

## Understanding Customer Intention to Adopt Sustainable IT Products through Two Dimensional Value Structure and Perceived Sustainability\*

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As sustainability has grown into a key global issue, more and more information technology (IT) products have adopted these concepts to attract consumers. However, these products potentially require consumers' physical or economic sacrifice at least for a short period of time. Therefore, the reason of consumers' adoption of sustainable IT products cannot be fully explained by the two traditional values: hedonic and utility values. However, expectancy-value theory, which has been used to explain the relationship between value and behavior, still takes hedonic value and utility value into consideration. The purpose of this study is to suggest an amended expectancy-value theory to better explain the adoption of IT products that consider sustainability. For this purpose, two social values—the normative value based on the Schwartz's model of moral norm and the eudemonic value of the Stoic philosophy—were added to the individual values to examine which value particularly influences the adoption of sustainable IT products. In addition, the moderating effect of perceived sustainability between four values and adoption of sustainable IT products was verified.

**Keywords :** G-IS Usage, Green IS; Theory of Value Structure, Eudemonic Value, Perceived Sustainability, IT Adoption

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## I . Introduction

As the paradigm of world economy has transitioned from digital economy to green economy, one issue in particular has emerged as a key factor: sustainability. Sustainability creates long-term life value by embracing opportunities and managing risks deriving from economic, environmental and social developments. Hence, sustainability engages environmental, social, and economic factors. For this reason, products are emerging in the marketplace that adopts sustainability features, whether to a greater or lesser degree. Sustainable IT products can be seen as those products providing environmental, social and economic benefits based on IT capabilities while protecting public health and welfare from the extraction of raw materials to final disposition or reuse. An example is eco-friendly cell phones that are designed to save energy and deploy parts of devices made with recyclable or biodegradable materials such as starch. Another example of sustainable products and services include eco-friendly products such as electronic devices operated by natural energies such as solar energy. Besides, HP's eco-solutions and Apple's eco-friendly MacBook computers can be declared as sustainable IT products.

People's attitude toward IT products has, until now, been explained by traditional models of utility value and hedonic value. Utility value includes convenience, efficiency, goal achievement, and other factors that represent how much a product helps a certain task or problem-solving. Hedonic value relates more to the emotional aspects, such as fun, sensibility, and pleasure.

However, purchasing patterns of sustainable

IT products are not fully explained by these two values. Sustainable products are adopted in spite of the dearth of utility and hedonic values: They are relatively pricy, often lack efficiency, and can even require consumers' sacrifice or pain. For example, how could we explain people's participation in the "Go Green Campaign" that seemed to oppose convenience? How could we explain people's decision to purchase recyclable IT products that are more expensive? The Expectance-Value Theory (EVT) and the adjusted theories such as Theory of Reasoned Action and the Theory of Planned Behavior struggle to accommodate this dimension.

EVT explains people's choice of products using the concept of value [Atkins, 1964]. EVT has been one of the important baselines for explaining people's behaviors. The core of this theory is that expectancy and value are the two most important motivations for doing certain behaviors; value in EVT consisting of utility value, interest (hedonic) value, attainment value, and cost. Hence, we argue that traditional EVT value set does not fully contain the factors that motivate users' selection of sustainable products. In particular, individual's values toward society such as prosociality, moral judgment, and responsibility are potential activators of human's adoption behavior. This means that human's adoption behavior will not be fully explained by utility value and hedonic value, which has been regarded as underlying values leading to adoption motivation.

Meanwhile, theory of value structure, which argues that human values are identified as multidimensional structure, can help interpreting human's green behavior on top of EVT. For

example, Schwartz's Norm Activation Model, which considers personal norm as a precedent of human behavior, supports the rationality of these arguments [Schwartz, 1970]. Moreover, Sparks suggested the concept of moral judgment as an approach to explaining behaviors using the EVT [Sparks and Shepherd, 2002]. Thus, it is possible to include a perceived moral obligation, or say, normative value into the value set of extended model of EVT.

