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The Effect of the Green IT to the IT Users' Perception and Re-use Intention

친환경 정보기술이 정보기술 사용자들의 인지와 재사용의도에 미치는 영향

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ABSTRACT

The development of green IT for business will open up exciting opportunities for finding new and efficient way of doing businesses. This study is to contribute to a better understanding of green IT by carrying out the survey among IT users on the factors of green IT and IT users' perception to the GIT. Based on the literature study, a conceptual framework of green IT will be developed to investigate the relationship between green IT and the user's intention to use GIT.

Key Words : Green IT, User Perception, Re-use Intention

Ⅰ. Introduction

Green computing or Green Information Technology (GIT), refers to environmentally sustainable computing or Information Technology (IT). It is the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems—such as monitors, printers, storage devices, and networking and communications systems—efficiently and effectively with minimal or no impact on the environment (Murugesan, 2008). Greening our IT products, applications, services, and practices is both an economic and an environmental imperative, as well as our social responsibility (Murugesan, 2007). Therefore, a growing number of IT vendors and users are moving toward green IT and thereby assisting in building a green society and economy. The goals of green computing are similar to green chemistry; reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste.

The purpose of this study is to contribute to a better understanding of IT users' perception on the productivity of the businesses for the green IT by carrying out the survey among businesses on the factors of green IT. The whole purpose of IT is to make businesses more productive and efficient, and to save money. They will have to learn to use less electricity in just the same way, using green –sustainable- computing to save money. This will demand major changes in IT user behaviors and policies. As energy and infrastructure costs continue to increase exponentially, and as environmental considerations become more prevalent, there is a real need for a power-based IT optimization strategy, bringing power right to the fore of IT policy, thereby impacting the end-to-end architecture, hardware and software, and on all of the processes undertaken day-to-day to support a company's workflow. This could force the adoption of new infrastructure, and will increasingly inform decision making when new platforms are procured, or when decisions are made about IT strategies – whether to centralize or whether to adopt a more distributed architecture and so on. Other companies will have to take more modest steps, simply making sure that desktop PCs, monitors and printers are turned off at night, and/or using more effective power-saving modes on unused equipment. Others will opt to use more energy-efficient components, such as LCDs rather than CRT monitors when buying new hardware. New dual-core processors are faster than traditional chips and yet use less energy, and the latest generation of dual-core processors promise

to consume about one third less power than their predecessors while offering up to 80% better performance. Other IT users may need to investigate the use of DC power. Most energy suppliers provide AC power because it is easier to transport over long distances, although most PCs and servers run on DC, so that the AC current from the utility has to be converted to DC before it reaches the hardware, with inevitable losses of energy in conversion.

Based on the literature study, a conceptual framework of green productivity was developed to investigate the relationship between green productivity factors and businesses' perception on them. Using the factors identified a research model was developed to measure the businesses' satisfaction on green business.

Ⅱ. Theoretical Background

Businesses will have to learn to use less electricity in just the same way, using green computing to save money. Some will opt for modest steps; others for more energy-efficient components. There is a real need for a power-based IT optimization strategy. Some companies may benefit from moving away from distributed computing based on individual desktop PCs to a small, thin client server architecture. It has been suggested that a 10-user system could save about 3,200kWh per year in direct electricity costs. The total production and operating cost savings over the three-year life span of a 10-user system would be more than 33 tones. In an existing server environment, there is significant cost savings associated with any reductions in cooling requirements, and keeping server rooms and computer workspaces at the right temperature is critical. Virtualization and server consolidation can allow users to 'do more with less', allowing one large server to replace several smaller machines. This can reduce the power required and the overall heat produced.

Fortunately, business is getting outside support as it struggles towards greener computing. The US Environmental Protection Agency's Energy Star program is already promoting more energy-efficient IT infrastructures and policies, while IBM, Hewlett-Packard, Sun Microsystems and AMD have joined forces to launch the Green Grid environmental lobby, aimed at reducing energy consumption at computer data centers by encouraging and improving power-saving measures.

'Green IT' – the next burning issue for business. Some companies may benefit from moving to a small, thin client server architecture. Virtualization and server consolidation can allow users to 'do more with less'.

