

# **Youths' Green Information and Communications Technology Acceptance and Implications for the Innovation Decision Process**

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## **Abstract**

Presently, 'green' is a trendy word. 'Green ICT' is an important strategy with regard to technology due to its various benefits, including reducing greenhouse gas emissions, lowering electricity costs, or improving corporate images. However, green ICT products or services have not yet been widely adopted, especially in developing countries. Green consumers, particularly young people, are the key for wider adoption of green ICT. Thus, the objectives of this study are: to examine the understanding of youths about green ICT, to explore the awareness and acceptance of youths concerning green ICT practices, to discover the reasons for adoption or refusal to adopt it, and to introduce systematic guidelines for effectively promoting green ICT products or services. The research results could lead to an increase in the use of green ICT in young people.

## **Introduction**

Climate change resulting from greenhouse gas (GHG) emissions, particularly carbon emissions, has become a serious world problem. Although the Information and Communications Technology (ICT) industry is responsible for only two percent of total carbon emissions (Woodhead, 2007), green ICT could contribute to environmental goals. In this paper green ICT is defined as:

“... 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”  
(Council of European Professional Informatics Societies, 2015).

Green ICT, such as extreme low-energy servers and cloud computing, were ranked as one of the top ten strategic technologies for 2010 and 2012 (Gartner, 2009, 2011). This encompasses broad ICT activities that are not limited to product procurement or product development, but encompass the whole product lifecycle (Murugesan, 2007). Both public and private sectors present variety of green products, innovations, collaborations, and solutions (ACS, 2007; Elliot, 2007; Forge, 2007; Griffith University, 2006; Harris,

2008; Murugesan, 2007; Olson, 2008; UCSU Environmental Center, 2009). In spite of the fact that the market segment of green consumers is growing (Fraj & Martinez, 2006), green ICT practices - green innovations, the application of the green ICT, environmental collaborations, regulations, agreements, standards, and green frameworks, roadmaps, or models - have not yet been adopted extensively, especially in developing countries.

Youths engaged if global environmental problems are ready to solve many problems since young people tend to hold more favorable attitudes toward the environments (Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003). Moreover, they tend to be more concerned about the environmental quality than older people (Boeve-de Pauw & Van Petegem, 2010). Youths are also willing to make economic sacrifices for a better environment (Wesley, 2011). According to UNESCO (2012), 'youths' are persons between the ages of 15 and 24 years. This paper uses the terms "youths" or "young people". Tailored communication for different green consumer groups is also necessary to help green marketing succeed (Tadajewski & Wagner-Tsukamoto, 2006).

Due to the importance of youth contributing to the environmental issues, objectives of this work are to evaluate the awareness of green ICT in young consumers, to explore their adoption of green ICT, to reveal the reasons why they accept or reject green ICT products or concepts, and to propose a guideline for green product developers and marketers regarding how to increase youth consumers' awareness and adoption of green ICT products and services.

### **Green ICT Practices**

Considering green innovations and the application of green ICT, various green technologies, products, and projects have been presented by international leading companies (Blue Earth phones, Big Green project, green line products, cooling technologies, energy-saving data centers, thin clients, green network equipment, or cloud computing) (Shehadi & Karam, 2010). Green computing policies have also been defined and enforced by various companies such as 3M, Microsoft, Apple, Intel, Dell, HP, and IBM (Harris, 2008). Green technologies such as emissions-free power sources, automated power control programs, have also been adopted by many organizations (ACS, 2007; Forge, 2007; Griffith University, 2006; Harris, 2008; Lloyd, 2008; Shehadi & Karam, 2010).

Environmental collaborations, regulations, agreements, standards, frameworks, and directives include ISO 14001, Triple bottom line (TBL), Energy Star, Leadership in Energy and Environmental Design (LEED), Electronic Product Environmental Assessment Tool (EPEAT), and Waste Electrical and Electronic Equipment (WEEE) (EU, 2003; Murugesan, 2007; NCC, 2008; Robins, 2006; U.S. Environmental Protection Agency, 2010). The Basel Convention is an international treaty signed by 150 countries (Basel Convention, 1989a, 1989b). The Kyoto Protocol was proposed to specify obligations to control GHG emissions that must be undertaken by 37 industrialized countries and the European community (United Nations, 1997). The Kyoto Protocol was

enhanced in the United Nations Climate Change Conference (COP15) as well (United Nations, 2009). Global and national organizations seeking sustainable solutions include the United States Environmental Protection Agency, Greenpeace, Organization for Economic Co-operation and Development, Australian Computer Society, the Thailand Greenhouse Gas Management Organization, etc. (ACS, 2007; Greenpeace, 2006; Harris, 2008; Thailand Greenhouse Gas Management Organization, 2009; United Nations, 1992, 1997; United Nations Environment Programme, 2005).

Green frameworks, roadmaps, and models, the green strategy for enterprises and the green strategy maturity model have been discussed by Olson (Olson, 2008). The maturity model is used for evaluating each strategic area in terms of the level of best practice adoption, with the five levels being awareness, developing, practicing, optimizing, and leading. A theoretical model for green IT adoption was presented by Molla (2008). The model consists of four factors: green IT context, green IT readiness, green IT drivers, and intention to adopt green IT. A Green IT Organizational Learning framework (GITOL framework) regarding the capability of enterprise-wide sustainability management was introduced by Cooper and Molla (Cooper & Molla, 2010). It consists of four stages, i.e., intuiting, interpreting, integrating, and institutionalizing. Ahola et al. (2010) define a green ICT roadmap for environmental sustainability. The roadmap contains three sub-roadmaps, which are empowering people, extending natural resources, and optimizing systems (Ahola, Ahlqvist, Ermes, Myllyoja, & Savola, 2010).

### **Technology Acceptance and Adoption Theories**

Fishbein and Ajzen (1975) developed the Theory of Reasoned Action (TRA). A person's intention to perform a behavior is determined by his/her attitude and the subjective norms. The Theory of Planned Behavior (TPB) extends TRA by adding a perceived behavioral control construct (Ajzen, 1985). Davis (1989) proposed the Technology Acceptance Model (TAM). It states that the attitude toward using technology is influenced by the perceived ease of use and perceived usefulness. Sheth, Newman, and Gross (1991a, 1991b) conceptualized the theory of consumption values. The five perceived values that explain how customers make market choices are functional values, social values, emotional values, epistemic values, and conditional values. Innovation Diffusion Theory (IDT) was introduced by Rogers (1995), which holds that the adoption rate of innovation depends on its relative advantage, compatibility, trialability, observability, and complexity. The Unified Theory of Acceptance and Use of Technology (UTAUT) integrates constructs from TRA, TPB, TAM, IDT, the motivational model, the model of PC utilization, and social cognition theory. The key factors are performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh, Morris, Davis, & Davis, 2003). The Green IT Adoption Model (GITAM) emphasizes three drivers of green ICT adoption in organizations: economic drivers, regulatory drivers, and ethical drivers (Alem Molla, 2009).