Hence, the purpose of this study is to suggest an expanded EVM to identify the values that influence people to purchase sustainable IT products by considering the value structure, not merely conventional utility and hedonic values. Based on the theory of value structure [Schwartz, 1992], we suggest two-dimensional value structure by adding normative and eudemonic value to utility or hedonic values. In this paper, the value set is represented as two dimensional value structures: self-enhancement vs. self-transcendence [Schwartz, 2004], and intrinsic vs. extrinsic value [Vallerand, 1997]. The uniqueness of this study is that we firstly invite eudemonic value into IT adoption theories. In addition, consumer's perception on sustainability is newly introduced to examine if perceived sustainability has a moderating effect that influences the values and adoption of IT products.

This remainder of this paper is organized as follows: Section 2 reviews the literature, including a study of Expectancy-Value Theory and Theory of Value Structure, which are the foundations of the theory suggested by this study. Section 3 introduces the research model and hypotheses of the theories and factors suggested by this study. Section 4 and 5 discuss

the process and findings of each substantial analysis, and states the academic and practical meaning of the findings along with the significance of the current study and prospective study topics.

## II. Theoretical Background

### 2.1 Expectancy-Value Theory

This study proposes values as the major factors that influence users' purchase intention. Achievement-motivation theories, such as Expectancy-Value Theory (EVT), explain the cause of people's attitude toward certain tasks or subjects with two decisive factors: value and expectancy [Atkinson, 1964]. Here, expectancy is defined as people's belief in the achievement of given task [Eccles *et al.*, 1983], and is sometimes explained as the expectancy of outcomes and the expectancy of achievement in relation to self-efficacy [Bandura, 1997]. Expectancy is an important decisive factor of selection.

In this theory, value is a subjective factor that could be different from each individual. This model focuses on two values. First, attainment value: earned when one's behavior is achieved as intended. Utility value or usefulness refers to how a task fits into an individual's future plans. Cost refers to how the decision engaged in one activity limits access to other activities, assessments of how much effort will be taken to accomplish the activity, and its emotional cost. Second, intrinsic value: the enjoyment of performing the task itself. When individuals perform tasks which are intrinsically valuable, there are important psychological consequences, most of which are

positive [Deci and Ryan, 1985]. Utility value is also considered a value of the outcomes by performing a task rather than the task *per se*, and has been framed as an extrinsic value [Deci and Ryan, 1985; Harter, 1981]. Other motivation theorists developed the concept of interest value as an intrinsic value. People perform tasks not only because of outcomes, but also for interest and enjoyment [Harter, 1981].

## 2.2 Theory of Value Structure

Smith and Schwartz [1997] define values as beliefs that refer to desirable goals, transcend specific actions or situations, serve as standards to guide the selection or evaluation of behavior (e.g. technology adoption), people (e.g. community member) and events (e.g. ads on global warming), and are ordered by importance relative to one another. Values represent what is important or not in their lives. Values has been regarded as determinants to understand attitude and behavior in IS research.

Schwartz developed value theory by deriving ten motivationally distinct value types from three universal requirements of human existence [Schwartz, 1992]. The ten value types are classified into two dimensions: openness versus conservation, and self-enhancement versus self-transcendence. Among those, self-transcendence deals with enhancement of others and transcendence of selfish interests, while self-enhancement is composed of achievement and power.

Self-transcendent value in theory of value structure is extended to Schwartz's model of moral norm, which is useful to explain people's pro-environmental behavior [Schwartz,

1970]. Norm activates altruism results when an individual is aware of negative consequences to others and is willing to ascribe responsibility at an individual level to prevent those consequences. As people have an increased sense of possible negative effects to others and ascribe responsibility, they are more likely to experience a sense of obligation to act to prevent harm as an altruistic personal norm. The variables of Schwartz's model-the sense of negative consequences to others and ascribed responsibility-have been expanded to include self-interest calculations in the form of perceived personal costs, as a potential influence on behavior [Black *et al.*, 1985].

Schwartz's model of moral norm indicates the significance of normative value as a determinant of intention to use products that are socially acceptable, and hence provide more opportunities to actually use them. At the same time, a normative value may inhibit an intention not to use products if they are not socially acceptable.