Also, the Japanese electronics giant NEC said it has designed a new type of portable data center that can use the temperature difference between hot air exhaled from servers and untreated air from outside to create air flow and lessen the need for dedicated coolers. While using convection to cool data centers is not a new concept, NEC said in a press release that most such facilities in Japan operate under old temperature and humidity standards published by the American Society of Heating(ASHRAE) for refrigerating and air-conditioning. The company said that newer standards, combined with its innovations in combining cooling and air flow, will allow for the greater power savings.

The american big company, Apple was consistent in its commitment to energy and received the same score. Other companies jumped ahead because of their increased environmental commitment. Apple has done a great job of measuring and reporting its environmental footprint, but the growing use of iPads and iPhones is weighing on the company.. There is a higher energy footprint in the supply chain with each new generation of Apple products, but the company is doing its best in an effort to reduce greenhouse gas emissions.

The Wikipedia.com (2009) suggests that a holistic approach should be adopted and the entire IT life cycle should be made greener to comprehensively and effectively address the environmental impacts of IT by addressing environmental sustainability along the following four categories – Green use, Green disposal, Green design, and Green manufacturing.

Table 1. Green IT Categories

Green use	reducing the energy consumption of computers and other information systems as well as using them in an environmentally sound manner
Green disposal	refurbishing and reusing old computers and properly recycling unwanted computers and other electronic equipment
Green design	designing energy-efficient and environmentally sound components, computers, servers, cooling equipment, and data centers
Green manufacturing	manufacturing electronic components, computers, and other associated subsystems with minimal impact on the environment

Source: Wikipedia, 2009

Based on the factors identified, research framework is developed. In developing the framework, it is important to know what factors the Green IT effort offer to the business's productivity. This structural model also set the two intermediate variables – Business' Perception to the Green IT and Royalty to the Green IT. Four variables will eventually connect to the dependent variable – Productivity of the Business.

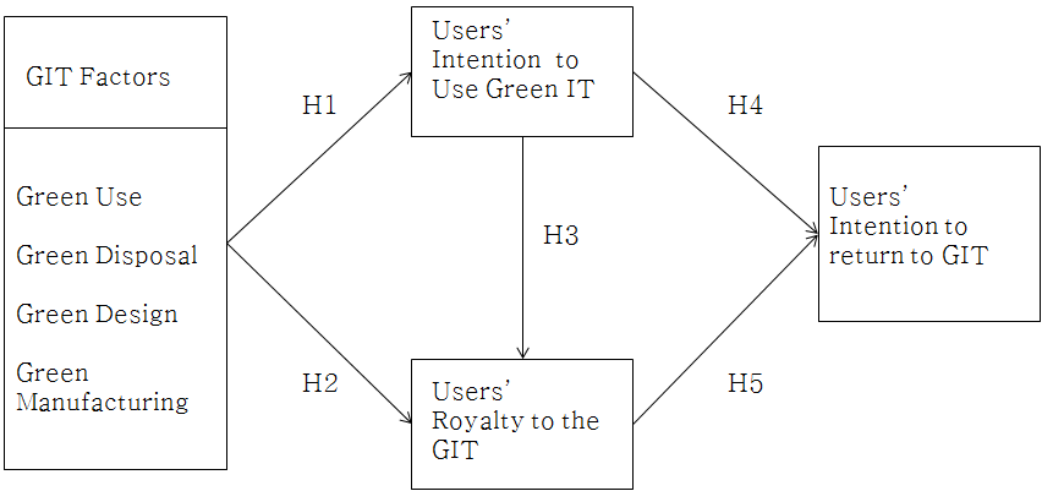

Figure 1. Research Framework

Ⅲ. Research Methodology

In order to reach a proper subset of IT users in the businesses for this research, about a hundred IT users in several different industry were chosen for this study. To determine the relations among research constructs, a questionnaire were developed for each variables. Seven questionnaire for the 'Green Use' variable, five for 'Green Disposal,' four for 'Green Design,' two for 'Green Manufacturing,' five for Intention to Use GIT,' six for 'Royalty to the GIT,' and three for 'Intention to Return for GIT were developed. The items in the first part were designed to find out the relationships among GIT factors and their perception for the businesses' productivity for which they are working for. For each questionary, five-point Likert scale was employed with

"Strongly disagree" on one extreme and "Strongly agree" on the other.

The reliability of the model is first examined by checking Cronbach Alphas.(Table 3) The use of structural equations modeling allows us to test the reliability of the model by testing a series of confirmatory factor analysis (CFA). As opposed to components analysis, it is possible to test model that more closely resemble the hypothesized construct and its relationship to other constructs (Long, 1983). Rather than merely specifying the number of components and items to be analyzed, CFA allows the researcher to specify the exact relationship between common factors and the items used to measure them as well as the linkages among the factors.