## **Environmental Attitudes and Behaviors of Youths**

Worsley and Skrzypiec (1998) explored the environmental attitudes of senior secondary school students in thirty-two countries. Most students were concerned about environmental issues. Male youths and students with lower socio-economic status expressed more support for scientific solutions than other students. Connell et al. (1999) studied the environmental attitudes of young people in Melbourne and Brisbane using focus groups. The result revealed a conflict between environmental concern and pessimism. Blanchet-Cohen, Ragan, and Amsden (2003) carried out action research using visual maps to explore the viewpoints of children in regard to environmental issues (Blanchet-Cohen, Ragan, & Amsden, 2003). Ten themes reflecting the environmental thoughts and behaviors of children were classified: initiatives, value statements, thinking, affective, doing, policing, lifestyle choices, educational awareness, stop doing, and bad. Meinhold and Malkus (2005) studied the relationship between youth environmental behaviors, self-efficacy, knowledge, and attitudes. The results illuminated the effect of pro-environmental attitudes towards pro-environmental behaviors. Results reveal that environmental knowledge was a significant moderating factor for environmental attitudes, with self-efficacy positively affecting environmental behaviors. Hicks and Holden (2007) conducted a survey of 11-year old primary school children that explored young people's needs for a future perspective. Findings show that they need more amenities, affordable housing, better relationships between people, less crime and violence in their local community. Secondary school students between the ages of 14 and 18 were also concerned about poverty, unemployment, and environmental problems (Hicks & Holden, 2007). Boeve-de Pauw and Van Petegem (2010) analyzed the environmental attitudes of adolescents from 56 countries. The results, at the individual level, were similar to the literature in that gender, socio-economic background, cultural and educational resources had an influence on environmental attitudes. At the country level, the results indicated the importance of the natural richness of a country and the country's environmental problems in relation to the environmental attitudes of young people.

## **Green Consumer Behaviors**

Psychographic variables that affect green consumer behaviors are perceived consumer effectiveness, altruism, liberalism, and environmental concern (Peattie, 2001; Straughan & Roberts, 1999; Thompson, Anderson, Hansen, & Kahle, 2010). Straughan and Roberts (1999) explored the ecologically conscious behaviors of college students. The results showed that psychographics are more effective than demographics in explaining the variation of student behaviors. Chan and Lau (2000) examined the influence of cultural values, ecological affect, and ecological knowledge on green purchases in China. The results demonstrated the power of ecological effects and ecological knowledge on green purchasing intention and actual behaviors. Laroche, Bergeron, and Barbaro-Forleo (2001) explored the determinants of consumers' willingness to pay for green products. The research findings indicated that green consumers are normally female, married, with at least one child, and living at home. Ginsberg and Bloom (2004) proposed a green marketing strategy matrix consisting of the lean green strategy, the

defensive green strategy, the shaded green strategy, and the extreme green strategy. Fraj and Martinez (2006) explored which values and lifestyles best describe green consumer profiles. The results highlighted that environmental patterns and self-fulfillment values are best able to explain the green market segment. Tadajewski and Wagner-Tsukamoto (2006) developed a new research strategy, called “cognitive anthropology”, to study complex green consumer behaviors. Chan, Wong, and Leung (2008) explored Chinese consumers’ intention to Bring Your Own shopping Bags (BYOB). The findings revealed that teleological evaluation and habits had a direct effect on the BYOB intention and deontological evaluation and teleological evaluation had an effect on ethical judgment with respect to BYOB behavior. Young et al. (2010) examined the purchasing process in regard to the technology products’ of green consumers in the United Kingdom. The results showed incentives and environmental labels needed to fit green shopping into consumers’ busy lifestyles. Lee (2010) studied the green purchasing behaviors of young consumers in Hong Kong. Six influential factors found to affect purchase behavior were peer influence, local environmental involvement, concrete environmental knowledge, parental influence, environmental awareness, and media exposure to environmental messages.

## **Research Design**

The respondents in this study were university freshmen between nineteen and twenty years old enrolled in a Management Information Systems course in the Thammasat Business School. This is a required course for all undergraduate students. The respondents had various backgrounds, skill sets, and experience with technology, and their ages were in the middle of the youth age range (UNESCO, 2012). At the beginning, they were asked to answer an open-ended question (in Thai) on their notions about green ICT based on their past knowledge and experience. Then, they were instructed to search about green ICT from online or offline sources. Finally, they were asked for their opinions about green ICT awareness and facts about their green ICT adoption. Four asked questions:

- In your opinion, is the green ICT important or not, and why?
- Please explain your actual usage behaviors that are in keeping with the green ICT concepts.
- According to your prior answer, please explain the reasons why you apply the green ICT concept.
- Please explain the reasons why you do not act in keeping with the green ICT concept.

Emerging themes were then extracted for all the answers using conventional content analysis. Conventional content analysis is suitable when existing theories or research literature are limited (Hsieh & Shannon, 2005). Coded themes were also numerically described in terms of the percentage of supporting respondents, classified by gender. Theory triangulation was applied to validate the results and show evidence for linkage with the literature. Theory triangulation is the use of multiple theories or perspectives to interpret and explain the data (Johnson, 1997).

## The Cognition of Green ICT

Gartner defines green ICT as encompassing environmentally sustainable IT and the use of IT in order to contribute to environment preservation (Shim, Kim, Cho, Park, & Lee, 2009). OECD defines green ICT as ICT with a low ecological footprint; using ICT as an enabler reduces environmental impacts across the economy outside of the ICT sector (Reimsbach-Kounatze, 2009). Shim et al. (2009) define green ICT as the reduction of energy consumption and environmental pollution through the use of IT (p. 16). Green IT is defined as the collective representation of IT products and practices that reduce environmental impacts, either by leading to lower net emissions or by reducing waste by-products (Shehadi & Karam, 2010).

Of the 64 students, fifty-seven students participated (89% response rate). Thirty-five respondents (61.4%) were female and twenty-two respondents (38.6%) were male. In light of the above definitions, the majority of students (50 of 57 students) correctly defined green ICT. However, four thought that green ICT refers to properly using ICT. Two freshmen took the view that green ICT is secure ICT. One student guessed that green ICT is defensive technology. These views are represented by the three following statements:

*“From my perspective, green ICT is the ICT which are harmless. It should be free from spyware. Also, the accesses to improper websites are blocked.” - Female#1*

*“I thought of the green ICT as a new government policy for controlling the security of various media such as information, websites, etc. before I came to know the meaning of it.” - Male#4*

*“Green ICT, in my point of view, is a technology intended to prevent or to eradicate illegal websites such as the websites selling pirate products.” - Female#27*