## III. Model and Hypothesis

### 3.1 The Nature of Information System Sustainability

Information systems have several angles related to sustainability issues. First, as a resource of transformation, information systems contribute to realize or improve sustainable organizations. From a sustainability perspective, IS enables firms to standardize, monitor, capture, and utilize data and metadata (e.g., location, temperature) that facilitates energy efficiencies [Melville, 2010]. Second, information

technology is a target itself for improvement in terms of sustainability. The Global eSustainability Initiative (GeSI) examined how information and communications technologies (ICT) affect climate change. Their results confirm that information and communication technology industries could do much to reduce greenhouse gas emissions. In 2007, about 2% of total carbon-dioxide emissions from human activity come from IT products such as PCs, peripherals, and mobile and network devices. However, information systems also contribute to measuring how much sustainable a target product or service is, and furthermore, what can be used to control or optimize it [Dong *et al.*, 2010]. These endeavors include participating in a sustainability test bed as a component.

Information systems that embody sustainability as one of the IT capabilities—such as connectivity, ubiquity, and interoperability—can have a strategic impact. This strategic impact includes new products or services that let people feel that the product or service can improve the societal and/or economical sustainability. IT-empowered sustainability can reduce the total cost of ownership (TOC). Recently, enterprises are either voluntarily or coercively responsible for taking sustainability issues into account as green businesses. Along with this, LCA (Life Cycle Assessment) is one standardized effort to estimate the total environmental cost and incorporated in value assessment of product, service or enterprise. Sustainable information systems will be profitable to the enterprise in terms of LCA. Meanwhile, the proper IS can increase organizational efficiency by enabling sustainability. In this paper, we focus on the aspect of information systems that

embody sustainability and hence contribute to the sustainable societies.

Sustainable IT consists of greened IT and greening IT. Greened IT is the improvement of conventional IT in that greened IT save more energies and include less pollutant such as green computers. Greened IT itself is a target of improvement in terms of sustainability. Global eSustainability Initiative (GeSI) examined how information and communications technologies (ICT) affect climate change. The result confirms that information and communication technology could do much to reduce gas emissions. Not a little carbon-dioxide emission from human activity comes from IT products such as PCs, peripherals, mobile devices and network devices. IT products which save more power are main issue in this viewpoint. Greening IT, on the other hand, is an IT that enables consumers be more eco-friendly in their lives or tasks. Smart Grid and websites which provide information how to live eco-friendly can be classified as greening IT. In this paper, we will focus on greened IT product such as eco-phones.

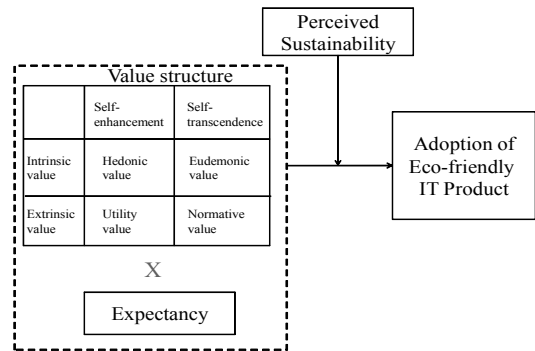
### 3.2 Overview of the Proposed Research Model

The focal point of this study is to understand the selection of IT products that emphasize sustainability. The proposed research model stems from the traditional EVT in that essential keys to explain the adoption behavior are value and expectancy. We suggest an expanded Expectancy-Value Theory by analyzing whether there are other forms of values that are not discussed by other IS theories. In par-

ticular, this study considers the theory of value structure such as Schwartz’s model of moral norm to explain sustainability-friendly behaviors. As shown in <Figure 1>, the originality of the proposed model is that we firstly consider two-dimensional value structure by inviting the theory of value structure into IT adoption research. Moreover, this study recognizes that self-transcendence value is related to not only normative but also eudemonic values, representing the feelings of happiness. Consequently, the new expanded EVT sees the Cognitive Structure of Values that includes eudemonic value as a novel essential determinant of the adoption of sustainable IT products.

However, values in the cognitive structure of values are not mutually exclusive. For instance, even though hedonic value pursues pleasure, and utility value pursues work or task, they are not completely opposite [Deci *et al.*, 1981]. There are prior studies supporting the idea that utility and hedonic values can be felt through shopping experiences in product purchasing [Belk, 1987; Sherry, 1990]. In other words, hedonic pursues enjoyment, pleasure, and convenience; utilitarian pursues economic value and incentives; normative pursues satisfaction with social encouragement or criticism; and eudemonic pursues reward or good feeling. For example, people of intrinsic value pursue emotional maturity or personal growth, more than extrinsic values, such as financial success, appearance, and reputation [Robins *et al.*, 2001; Sheldon, 2005]. Additionally, normative pressure has been described as a significant influence to argue that service innovation must occur not only in utility value for economic factors, but also in all other values [Jeya-

raj *et al.*, 2009]. Two dimensional value structure can expand our thought that consumer’s values can influence their adoption of sustainable IT products, such as mobile devices, servers, personal computers, and even sensor networks.



