies (NIA) Green IT Maturity Model Integration (GMMI) to assess the readiness of Green IT in Thailand government sector. This study uses this model to evaluate 55 government agencies from ministerial and departmental or equivalent level to assess the overall level of Green IT maturity among government agencies. The current status of Thailand Green IT Development in government agencies and improvement strategies are presented in this study. The overall levels of Green IT maturity among Thailand government agencies are likely to be lower. The needs for Green IT are acknowledged. Limited Green IT efforts are found but not producing substantial outcome. Structure and framework on Green IT are required for systemic management. Green IT efforts are required by adopting a variety of technology to manage eco-friendly IT resources. In order to accelerate Green IT development in Thailand, this study recommends that the government should take a leading role to promote Green IT through National Green IT initiatives including the reform of policy, strategy, regulation and promote education & training as well as provide technical assistance for accelerating Green IT development. Future study should be expand the assessing agency to national level including local government and/or private sector for further development and towards to low carbon society.**

***Keywords*— Climate Change, Sustainability, Green IT, Green IT Maturity Model, Green Management**

I. INTRODUCTION

Climate change is a global issue but we still do not have enough knowledge to predict the full extent of its impact. Urgent responses from all sectors in every corner of the world must be carefully strategized in order to mitigate the impact while sustaining economic growth. The IT sector is no exception and can do a lot more to contribute to a greener regional economy. However, in the initial stage, we must be able to understand the extent to which IT can help make the world greener.

Enterprises' information resources are one of the main sources of Greenhouse Gas (GHG) emission. At the same time it is a key solution for low-carbon and green management. IT offers many opportunities for Corporations to operate in a greener manner and provides an opportunity to save costs or increase revenue [1]. Green IT is a multifaceted construct [2] that is intended to address both of Green of IT and Green by (using) IT. Corporations need to actively adapt Green IT as part of strategic effort to reduce energy consumption and greenhouse gas emissions. In order to effectively attain the goal of green management, corporations must first accurately assess the current level of Green IT Maturity and establish improvement strategies [3]. Government agencies in developed countries and global firms are assessing their current level of Green IT Maturity for more effective implementation of improvement efforts.

In Thailand, the government has a green growth vision, and followed suit with policy measures reflecting the vision such as 'The ICT2020 policy framework'[4]. In strategy No. 7- ICT and Environment- the Green ICT, The main purpose of the strategy is to make ICT an important driving force in green economy and social development. The strategic actions and measures concern on greening of ICT as well as greening by ICT. In this article, Author presents a model for assessing the level of Green IT Maturity among Thailand government agencies. Using this model, Author assesses the level of Green IT readiness in 55 agencies that are representative of their respective government agencies. Referring to the results of assessment, Author proposes strategies for accelerate Green IT Development in Thailand.

II. LITERATURE REVIEW

A. Accenture: Green Maturity Model

Accenture developed green maturity model for evaluating the level of green IT maturity of companies and proposing strategy for improving green performance. Accenture Green maturity model measures the green IT maturity of companies by using 300 indicators in 5 evaluation areas including data centers, office environment, work practice, procurement, and corporate citizenship. [5]

B. U.K. Cabinet Office: Green ICT Scorecard

The British Cabinet Office co-developed Green ICT scorecard with Gartner to assess the level of Green IT Maturity among government agencies. The green ICT scorecard, developed to reduce the environmental impact of ICT, is designed and used with the targets of the Sustainable Operations by government. In 2009, the scorecard was piloted in 8 government agencies and the local government of Scotland.[6]

C. Korea: Green IT Maturity Model Integration

Korea, National Information Society Agency (NIA) have developed Green IT Maturity Model Integration (GMMI) to assess the current status of and support for Green IT in order to build a roadmap and an effective action plan for the promotion of Green IT. The GMMI consists of 5 main categories, namely, Leadership, Work Practice, Office Environment, IT Asset Management and Data Center. An organization's level of Green IT Maturity is assessed based on the maturity stage model, which consists of 6 stages (0 to 5) for each indicator. An indicator-specific weight is applied to calculate the overall score.

D. Australia: Green IT Readiness Index

Australia Connection Research, IT consulting firm, co-developed with the Royal Melbourne Institute of Technology, Green IT readiness index for measuring the level of green IT maturity among Australian companies in 2009. Connection Research explores around 200 Australian companies [7]. The green IT readiness of companies is me measured in 36 indicators in 5 areas, including lifecycle, end user, enterprise, enablement and metrics.