## Awareness of Importance of Green ICT

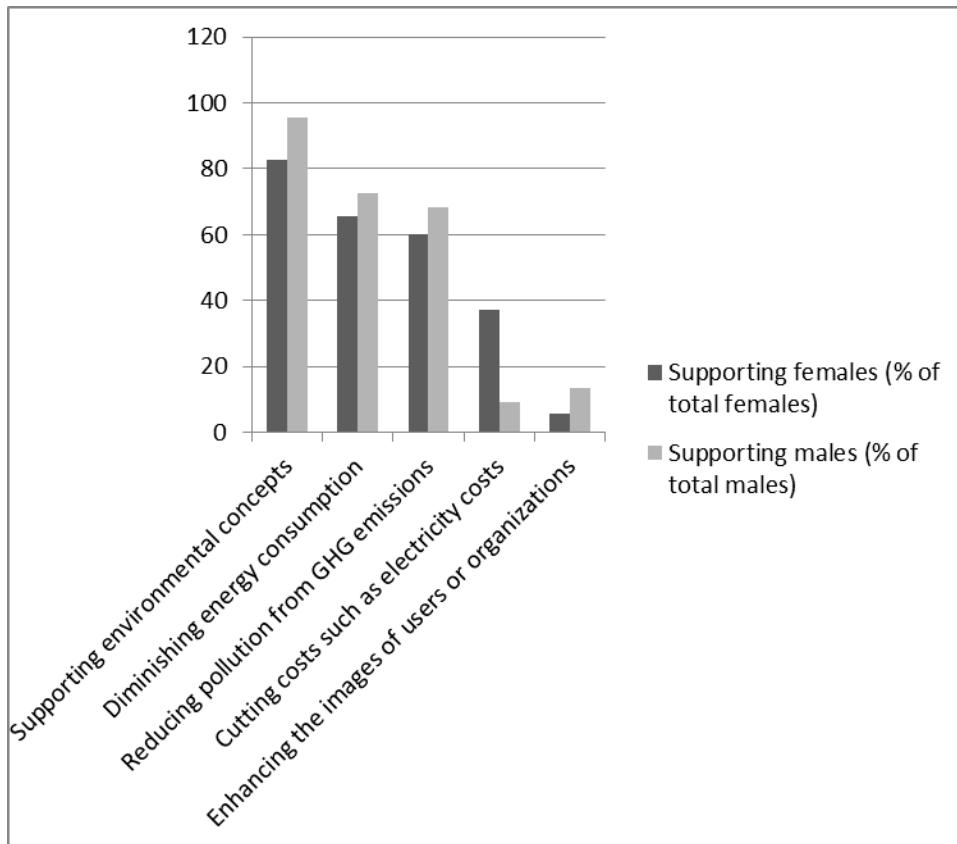
All respondents specified that green ICT is important. Most of them (41 students) emphasized that green ICT is very important. Figure 1 shows the number of supporting respondents for each reason, classified by gender. Since the total number of male and female respondents is different, the result is standardized by the percentage of supporting respondents of each gender.

The most commonly mentioned reason (by 50 respondents: 29 females, 21 males) is to support environmental concepts or to solve global warming problems. This is in line with the influence of environmental problems on environmental attitudes (Boeve-de Pauw & Van Petegem, 2010), the benefit of responding to social and environmental responsibility requirements (Simula, Lehtimäki, & Salo, 2009), and green IT motivation

about environmental consideration (Alem Molla, 2009). The following quotes illustrate some of the youths' opinions about this view:

*"I think the green ICT is very important concepts because it is the management and application of technology that is environment-friendly." - [Male#2]*

*"Green ICT saves nature and preserves the planet despite its high cost of production." - Female#10*



**FIGURE 1:** A comparison between genders in regard to reasons for giving importance to green ICT

The second most mentioned reason (by 39 respondents: 23 females, 16 males) is to decrease energy consumption or to increase the efficiency of energy consumption. This is the same as the improvement of the energy efficiency of IT facilities because of green technology (Accenture, 2009). This view is illustrated by two statements:

*"Adopting technology consuming less power in organizations, such as video conferencing, helps to reduce the use of oil or natural gases for transportation purposes." - Female#24*

*"Green ICT is efficient and environmental-friendly use of technology or energy, not only increasing the efficiency of engine, but also consuming less energy." - Male#8*

The third most mentioned reason (by 36 respondents: 21 females, 15 males) is to reduce pollution from GHG emissions by recycling or not using hazardous substances in ICT products. This supports the environmental benefit from the reduction of infrastructure requirements because of green technology (Accenture, 2009). Statements relating to this issue are as follows:

*“Green ICT is very important to the world and environments in the aspect of e-resource recycling. The generated GHG and global warming could decrease when e-waste is reduced.” - Female#2*

*“Green ICT is a vital measure to reduce pollution or global warming by eliminating GHG emissions in ICT manufacturing.” - Male#17*

The fourth most mentioned reason (by 15 respondents: 13 females, 2 males) is to cut costs such as electricity costs, the costs of new hardware, etc. This is in line with the green IT motivation related to IT cost reduction concerns (Alem Molla, 2009) and the economic benefits of green technology (Accenture, 2009), as the following quotes demonstrate:

*“Green ICT lessens unnecessary expenses by adopting hardware or software solutions to save energy or to reduce energy loss. - Female#4*

*“If we can effectively manage energy usage and reduce power consumption, it means we can decrease our organization’s expenditures.” - Male#6*

The least mentioned reason (by 5 respondents: 2 females, 3 males) is to enhance the images of users or organizations. This supports the benefit of a better brand image and reputation (Simula et al., 2009) and the perceived level of corporate responsibility by consumers (Laroche, Bergeron, & Barbaro-Forleo, 2001). The following statements show some of the youths’ opinions about this issue:

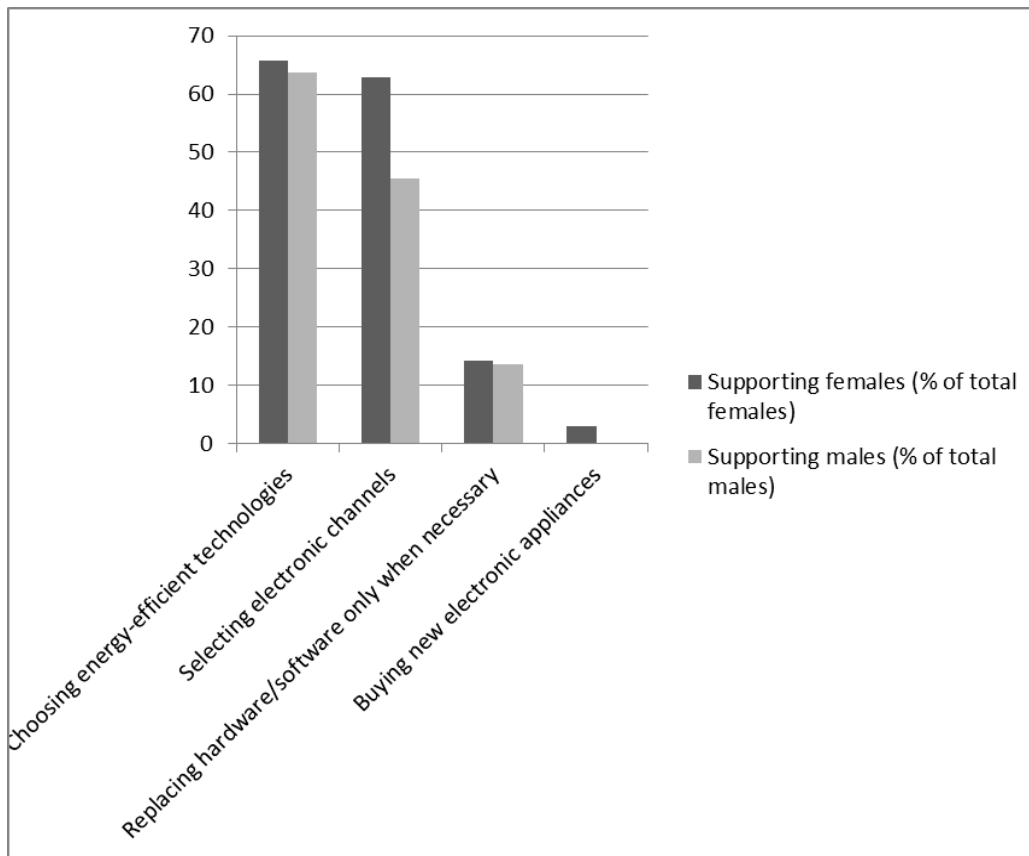
*“It shows good consumer image because it is the environmental-concerned technology.” - Male#1*

*“I think green products are the creation of something to save the earth and human from changes in natural conditions, and to lead to innovative marketing strategies.” - Female#15*

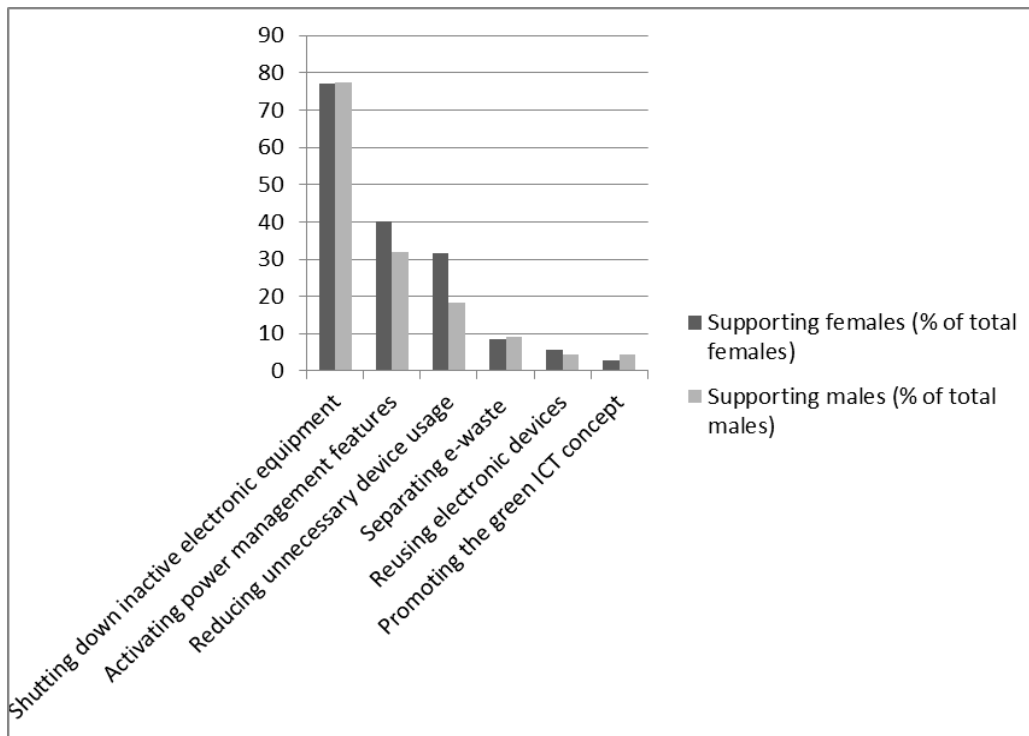
The reasons of support for environmental concern, efficient energy consumption, and pollution reduction indicate that youths pay attention to the community more than themselves. In the aspect of gender, Boeve-de Pauw and Van Petegem (2010) and Zelezny et al. (2000) emphasized that females are more concerned with the environment than males (Zelezny, Chua, & Aldrich, 2000). However, this work shows the interesting result that the standardized percentages of supporting males for the top three reasons were higher than the standardized percentages of supporting females, indicating that male youths pay attention to the environment.

## Green ICT Adoption

Green ICT adoption is categorized into two main groups: products/services selection and usage behavior. The products/services selection category focuses on the process of choosing or acquiring ICT products or services. The usage behavior category considers the process during or after the period of consumers' ownership of products/services including usage, disposal, and recycling. Regardless of whether the students clearly understood the green ICT concept or not, they implemented green ICT practices throughout the lifecycle of products or services. Figure 2 – Figure 3 shows the adoption of the green ICT concept in terms of the selection of products/services and usage behavior respectively, classified by gender. The majority of students adopted green ICT, in line with the greater number of students having positive attitudes toward the importance of green ICT. Thus, this research supports the significance of pro-environmental attitudes towards pro-environmental behaviors (Meinhold & Malkus, 2005).



**FIGURE 2:** A comparison between genders in regard to the applications of green ICT: products/services selection



**FIGURE 3:** A comparison between genders in regard to the applications of green ICT: usage behavior

Considering products/services selection, most implementation of the green ICT concept (by 37 respondents: 23 females, 14 males) is selecting energy-efficient technologies. Many respondents choose LCD monitors rather than CRT monitors, buy laptops due to their mobility and lower energy consumption rather than desktop computers, implement wireless local area networks (LANs) rather than wired LANs, and select rechargeable batteries rather than disposable batteries. This is in line with young Finnish consumers' buying behaviors in terms of choosing environmentally sound products (Autio & Heinonen, 2004). The following quotes summarize some of youths' opinions about this view:

*"I choose a laptop with a separated graphic card, it makes me can switch between two cards. For normal usage, without the need of high graphic resolutions, I use the onboard graphic card. But if I want to use the high quality mode, such as playing games or editing videos, my laptop will automatically switch to another card which is more effective but consumes more power."* - Male#7

*"I use electrical appliances which are conformed to the energy saving standard (Thailand's Energy Label No.5)."* - Female#12

The second implementation of the green ICT concept (by 32 respondents: 22 females, 10 males) is selecting electronic channels. The young generation, familiar with new technologies, prefers to use digital channels such as e-documents, e-mail, e-

conferences, and social network systems (SNSs) rather than traditional channels. This is illustrated by two quotes:

*“I use word processing software to create documents and submit to teachers via e-mail or upload those documents to the workspace for others because I don’t want to consume paper resources. It would be beneficial to others too.” - Male#1*

*“Most works were sent through email in the electronic form rather than hard copies which unnecessarily consume paper resources.” - Female#23*

The third implementation of the green ICT concept (by 8 respondents: 5 females, 3 males) is replacing hardware or software only when necessary. Some students try to fix broken equipment before disposing of it. The representation of this view is as follows:

*“I utilize hardware and not change them unless necessary. Also, I rarely buy fashionable devices.” - Female#2*

*“I fix damaged electronic devices. I don’t buy a new one. Buying new one would increase e-waste.” - Male#11*

The last implementation of the green ICT concept (by one female respondent) is buying new electronic appliances when necessary. The following quote shows her opinion:

*“I stop using the obsolete appliance. Then, I change to use new appliance which consumes less power.” - Female#18*

The comparative results in Figure 2 support Diamantopoulos et al. (2003) and Olli, Grendstad, and Wollebaek (2001), who found that females have greener shopping habits than males. Tanner and Kast (2003) and Laroche et al. (2001) also concluded that green marketing should focus on women.

Considering usage behavior, most implementation of the green ICT concept (by 44 respondents: 27 females, 17 males) is shutting down inactive devices such as computers, monitor screens, air-conditioners, etc. The following statements illustrate some of the youths’ views:

*“I turn off electrical appliances when not in use to reduce energy consumption. - Male#20*

*“I unplug a fan, a cell phone charger, an iron, a microwave oven, a vacuum cleaner, and lamps when not in use.” - Female#28*

The second implementation of the green ICT concept (by 21 respondents: 14 females, 7 males) is activating the power management feature of appliances, for example, applying the hibernate mode, reducing screen brightness, etc. The statements reflecting this are shown below.

*“I set energy saving mode for my notebook. It will automatically enter sleep mode when not in use for a period of time.” - Male#7*

*“I set energy safe mode for electronic devices: mobile phone and notebook. I also buy devices with power saving modes.” - Female#1*

The third implementation of the green ICT concept (by 15 respondents: 11 females, 4 males) is reducing unnecessary device usage. The representation of this is as follows:

*“I use devices only as necessary. For instance, I don’t use cell phone too much.” - Female#35*

*“I don’t needlessly use notebook or IT devices. I also reduce device usage for an entertainment purpose, especially during the exam period.” - Male#17*

The fourth implementation of the green ICT concept (by 5 respondents: 3 females, 2 males) is separating e-waste. This is in line with the waste management of young Finnish consumers (Autio & Heinonen, 2004), as the following quotes demonstrate:

*“I dump electronic devices to the right place, to decrease toxic contamination and to reduce natural resource depletion because of producing new ones.” - Male#2*

*“I dump garbage into the can which matches the garbage type of e-waste.” - Female#28*

The fifth implementation of the green ICT concept (by 3 respondents: 2 females, 1 male) is reusing or recycling electronic devices, for example, donating computers to rural areas or reusing them in other places. This supports the reusing or recycling of young Finnish consumers (Autio & Heinonen, 2004). The results in Figure 3 are also consistent with Diamantopoulos et al. (2003) and Olli et al. (2001), in that females are likely to do recycling activities more often than males. The following quotes show some of youths’ opinions about this issue:

*“After getting a new computer, I don’t throw away my old computer immediately. I move it to my office, to process order forms, shipping documents, etc., because it still works fine for such purpose.” - Male#3*

*“When I purchase a new laptop, I give the old one to a person in my family. So, he/she doesn’t have to buy a new one.” - Female#13*

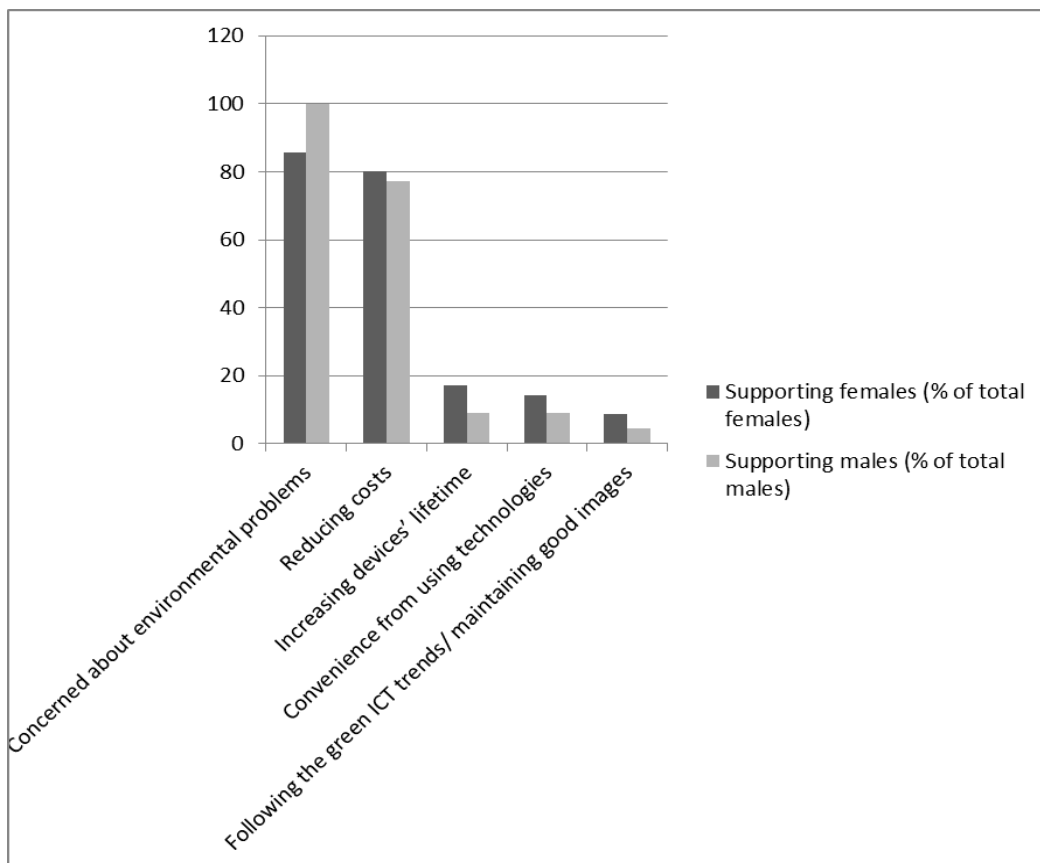
The last implementation of the green ICT concept (by 2 respondents: 1 female, 1 male) is promoting the green ICT concept. This could enable the green ICT concept to succeed since the influence from other people, such as peers or parents, is important for green consumer practices (Boeve-de Pauw & Van Petegem, 2010; Chawla &

Cushing, 2007; Lee, 2010; Mintz, 2011). The following quotes present this issue as follows:

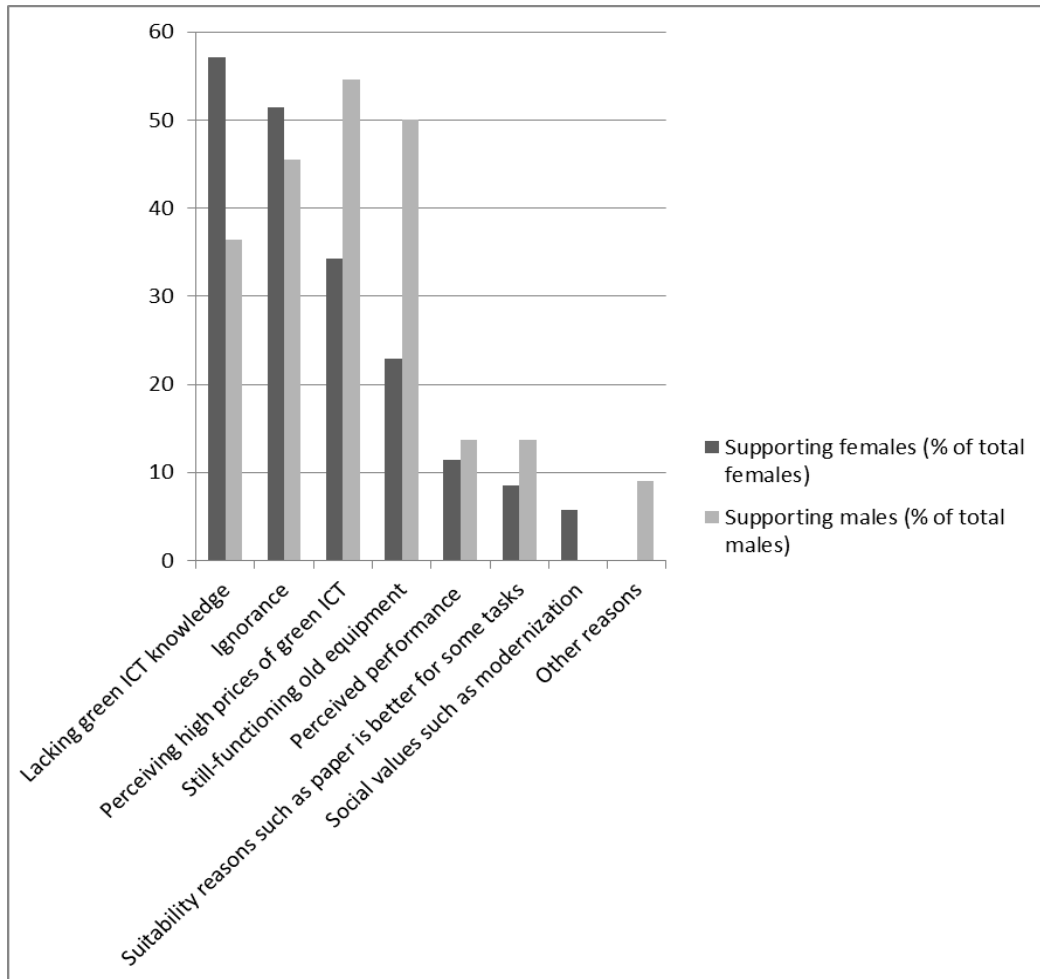
*“I search more the green ICT concept, to tell the people around me.” -Male#12*

*“I suggest my family to use renewable energy resources. I also recommend them to replace obsolete electric appliances, which excessively consume power. Power consumption requires natural resources to produce. It greatly diminishes natural resources.” - Female#19*

In addition to applying the green ICT concept, many students specified that they apply other green ideas, such reusing/recycling papers, choosing green products such as paper bags, cotton bags, etc., walking/biking/carpooling/ and using public transportation instead of driving, taking the stairs instead of lifts, donating unused products such as old clothes, computer boxes, etc., and using renewable energy sources. Autio and Heinonen (2004) summarized that contemporary Finnish youths are conscious of green practices and their benefits, but this is not reflected in their consumption. On the contrary, this work discloses the remarkable result that university students are both aware of the value of green ICT and also implement green ICT practices. This is explained by Boeve-de Pauw and Van Petegem (2010), who found that a higher level of education and urbanity is associated with a greater level of environmentalism and environmental attitudes.



**FIGURE 4: A comparison between genders in regard to the reasons for adopting green ICT**



**FIGURE 5: A comparison between genders in regard to the reasons for rejecting green ICT**

The reasons why university freshmen adopt green ICT or refuse to implement it are summarized in Figure 5. Considering the reasons for applying the green ICT, the most frequently mentioned reason (by 52 respondents: 30 females, 22 males) is being concerned about environmental problems. This is in line with attitude constructs influencing the behavior intention of TRE (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1985), the perceived usefulness of TAM (Davis, 1989), relative advantages of IDT (Rogers, 1995), ethical drivers to adopt green IT of GITAM (Alemayehu Molla, 2008), the emotional value of the consumption value theory (Sheth, Newman, & Gross, 1991a, 1991b), perceived consumer effectiveness (PCE)/the ecological effect toward green purchase intention/pro-environmental actions (Chan & Lau, 2000; Straughan & Roberts, 1999), and environmental concerns/attitudes relating to environmental intention/behaviors (Chawla & Cushing, 2007; Laroche et al., 2001; Lee, 2010; Meinhold & Malkus, 2005; Olli, Grendstad, & Wollebaek, 2001; Tanner & Wölfling Kast,

2003; Young, Hwang, McDonald, & Oates, 2010). The following quotes illustrate some of youths' opinions about this view:

*"An indirect benefit of the green ICT is the positive impact to the world. It helps to delay the global warming, to reduce toxic emissions from the production process, and to decrease natural resource usage. These will be beneficial for people in several aspects: good health, better weather, and so on." - Female#3*

*"I use the green ICT because it is good for environments." - Male#9*

The second most mentioned reason (by 45 respondents: 28 females, 17 males) is cost reduction, for example, costs of electricity, paper, new equipment, transportation, etc. This supports the attitude affecting behavior intention of TRE (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1985), the perceived usefulness of TAM (Davis, 1989), the relative advantages of IDT (Rogers, 1995), the economic driver of GITAM (Alemayehu Molla, 2008), and the positive benefit (lower expenses) of sustainable behavior (Dwyer & Hasan, 2012). This view is illustrated as follows:

*"I apply the green ICT because of cost-saving advantages; for example, using a laptop, I don't have to pay electricity bills as much as I use a personal computer; using a sticky note program, I don't have to buy paper notes." - Male#1*

*"Applying the green ICT decreases an expenditure burden of my family." - Female#33*

The third most mentioned reason (by 8 respondents: 6 females, 2 males) is increasing devices' lifetime. This agrees with attitudes affecting the behavior intention of TRE (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1985), the perceived usefulness of TAM (Davis, 1989), and the relative advantages of IDT (Rogers, 1995). The representation of this issue is found in two statements below.