<Figure 1> Research Model

### 3.3 Cognitive Structure of Values

In this paper, the value set is represented as two dimensional value structures: self-enhancement vs. self-transcendence [Schwartz, 2004], and intrinsic vs. extrinsic value [Vallerand, 1997]. When it comes to self-enhancement vs. self-transcendence, the values are different from each other in terms of “the extent to which they motivate people to enhance their own personal interests even at the expense of others (self-enhancement) versus to transcend selfish concerns and promote the welfare of others, close and distant, and of nature (self-transcendence) [Schwartz, 2004, p. 236].” In special, they clearly located ‘protecting the environment’ and ‘social justice’, which is substantially related to eudemonic and normative value in the context of our study, at self-transcendence value. Meanwhile, intrinsic value is related to pursue sat-

isfying oneself; while extrinsic value is related to show self to others or environment [Vallerand 1997].

### 3.3.1 Utility Value and Hedonic Value

Over the past few decades, utility and hedonic values have been used to understand the consumer's attitude within the IS community. Utility value is related to products' performance as tools and functions [Batra and Ahtola, 1990]. Consumers who rely on utility value are task-centered and rational, and try to be effective and punctual to purchase products with minimum irritations [Childers *et al.*, 2001]. On the other hand, hedonic value is related to pleasure and experience.

These two values have been used not only to understand consumer attitudes toward various products, such as laptop computers and online shopping, but they have also been used to study how they influence consumer attitude in terms of circumstances, environment, or product characteristics [Childers *et al.*, 2001; Collier, 2006]. Also, utility value is related to extrinsic motivation in that it values achieving certain goals; while hedonic value is related to intrinsic motivation in that it values pursuing pleasure [Vallerand, 1997].

Utilitarian value and hedonic value influence purchase intention or motivation. For instance, through advertising, items of cognitive involvement in the utilitarian dimension and affective involvement in the hedonic dimension influence the utilitarian dimension of attitude and the hedonic dimension of attitude, and eventually the brand's purchase intention [Voss *et al.*, 2003]. To *et al.* [2007] supported that utili-

tarian value and hedonic value directly or indirectly influence consumers' purchase intention in online shopping, while Saksriboworn [2008] indicated that utilitarian value and hedonic value influence their purchase intention in online shopping through attitude. Overby *et al.* [2006] said that the preference of Internet retailers influences consumers' future purchase intentions. In sum, if all other conditions are identical and the existing theory is generalized, hedonic and utility values would consistently be positively related to customers' purchase intention of sustainable IT products. Therefore, we suggest the following hypotheses:

*Hypothesis 1-1: Motivation from hedonic value (Hedonic value×Expectancy) has a positive influence on customer's adoption of sustainable IT products.*

*Hypothesis 1-2: Motivation from utility value (Utility value×Expectancy) has a positive influence on customer's adoption of sustainable IT products.*

### 3.3.2 Normative Value

Normative value is a "general and stable dispositions of individuals, verbalized by them or inferred by the researcher, involving preference or a sense of obligation." [Barton, 1962]. Based on this opinion, normative value is often interpreted as "I ought to" rather than "I want to." Friendliness, honesty, loyalty, moral courage, and responsibility are considered important normative values [Denis, 1965].

Normative value is perceived differently from one person to another. Vaske *et al.* discovered that demographic characteristics, such as gen-

der and years in current residence, influence people's ecological and biocentric/anthropocentric value orientation tendencies, the normative belief in natural resource management [Vaske *et al.*, 2001].