E. Infosys: Green IT Maturity Model

Infosys introduces a green IT maturity (GITM) model [8] for assessment and implementation of Green IT services. This model used to measure and grade an organization's maturity in being green and its efforts towards a greener future. The factors that are typically integrated in the maturity model are 1) Data center and facilities 2) End user computing 3) Asset lifecycle 4) IT service management and 5) People practices.

F. APECTEL: Green ICT Maturity Model

The project "Study Workshop on Best Practices Transfer of Green ICT for Sustainable Growth [9]" has been approved by APEC Secretariat in Year 2010 and conducted by NSTDA Academy, National Science and Technology Development Agency, Thailand in Year 2011. The assessment areas are 1) Knowledge & Awareness 2) Policy & Strategy 3) Management Techniques and 4) Implementation and Development

G. Comparison of 6 Existing Tools for Green IT Assessment

Regarding to existing assessment tools as Table 1 which was initiated from Public and private Agencies as well as Academic Institute. There are diversities on Strength and weakness. This study applies Korea National Information Society Agencies (NIA) Green IT Maturity Model Integration (GMMI) to assess the readiness of Green IT in Thailand government sector. GMMi is the most proper for adapting to Thailand Government Agencies. GMMI is designed for Korea Government Sector and already implemented with Korea Government agencies in Year 2010. This model reflects specific IT conditions in the government sector, consists of concrete 42 indicators in 5 areas and 15 sub categories.

TABLE I COMPARISON OF 6 EXISTING TOOLS FOR GREEN IT ASSESSMENT (ADOPTED FROM [3])

	Green Maturity Model	**Green ICT Scorecard**	**Green IT Maturity Model Integration**	**Green IT Readiness**	**Green IT Maturity Model**	**APECTEL Green ICT Maturity Model**
Initiator	Global Consultancy: **Accenture**	National Government: **U.K Cabinet Office**	National Information Society Agency **Korea**	National IT Consultancy **Australia Connection Research**	Biz Tech Consulting: **Infosys**	NSTDA Academy **Thailand**
Assessment Area	1. Data center 2. Office Environment 3. Work Practices 4. Procurement 5. Corporate Citizenship	1. Sustainable Development and Corporate Social Responsibility 2. Level of Tech Optimization 3. Green ICT Policy	1. Leadership 2. Work practice 3. Office Environment 4. IT Asset Management 5. Data Center	1. End user 2. Enterprise 3. Life Cycle 4. Metrics 5. Enablement	1. Data Center 2. End User Computing Asset Lifecycle 3. IT Service Management 4. People Practices	1. Knowledge and Awareness 2. Policy & Strategy 3. Management Techniques 4. Implementation & Development
Strengths	Comparative analysis information is rich due to the developer's world-wide practice	Well aligned with a corporate-level sustainability management process	Concrete indicators in 5 areas, 15 sub-categories, reflecting specific ICT conditions in public sector.	Yearly feedback on impact measurement for private firms in Australia	Focusing on Technology	Well combination in policy & implementation level
Limitations	Few guidelines are given on how to validate and apply indexes in a rigorous way	Limited to central or local government	No international Adoption/ Inter-national Site References	No details on Index selection or weight assessment	No international Adoption	No follow up

Korea GMMi focuses on Management and Technical Aspect especially for the Scenario of Government sector; it is described in 5 assessment areas as Table II.

TABLE III ASSESSMENT AREA AND CONCEPT

Area	Concept and indexing: To diagnoses
Leadership	Capabilities and the intention to promote Green IT, and is composed of vision, strategy, implementation capability and change management.
Work Practice	The way of performing work including the business process, and is composed of administrative informatization, business innovation, and smart work.
Office Environment	The level of environmental friendliness of the computing environment and equipment in the office, and is composed of the PC/monitor, printer, OA equipment, and office facilities.
IT Asset Management	The level of environmental friendliness of information asset purchases and management, and is composed of purchase operation, reuse, and disposal.
Data Center	Eco-friendliness of the data center or computer room configuration and operation, and is composed of the server assets, support infrastructure, and buildings.