*"In terms of batteries, if they are used continuously without the off period, their lifetimes will be shortened, due to being in high temperatures continuously." - Female#1*

*"If we turn off the computer screen when not in use or use devices carefully, we would not need to replace them frequently." - Male#6*

The fourth most mentioned reason (by 7 respondents: 5 females, 2 males) is the ease of producing outputs or speeding up communication such as sending e-mail instead of submitting papers. This is in line with the attitude towards behavior intention of TRE (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1985), the perceived ease of use of TAM (Davis, 1989), the relative advantages of IDT (Rogers, 1995), the functional value of the consumption value theory (Sheth et al., 1991a, 1991b), and the positive benefit (simpler lifestyle choices) of sustainable behavior (Dwyer & Hasan, 2012). The following quotes express this view:

*"I use the technology because of its convenience. It helps me to save both time and money. I don't waste inks or papers because I don't have to print all documents. I save them in a computer instead. When I want to talk to friends, I don't have to travel to see them. I use MSN chat or Skype instead." - Female#7*

*"I choose the green ICT due to the convenience reason." - Male#22*

The least mentioned reason (by 4 respondents: 3 females, 1 male) is following green trends or maintaining good images. This supports the attitude construct influencing behavior intention of TRE (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1985), the perceived usefulness of TAM (Davis, 1989), the observation ability of IDT (Rogers, 1995), injunctive norms affecting environmentally-friendly behavior (Mintz, 2011), the social value of the consumption value theory (Sheth et al., 1991a, 1991b), and peer acceptance and image-driven values towards Generation Y (Williams & Page, 2011). The following statements illustrate some of youths' opinions as follows:

*"The green ICT promotes positive images of users and the company, in the sense of the world protection." - Male#16*

*"I use the green ICT because it is received a lot of attention at the present time." - Female#5*

Regarding the reasons for rejecting green ICT, the most commonly mentioned reason (by 28 respondents: 20 females, 8 males) is a lack of green ICT knowledge. This is in line with the effect of environmental knowledge on environmental attitudes/ intention/ behaviors (Boeve-de Pauw & Van Petegem, 2010; Chawla & Cushing, 2007; Meinhold & Malkus, 2005; Olli et al., 2001), the importance of supporting scientific solutions for environmental problems (Worsley & Skrzypiec, 1998), the importance of better environmental education systems (Wesley, 2011), the negative result from lacking time to search for information before making decisions (Young et al., 2010), and the mistrust of environmental claims (Kalafatis, Pollard, East, & Tsogas, 1999). The following statements reveal some opinions about this issue:

*"The green ICT have not been sufficiently publicized or have been less advertised. Many people had never heard about the green ICT. I have just heard it for the first time from this assignment. In the past, I didn't understand what the green ICT is. I didn't know what behaviors are green ICT practices too." - Male#3*

*"The green ICT is not yet widespread. Some people still don't know the green ICT. Manufacturers also didn't clearly label which products could help to save energy or to reduce global warming." - Female#33*

The second most mentioned reason (by 28 respondents: 18 females, 10 males) is ignorance or not realizing the consequences of not using green ICT. This is supported by the effort expectancy of UTAUT (Venkatesh et al., 2003), the hesitance of people to make environmental changes due to fears of sacrificing freedom (Wesley, 2011), young

people feeling powerless to do much about environmental problems (Connell, Fien, Lee, Sykes, & Yencken, 1999), and the reluctance to change habits (Kalafatis et al., 1999). This issue is presented as follows:

*“I have never thought about the green ICT. I fail to realize the effect of denying the green ICT ideas which are the shorter lifetime of hardware, additional energy costs, and maintenance costs, etc.” - Female#4*

*“I don’t use the green ICT because of thoughtless or concerning about my convenience.” - Male#4*

The third most mentioned reason (by 24 respondents: 12 females, 12 males) is the perception that green ICT devices are expensive and there are too few green ICT products with too little variety. This relates to the hesitance of people to make environmental changes due to their belief that certain environmental issues may sacrifice economic stability (Wesley, 2011), young people’s beliefs that it is often too hard or expensive for people to do more than they are already doing (Connell et al., 1999), consumers’ attitudes that depend on the current economic climate (Mintz, 2011), financial status as an obstacle to changing environmental behaviors (Evans et al., 2007), the limited number of green products (Chan, 2001; Mintz, 2011), the influence of the perceived price differential between “green” products’ and others (Kalafatis et al., 1999), and the importance of affordable prices to green customers (Young et al., 2010). The representation of this view is as follows:

*“A few electronic devices are green. In addition, they are too expensive, so I cannot afford them.” - Male#2*

*“The green ICT devices are expensive.” - Female#31*

The fourth most mentioned reason (by 19 respondents: 8 females, 11 males) is that old equipment is still functioning. This reason may have been mentioned because of students’ financial status. The following statements reflect this issue:

*“Sometimes, devices without energy-saving features are still operable. Although they consume so much energy, I would feel regret if I left them while they was usable.” - Female#1*

*“Old hardware works properly, so we don’t want new equipment even though the new one is better.” - Male#6*

The fifth most mentioned reason (by 7 respondents: 4 females, 3 males) is perceived lower performance of some green technologies compared to old technologies. This supports the performance expectancy of UTAUT (Venkatesh et al., 2003), the expectation that green products must competitively perform in other dimensions (Diamantopoulos et al., 2003; Schlegelmilch, Bohlen, & Diamantopoulos, 1996), the functional value of the consumption value theory (Sheth et al., 1991a, 1991b), and the

importance of the performance of green products (Young et al., 2010). The following quotes reveal some of the youths' opinions about this point:

*“Some green-supported technology is incomparable with the existing technology. For example, some laptops don't perform as fast as PCs.” - Male#1*

*“Sometimes, I don't use electronic channels because they are inconvenient. The internet is not available at some places too.” - Female#2*

The sixth most mentioned reason (by 6 respondents: 3 females, 3 males) is that paper is more suitable for some tasks such as taking notes promptly, reading full articles, etc. This is in line with the complexity of IDT (Rogers, 1995), time commitments as an obstacle to environmental behaviors (Evans et al., 2007), the conditional value of the consumption value theory (Sheth et al., 1991a, 1991b), and purchase criteria such as convenience or durability (Diamantopoulos et al., 2003; Laroche et al., 2001). The following statements show this view:

*“Sometimes it is inconvenient; for example, if I want to write something now, I will grab a paper to write, as this is faster than typing into a computer or a mobile phone.” - Male#1*

*“I don't carry a laptop all the time. If I want to take notes immediately, I can't do it. So I don't always use e-documents instead of papers.” - Female#25*

The seventh most mentioned reason (by 2 respondents: 2 females) is social value such as modernization. This supports the social influence of UTAUT (Venkatesh et al., 2003), social values (Sheth et al., 1991a, 1991b), and the importance of non-green criteria, which are recognized brands and specific brands (Young et al., 2010). Two quotes below represent this view.