Information systems that address sustainability can be conceptualized as fitting two archetypes: responsive green IS and strategic green IS [Porter and Kramer 2006]. Among those, responsive green IS enables companies to be good citizens by addressing sustainability issues that may not be a direct result of their operations, or mitigate the negative impacts of day-to-day value chain activities and operations. Porter and Kramer's responsive green IS has much to do with normative value. Therefore, the following hypothesis would be feasible:

*Hypothesis 2-1: Motivation from normative value (Normative×Expectancy) has a positive influence on a customer's adoption of sustainable IT products.*

### 3.3.3 Eudemonic Value

Eudaimonia, the root of eudemonic value, was derived from the study of happiness and well-being. Eudemonic value is defined as Aristotle's self-realizing value that focuses on an individual's ability to realize his or her true potential and disposition [Broadie, 1991]. In a eudemonic approach, happiness is the state where one's potentials are sufficiently realized, or one's capacity to fulfill a potential is maximized. Eudaimonia is also "meaningful living conditioned upon self-truth and self-responsibility" [Norton, 1976]. Eudemonic activity has the ultimate purpose to realize one's well-being.

Compared to hedonic or utility value, eudemonic value has the following unique characteristics: First, in terms of Maslow or Elderfer's level of needs, eudemonic value is closely related to highest needs: self-growth. Important parts of decision-making or behavior, such as social relationships, autonomy, authority, and responsibility, are not solely explained by hedonic or utility value. Therefore, eudemonic value focuses on one's meaning and self-realization. People may need social relationships from a hedonic value perspective. However, this is not about self-realization but about the pleasure of such relativity [Steger *et al.*, 2008]. Second, eudemonic value stresses both results and processes. Self-realization is not just about the results of certain achievement. Rather, it is more closely related to how much one demonstrates righteous or desirable human nature in the process of such achievement [Waterman 1993]. Eudemonic value comes not from a final outcome or state, but rather a process of fulfillment or realization of true human nature and achievement of human potential. These characteristics can potentially explain why people having eudemonic value are willing to pay for IT products that are more expensive because they are sustainable. Last, eudemonic value results are not always proportional to those of hedonic and utility values such as pleasure, convenience, or financial interest. Rather, the results may be opposite to each other. Sometimes, adopting sustainable IT products do not even simply moderate pleasure, but demand one's sacrifice or personal loss [Waterman, 1993].

When it comes to normative values, the eudemonic value is different because it is more autonomous and spontaneous [Waterman, 1993;



Ryan *et al.*, 2008]. In other words, the normative value has a premise that there is an absolute, or at least a contemporarily absolute, norm. Eudemonic value is also spontaneous in that one forms as a member of the society. Eudemonic value is characterized by the fact that the authority of decision-making is given to each person, not explicitly pressured by a group or society. Therefore, eudemonic value can be explained by a self-determination theory [Ryan and Huta, 2009]. This theory classifies one's behaviors into self-determined behaviors and non-self-determined behaviors according to whether one's behavioral motivation is intrinsic or extrinsic. In other words, the possibility of autonomous behavior increases when extrinsic motivation becomes more sufficiently intrinsic and integrated with oneself.

If selecting sustainable IT products is not done by external pressure, fun, or utility, it would more likely to be done by an autonomous and high-level value of ego. Therefore, eudemonic value and adoption of sustainable IT products would form a positive correlation.

*Hypothesis 2-2: Motivation from eudemonic value (Eudemonic value×Expectancy) has a positive influence on customer's adoption of sustainable IT products.*

### 3.4 Expectancy

It has been prominently noted that motivation increases with the expectancy of reaching a goal, and along with the goal's value, are found in expected utility theory [Edwards, 1951], the theory of achievement motivation [Atkinson, 1964], the theory of reasoned action [Fishbein

and Ajzen, 1974], and the theory of motivation in organizational psychology [Mitchell, 1982].

Expectancy has four facets: Expectance as probability, task difficulty, sufficiency, and necessity [Lieberman and Foster, 2008]. Probability is the likelihood that a certain event will really happen. Task difficulty, which is one of several influences on subjective expectancy, indicates the amount of effort required to do well. Sufficiency can be viewed as self-efficacy because sufficiency means the extent to which one feels capable of bringing about the desired outcome. Necessity is the likelihood of achieving the goal without the action. Even though the boundaries among the four concepts are somewhat fuzzy and interconnected, indicating one facet of expectancy would be useful to clarify incorporating expectancy construct in the model.