Table 2. Research Hypothesis

H 1-1: Green use is positively related to the users' intention to use GIT.
H 1- H 1-2: Green disposal is positively related to the users' intention to use GIT.
H 1- H 1-3: Green design is positively related to the users' intention to use GIT.
H 1-4: Green Manufacturing is positively related to the users' intention to use GIT.
H 2-1: Green use is positively related to the users' royalty to use GIT.
H 2-2: Green disposal is positively related to the users' royalty to use GIT.
H 2-3: Green design is positively related to the users' royalty to use GIT.
H 2-4: Green manufacturing is positively related to the users' royalty to use GIT.
H 3: Users' intention to use GIT is positively related to the users' royalty to the GIT.
H 4: Users' intention to use GIT is positively related to the users' intention to return to GIT.
H 5: Users' royalty to use GIT is positively related to the users' intention to return to GIT.

Further more, various overall model fit indices are obtained to determine how well the model explains the sample data. As can be seen on Table 4, all of the model fit indices surpass the recommended value for a good model and therefore suggest the measures are reflective of a single factor.

The next step was to ensure that this set of items provided both convergent and discriminant validity. A series of confirmatory factor analyses were performed to find if the loadings of the measures (Bagozzi and Yi, 1988). Discriminant validity is suggested if the correlation between constructs is not equal to 1.0. While this is suggested by the relatively low correlations between constructs, it can be tested empirically using a chi-square difference test. A chi-square difference greater than 3.82 (p=0.05) is suggested. As seen on table, the final set of items appear to demonstrate both convergent and discriminant validity.

Table 3. Results of Reliability Tests

Variables	Number of Measurements	Cronbach Alpha
Green Use	7	.867
Green Disposal	5	.855
Green Design	4	.671
Green Manufacturing	2	.734
Intention to Use GIT	5	.874
Royalty to the GIT	6	.906
Intention to Return for GIT	3	.792

Table 4. Results of the analysis for model fit

Statistic	Suggested	Obtained
Chi-square		342.12
RMR (Hu and Bentler, 1995)	<0.1	0.039
GFI (Joreskog and Sorbom, 1988)	>0.9	0.91
AGFI (Joreskog and Sorbom, 1988)	>0.8	0.88
CFI (Bentler, 1990)	>0.9	0.97

Ⅳ. Findings

The scales adopted for this study was from Jarvenpaa & Todd (1997), while demonstrating excellent psychometric properties may not be the most appropriate in this context. On the theoretical front, the study makes several contributions. Figure 2 depicts causal diagram for the model with path loading. The results of the study support several findings. In terms of the hypothesized links between factors, green use (0.33), green design (0.38) and green manufacturing (0.22) favorably influence Intention to use GIT. However, For green disposal (-0.15), the negative relationship was found.

The links between green disposal (0.5), green design (0.22) were also favorable to royalty to GIT. These findings are important, especially to practitioners who are interested in applying disposal and design technology to GIT. It is clear that the users will think positively for the

value of design and disposal of IT equipments for a better environment. However, they will take the technology with good design and disposal method not with the green use and manufacturing features and assessment procedure.

In addition to that, the suggested impacts of intention to use GIT on royalty to the GIT (0.24) and intention to return for GIT (0.28) were also significant as well as the royalty to the GIT, and royalty to the class (0.61) to the intention to return for GIT. Based on these results, an interesting fact can be announced. An increased level of green design, disposal and use will lead to the increased IT user's value for GIT and it will eventually end up to greater user's intent to return for GIT.