*“The popularity of new edition of cell phones forces my phone to be outdated, so I need to replace it. Moreover, my thought was dominated by marketing and promotion, to follow such trends (changing the mobile phones or buying new computers). However, after replacing them, I don't use any features rather than the features of the previous one at all.” - Female#3*

*“Sometimes I want new technology or new electronic equipment just because I want to show off, without considering an increase of e-waste and pollution to the planet.” - Female#16*

The least mentioned reasons (by 2 respondents: 2 males) are other reasons. This is in line with facilitating conditions of UTAUT (Venkatesh et al., 2003). It also supports the importance of available educational resources for youths, which are access to books, the Internet, encyclopedias, and educational software (Boeve-de Pauw & Van Petegem, 2010). The following quotes relate to this issue:

*“Some assignments don’t support me to use this kind of technology; for instance, a teacher requires a printed report rather than an e-report submitting via e-mail.” - Male#1*

*“Many times I want to read an e-book but there is no an electronic version of that book available.” - Male#22*

### **Research Limitations and Implications**

Generalizations from this study to the whole youth population should be made with caution. The sample in this study consisted of freshmen from the Thammasat University. Although the results support the literature to a large extent, it would be prudent to draw only tentative conclusions. However, a systematic framework of practical implications for green marketers and product developers according to the five stages of consumers’ innovation-decision process (Kabbar & Crump, 2006; Rogers, 1995) may be developed based on the study.

The knowledge stage is the stage where a person realizes the existence of an innovation, its functionality, and the good or bad aspects of the innovation. Characteristics affecting the knowledge stage are socioeconomic characteristics, personality variables, and communication behavior (Kabbar & Crump, 2006). The findings indicate that some young people are not aware of what the green ICT is; in fact, most of them only have a rough idea about its meaning. Thus, both the public and private sectors should collaborate to educate youths about the green ICT concept and its advantages in order to raise awareness of this issue. In addition, the results reveal that the main reasons that youth, especially females, reject green ICT is a lack of knowledge. Green product knowledge, environmental knowledge, and environmental education are important factors influencing green purchase behavior (Chan, 2001; Chan & Lau, 2000; Connell et al., 1999; Dwyer & Hasan, 2012; Lee, 2010; Young et al., 2010). Thus, marketers should communicate more information about environmental knowledge and green product specifications to youths, especially in regard to the comparable quality and performance of products. Different tools should be applied to match the different communication behaviors of consumers. Tools such as environmental web portals, blogs, wikis, and interactive simulations should be used for green campaigning (Murugesan, 2007). Marketers should also encourage young people to join, participate, and exchange knowledge with the green community created by companies since social participation in environmental networks affects environmental behaviors (Olli et al., 2001).

The persuasion stage is the stage where a person develops his/her viewpoint about an innovation. The perceived characteristics of innovation, consisting of simplicity, trialability, observability, relative advantage, and compatibility, greatly shape a person’s attitude towards the innovation. The findings indicate that companies should attract green consumers by promoting environmental benefits in terms of environmental preservation, decreasing natural resource consumption, and reducing pollution, especially to male youths. The preferences of young people may also be changed by

emphasizing self-benefits in terms of cutting expenditures, particularly for female youths, and representing positive self-images, especially for male youths. The above together with the promotion of green ICT and its positive consequences could encourage youths to use green ICT. Marketing campaigns should focus on the emotional appeal because of its significant effect on the attitudes toward green purchases (Chan, 2001). This may increase the perceived importance of being environmentally friendly, which is crucial for green ICT adoption (Chan, Wong, & Leung, 2008; Laroche et al., 2001; Lee, 2010).

The decision stage is the stage where a person decides whether he/she will accept or reject an innovation. This decision may be reversed later at the implementation stage or the confirmation stage. Tradeoffs between perceived costs and perceived benefits are required in this stage (D'Souza, Taghian, Lamb, & Peretiatko, 2007; Peattie, 2001). The research findings indicate that marketers should promote tangible benefits (reducing costs, increasing devices' lifetime) and intangible benefits (helping to solve environmental problems, convenience of the technology, and showing good images). The objections to green ICT such as perceived costs (costs of searching for the green ICT knowledge and the belief that prices of green devices are high) or perceived risks (perceived lower performance of green ICT) should be addressed by price promotions and research and development, respectively. Moreover, since young people are not able to earn much money, green ICT products or services should be sold at prices that they can afford. Ignorance of the consequences is another reason that youths reject green ICT. Therefore, the significant impacts or environmental consequences, specifically those related to green products or green actions (Chan et al., 2008; Follows & Jobber, 2000; Lee, 2010), and concrete evidence such as green labels by a third party (D'Souza et al., 2007; Fraj & Martinez, 2006), should be made clear to young consumers.

The implementation stage allows a person starts using an innovation. Attributes, such as convenience, availability, price, quality and performance, are very important for both green and non-green products (Ginsberg & Bloom, 2004). These attributes should appear at this stage as they can lead to some changes in the next stage. The confirmation stage is the stage where a person assesses the innovation as part of the decision to continue using or stop using the innovation. If the evaluation result is negative, he/she will cease the adoption. Actual benefits that include solving environmental problems, decreasing expenditures, increasing equipment's lifetime, representing positive images, the actual convenience yield, actual costs, and received performance feedback will be considered at this stage. The findings emphasize that the reasons for rejection by male youths are the limited functions of green ICT and its low performance. Thus, green ICT products or services should be improved by the product or service owners to overcome these constraints. The guidelines for the decision stage should then be reapplied to encourage adoption of green ICT.

In the main, green ICT adoption relates to the buying of energy-efficient products and using electronic channels, with the findings indicating that the green market for young people still has more room to grow. The main green ICT usage behaviors are shutting

down inactive equipment, activating power management features, and reducing unnecessary electronic device usage. Promoting the green ICT concept to others is also important since subjective norms are a factor affecting the behavioral intention of young consumers (Ajzen, 1985).

## Conclusion and Future Research

In total, this work explored the awareness and the acceptance of university freshmen with respect to green ICT. The objectives of this research were to assess students' understanding of green ICT, to determine out how and why they accept or reject the technology, and to provide guidelines for owners and marketers of green products or services to increase the adoption. The findings show that most of the students have superficial knowledge of the green ICT; they need more knowledge regarding the environment, the benefits of green ICT, and the implementation of green ICT concepts. In terms of adoption, although the students do not understand green ICT completely, many students adopt green practices. This result reveals an opportunity for ICT companies to expand the green markets for youths by applying suitable green campaigns.

Further research might focus on the awareness and adoption of youths in different age groups, levels of education, and living standards. The correlation between youths' environmental attitudes, their intentions to use the green ICT and their actual behaviors should be explored quantitatively with a larger sample by expanding the survey to youths in other countries or in different environments, and then comparing the results with this study.

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