When it comes to sustainable IT product consumption, we will focus on expectancy as sufficiency: To what extent a user has self-confidence in dealing with sustainable IT products well enough to achieve individual or social eco-goal with the product.

### 3.5 Moderator: Perceived Sustainability

Prospective users' awareness of the level of sustainability of a selected IT product is named perceived sustainability in this paper. It is characterized by whether such products are operated by new regenerative energies, use pollution-causing materials, have energy-saving features, or use materials that are not harmful to human body and the environment.

We adopted subjective, perceptive variables rather than objective variables because each

user can have different attitude toward the same sustainable IT product. In fact, perceived sustainability is a key concept. For example, the European Union's DIAMONT (Data Infrastructure for the Alps-Mountain Orientated Network Technology) project for sustainable development of the Alps considers both measured sustainability and perceived sustainability [DIAMONT, 2008]. Even for this study's environmentally-friendly cell phones that use new regenerative energies such as solar energy, some consumers are less interested in this aspect of the phones' sustainability nature, but rather, they believe issues around the use of environmentally-friendly, non-polluting materials is the most important aspect. To these consumers, then, cell phones that are operated by solar energy do not meet their criteria of being eco-friendly phones.

A factual assessment of sustainability does not necessarily have corresponding outcomes with ordinary people's perceptive evaluation. For example, according to the evaluation of green efforts in consumer shipping, restaurant, and finance industries by Angus Reid Public Opinion, a Canadian consulting firm, there was a big gap between the results of objective measuring and subjective measuring [GreenBiz, 2010]. The essential reason was that the consumers are convinced by corporate campaigns, brand reputation, press evaluation, or product name [Timbers, 2010]. Perceived sustainability is obviously not an accurate evaluation of a product. From the consumers' point of view, value, expectancy, and production selection are formed by cognition. This supports the thought that perceived sustainability would be more practical to measure sustainability than an objective degree of sustainability. Hence, this

study suggests sustainability as a moderator to determine whether sustainable IT products and non-sustainable IT products have different value systems.

In particular, people who place a higher level of importance on eudemonic values will be more sensitive to perceived sustainability; that sensitivity will in turn affect adoption of sustainable IT products. This does not necessarily imply that other values such as utility value are not be affected by the intensity of perceived sustainability, because people who have utility value may likely adopt sustainable IT products because of their energy-efficiency and hence cost saving features-but not just sustainability *per se*. Likewise, people who place higher levels of importance on hedonic or normative values will not more rely on the essential value that sustainability has than pleasure or responsiveness to the stakeholders. On the other hand, self-enhancement values will not be influenced by the consumer's perception on sustainability issues. Hence, we hypothesize that perceived sustainability can be a moderator for only eudemonic value.

*Hypothesis 3-1: With higher perceived sustainability, adoption from self-transcendent value (eudemonic value and normative value) would be better explained.*

*Hypothesis 3-2: With higher perceived sustainability, adoption from self-enhancement value (hedonic value and utility value) would not be better explained.*

### 3.6 Intention to Purchase Sustainability IT Products

The meaning of behavioral intention in this

study is the pre-adoption of certain sustainable IT products. Behavioral intention means that consumers' behaviors are decided by their attitude and subjective norm. Behavioral intention to use has been one of the constructs explained by TRA and Technology Acceptance Model (TAM). In TRA, attitude toward behavior and subjective norm appeared to influence behavioral intention to use [Fishbein and Ajzen, 1975]. Thus, normative value is expected to influence both satisfaction and the intention to use. In TAM, perceived usefulness appeared to influence intention to use both directly and indirectly [Davis *et al.*, 1989].

## IV. Method

### 4.1 Measurement Development

The purpose of the experiment is to understand customer intentions towards adopting sustainable IT products mainly with value sets including utilitarian, hedonic, normative, and eudemonic values. The questionnaire was pre-tested with 51 graduate students and employees. The students and employees were requested to complete the questionnaire and then provide any comments or feedback about its statements; their comments and suggestions were incorporated into the final questionnaire. The questionnaire also collected details of participants' personal profiles, such as their age, gender, and whether or not they are currently using mobile any devices.