To determine the level of Green IT maturity for each of the 42 indicators, NIA defined 6 stages of maturity (Stage 0 to Stage 5) for each indicator as shown in Table III

TABLE IIIII STAGES OF MATURITY

Level	Description
0: Incomplete	Although a process is in place, it is not used, and efforts to draw actual benefits from it are insufficient.
1: Initial	The process is not at all or poorly documented, and tends to be modified depending on the user or event.
2: Repeatable	Although the process manual or instructions are far from clear or complete, they, nevertheless, are helpful in maintaining existing practices.
3: Defined	A clearly-established process exists, and the process has improved over time.
4: Managed	The process is carried out using statistical, quantitative techniques, and it is possible to predict quantitative values.
5: Optimized	There is a quantitative process improvement goal, and the process has been continuously improved to reflect the business goals.

III. ASSESSING THE LEVEL OF GREEN IT MATURITY AMONG THAILAND GOVERNMENT AGENCIES

A. Survey Method

To explore the Green IT maturity model developed in this study for its practical applicability and to measure the level of Green IT maturity among Thailand government agencies and explore strategies for improving their related performance, we evaluated 55 agencies (including ministerial, departmental, State Enterprise and Independent agency) using Korea Green IT Maturity Model Integration through 1) online survey, 2) offline survey (by email) and 3) Tele Interview

B. The analysis of results

The overall average score of the 55 agencies, evaluated for Green IT maturity, was rather poor at 1.55 and the best score is 3.30 from 5. The result is shown in Table IV

TABLE IV
RESULTS OF ASSESSING THE LEVEL OF GREEN IT MATURITY AMONG THAILAND GOVERNMENT AGENCIES

Assessment Area	Score	
	Best	**Average**
Overall	3.30	1.55
1) Leadership	2.67	0.54
2) Work Practice	3.94	2.11
3) Office Environment	3.71	1.83
4) IT Asset Management	4.86	1.63
5) Data Center	5.00	2.24

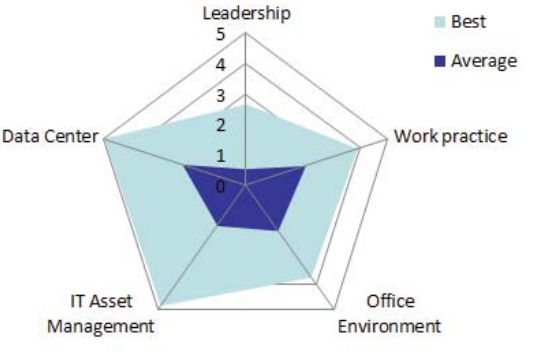

Fig.1 Results of Assessing the level of Green IT Maturity among Thailand government agencies

1) Overall analysis:

- The needs for Green IT are acknowledged and limited Green. IT efforts are found but not producing substantial outcome.
- Structure and framework on Green IT are required for systemic management.
- Green IT efforts are required by adopting a variety of technology to manage eco-friendly IT resources.

2) Area of Leadership:

- Structuring framework for strategic Green IT and consensus from central government are priorities.
- Green IT could contribute to GHG reduction; accordant performance management framework should be established.

3) Area of Work Practices:

- Major works should be computerized and those results should be shared through links with affiliated organizations.
- Public service should be made available online or on mobile, while staffs are teleworking for efficiency.

4) Area of IT Asset Management:

- From procurement, management to recycling or disposal of IT asset including guidelines or process, electricity efficiency or environment should be taken into consideration in implementation.
- Systemic efforts to reduce power consumption of IT devices at office are required, and solutions or support infrastructure should be introduced in long term.
- Office facility should be toward low electricity governance

5) The last area, Data Center:

- Equipment or solutions for efficient management need to be proliferated by applying advanced energy saving technology in data centers.

C. Recommendations for Improvement by category for Thailand

1) Leadership

The summary of Recommendations for Leadership Sector is as follow.

- Vision, strategy, as well as framework related Green IT should be structured and organized, thus Green Growth strategy can be supported in informatization either in planning or organization.
- Constant awareness on GHG emission reduction and management within the institution should be considered and the related informatization works follow. GHG emissions should be managed specifically and supporting data system is needed for management.
- Plan to manage Green IT performance needs to be structured. In a short term, performance should be managed within the existing informatization framework, whereas, in a longer term, independent category is needed within the institutional performance management assessment framework. Green Growth and Green IT strategy concerned, action plan for training & education needs to be established and implemented.

2) Work Practices

The summary of Recommendations for Work Practice Sector is as follow

- Computerization and business links need to be expanded actively minimizing inefficient work process. Public service should be serviced on mobile; such as tracking or simple administrative service.
- Major work process need to be reviewed, simplified and systemized. Information generated of work process should be integrated not producing duplicated information.
- Field work functions like emailing and e-payment need to be expanded in phases. Telework should be introduced and communication infrastructure among staffs using intra messenger, or collaborative work solutions need to be introduced.