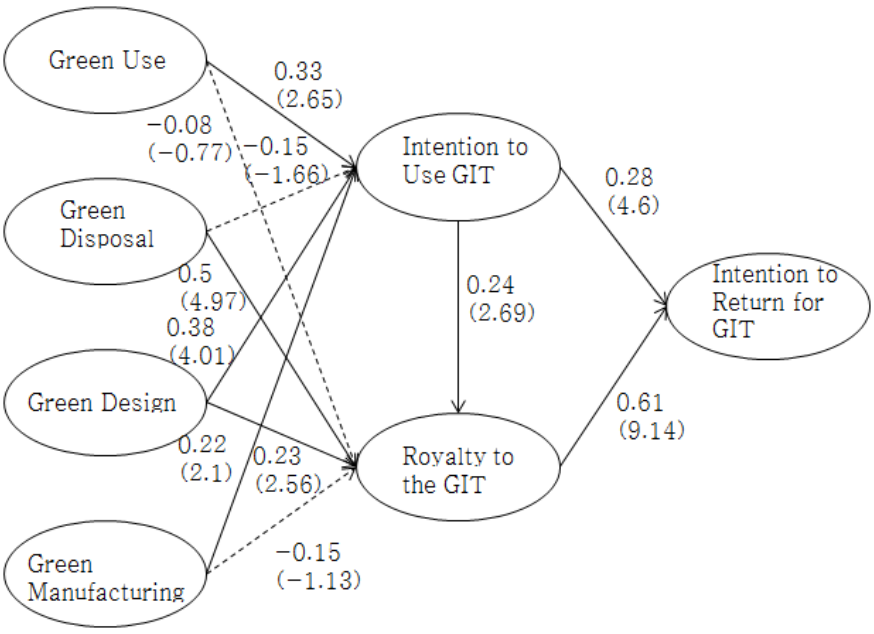

Figure 2. Result of Structural Equation Analysis

Table 6. Path Coefficient

Hypothesis	Path Coefficient	t-value	Accept/Reject
H 1-1	0.33	2.65	Accept
H 1-2	(0.15)	(1.66)	Reject
H 1-3	0.38	4.01	Accept

Hypothesis	Path Coefficient	t-value	Accept/Reject
H 1-4	0.22	2.10	Accept
H 2-1	(0.08)	(0.77)	Reject
H 2-2	0.50	4.97	Accept
H 2-3	0.23	2.56	Accept
H 2-4	(0.15)	(1.13)	Reject
H 3	0.24	2.69	Accept
H 4	0.28	4.6	Accept
H 5	0.61	9.14	Accept

V. Conclusion

Green IT use is to reduce the energy consumption of computers and other information systems as well as using them in an environmentally sound manner. Green disposal is to refurbish and reuse old computers and properly recycle unwanted computers and other electronic equipment. Green design includes process benchmarks involving interactivity, collaboration, and continuing assistance throughout the class period. Green manufacturing suggests manufacturing electronic components, computers, and other associated subsystems with minimal impact on the environment.

With more GIT experience for IT users, it would be reasonable to believe that IT users are fairly open-minded about the GIT for their daily use. GIT users are more comfortable with the environmentally friendly technology. The result of the study shows that eight our of eleven variables identified are positively related to the intention of It users and subsequent use of the GIT. As anticipated, the perception of IT users indicated GIT are favored most of variables.

The conclusion drawn from the present exercise can be placed in two categories: methodological and theoretical. On the methodological front, the development of reliable and valid measure to capture a critical construct to understand GIT users' behavior has been demonstrated. Still, more effort needs to be expanded to capture other critical constructs such as administrative support to the GIT. On the theoretical front, more application-specific scales need to be developed for further investigation of these phenomena.

The result of the study also provide information systems (IS) research community. this study

may suggest several opportunities for further research into the variables which impact GIT satisfaction in IS environment. For IS practitioners, this study can help firms to develop more environmentally friendly IT platforms and strategies, which promote GIT for IT users. In addition, application-specific scales will be developed for further investigation of these phenomena. While demonstrating excellent psychometric properties may not be the most appropriate in this context, this study will provide many opportunities for future research. One issue that should be addressed is the constructs that were chosen for this study. Future research could address other relevant constructs.

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국문초록

친환경 정보기술이 정보기술 사용자들의 인지와 재사용의도에 미치는 영향

김 태 환*

비즈니스 환경을 위한 친환경 정보기술의 개발은 새롭고 보다 효율적인 경영방법을 찾는 데 있어 좋은 기회를 제공할 것으로 보인다. 본 연구는 정보기술 이용자들에게 친환경 정보기술의 요인들과 친환경 정보기술에 대한 인지도에 대한 설문조사를 통하여 친환경 정보기술의 보다 심도 있는 이해에 기여하고자 하였다. 문헌조사를 통하여 친환경 정보기술과 사용자들의 친환경 정보기술에 대한 인지도와의 관계를 조사하기 위해 친환경 정보기술에 대한 개념적 모형이 개발되었으며 그 모형의 적합도와 변수들과의 관계가 규명되었다.

주제어 : 친환경 정보기술, 사용자인지도, 재사용의도

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