3) Office Environment

The summary of Recommendations for Office Environment is as follow

- Power saving management rule should be compulsory and automatic controlled solutions should be considered. Desktop virtualization should be assessed and its use expanded.
- Printer/ Office Automation (OA) equipment should be managed at corporate level sharing with different divisions in an integrated management. Solutions for printing or toner reduction should be introduced and in such a way printing consumption needs to be managed.
- High efficiency/ intelligent lighting system should be introduced, and heating controlled centrally and facility improved. Power consumption should be measured and managed by floor or section further.

4) IT Asset Management

The summary of Recommendations for IT Asset Management is as follows

- Institutional device is required to take into account of power efficiency or environment concerns pursuant to guidelines set forth in IT asset procurement.
- Life cycle management needs to be proliferated and efficiency of IT asset management measured. Links with IT asset list and applied system should be improved by introducing data resource system.
- Guidelines on recycling/re-use or eco-friendly disposal are required, implemented and those performances should be managed.

5) Data Center

The summary of Recommendations for Data Center is as follows

- Guidelines or management tools need to be improved for optimizing by utilizing or relocating data resources. Server virtualization or its application needs to be expanded gradually.

- While introducing virtualization technology in storage, efficiency of integrated backup system should be maximized. Network should be integrated on a wire/wireless basis actively.
- In establishing data centers, advanced energy saving technology should be introduced, and detailed management framework is required including for power consumption. Data resources should be integrated and managed by data center.

IV. Evaluation & Conclusion

The objective of this study was to assess the current status of the awareness and readiness of Green IT in government sector of Thailand. Considering the fact findings that the 55 government agencies evaluated in this study, the overall level of Green IT maturity among Thailand government agencies are likely to be lower. The needs for Green IT are acknowledged. Limited Green IT efforts are found but not producing substantial outcome. Structure and framework on Green IT are required for systemic management. Green IT efforts are required by adopting a variety of technology to manage eco-friendly ICT resources. Thus, it is time for Thailand Government Sector to make great further efforts to improve their Green IT performance. Leading countries around the world are making active efforts to make their processes greener society. Assessing Green IT Maturity is the First step towards creating a Green Society.

Proposing improvement strategies for Thailand from this study will be one of input for "Green ICT Initiatives" of the Draft of 3rd Thailand National ICT Master Plan (2014-2018) [10] and make Thailand Green ICT growth and sustainable.

V. Recommendations

The proposing improvement strategies for Thailand are described in 2 key approaches as below

1) Strategic Recommendations

For accelerating Green IT development in Thailand Government Sector, It is need to integration among Inter-Intra cooperation included Policy, strategies, implementations and monitoring in mainly 4 areas which are

1) Establishing the National steering on Green growth strategy and Green IT Policy.
2) Forming Policy and Regulation include Green IT Action plan and Green IT Procurement Guidelines.
3) Setting up Education and Promotion campaigns include Green IT Training and Government Green IT Awards.
4) Initiating Technical Assistance by setting up Green IT Technical Taskforce, Green IT forum and Call Center/Help Desk

2) Action Recommendations

In term of Enterprise level, these following actions are recommended to Thai Government to taking into consideration and move forward.

1) Leadership: Establishment of Green IT vision & strategy, Training, Campaign and Promotion.
2) Work Practice: Providing business workflow system development for business workflow with affiliated agencies and private sector
3) Office Environment: Adaptation of a PC/Monitor power-saving management system.
4) IT Asset Environment: Establishment of IT Asset lifecycle management system based on power efficiency and preparing the process in order to monitor power consumption by IT Asset and Replace inefficient equipment.
5) Data Center: Advancement of the management solution to measure power efficiency of data center periodically, including power consumption by item of equipment and improve operation efficiency by item of equipment.

VI. The Way Forward and Future Study

Regarding to moving forward on Thailand Green IT Development, Author would like to suggest further studies focused on government agency with the following:

1) To increase the sample size of respondents, it would be great to expand this survey to national level either in government or private sector by supporting from and cooperating with Thailand Ministry of ICT.
2) To develop online/mobile self-assessment tool for provision of a free consulting service via website that assess Green IT Maturity conveniently.
3) To develop Thailand indicators and weight for Green IT Maturity Model

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