The measures used in this paper were mainly adapted from relevant prior studies. All variables were measured with a survey using validated items involving a 7-point Likert scale

anchored at "strongly disagree" (1), "strongly agree" (7), and "neither agree nor disagree" (4). The references of these measures are summarized in <Table 1>. The items for hedonic and utility values are borrowed from Voss *et al.* [2003]. Eudemonic and normative values are measured by the items of Ryan *et al.* [2008] and Meyer *et al.* [1996]. Perceived sustainability is measured by modifying the Sustainable Society Index [van de Kerk and Manuel, 2008]. Expectancy was also measured by modifying the items of Eccles *et al.* [1998].

We selected eco-phones as a sustainable IT product in the questionnaire. (Please refer to <Appendix A> for the survey items.) The eco-phones are different from legacy phones in that they are not made of pollutants. Other than material differences, eco-phones are legacy phones are identical in terms of functional and service qualities. To mitigate the possible information gap, an illustration including examples and device images was given to the participants before answering the questions.

<Table 1> Source of Survey Items

Measure	Reference
Utilitarian Value (UV)	Voss <i>et al.</i> [2003]
Hedonic Value (HV)	Voss <i>et al.</i> [2003]
Normative Value (NV)	Meyer <i>et al.</i> [1996] (Modified)
Eudemonic Value (EV)	Ryan <i>et al.</i> [2008]
Expectancy (EXP)	Eccles <i>et al.</i> [1998] (Modified)
Perceived Sustainability (PS)	van de Kerk and Manuel [2008] (Modified)
Adoption (ADT)	Eccles <i>et al.</i> [1998] (Modified)

## 4.2 Subjects and Procedure

The empirical study was conducted in Korea and the research population chosen was that of adults who have economic potential to purchase cell phones. To minimize any chance of exposing the researchers' intentions, we worked with a survey institution to collect the data. Since the institution has no involvement with the mobile industry, we considered that the sample would not be biased. The survey was conducted from April to May, 2010. A total of 400 completed questionnaires were collected. Among those, two questionnaires were excluded because of abnormal responses. Finally, 398 questionnaires were included in the statistical analysis. SPSS 18.0 is applied for the analysis.

<Table 2> Subjects' Profiles

Variable	N	%
<i>Gender</i>		
Male	201	50.5
Female	197	49.5
<i>Age</i>		
20's	136	34.2
30's	153	38.4
40's	61	15.3
50's	48	12.1
<i>Occupation</i>		
Employee	162	58.3
Student	38	13.7
Household	22	7.9
Others	56	20.1
<i>Mobile device used</i>		
Cell phone	307	77.1
Smart phone	84	21.1
Eco phone	3	0.8
No mobile device	4	1.0

The gender ratio is almost balanced (Male, 50.5%/Female, 49.5%). The majority were in their 20's (34.2%) and 30's (38.4%). Most of them were cell phone users (77.1%), with a minority who used either a smart phone or eco phone. The descriptive statistic relating to subjects' profiles are summarized in <Table 2>.

## V. Results

### 5.1 Measurement Validation

In order to verify the feasibility of variables regarding the current study's value tendencies, we used an exploratory factor analysis. A principal component analysis was used to extract the components of all variables and orthogonal rotation was adopted to simplify factor loading. Factor loading shows the degree of correlation between each variable and factor. Therefore, each variable is included in the factor with the highest factor loading. Eigenvalue refers to the sum of squares of all variables loaded onto a certain factor and standardized dispersion of a certain factor. In social science, factors and items are considered significant when their eigenvalue is greater than 1.0 and factor loading is greater than 0.4. With factor loading greater than 0.6, a factor is considered important. Therefore, the current study set the eigenvalue to 1.0 or higher and factor loading to 0.6 or higher.

Regarding internal consistency (reliability), composite reliability scores for every construct (ranging from 0.913 to 0.951, as shown in <Table 3> were well above 0.70. AVE measures the amount of variance that a construct captures from its indicators relative to the amount due

to measurement error [Chin, 1998]. It is recommended to exceed 0.50 [Hu *et al.*, 2004]. <Table 3> shows that the AVE score for every construct (ranging from 0.835 to 0.933) satisfies this requirement. Barclay *et al.* [1995] suggested that item loadings should exceed 0.70. In this study, the loadings of each item meet this criterion.

<Appendix B> shows the results of factor analysis of value tendencies. Total dispersion explained was 76.499%. A total of seven factors were extracted from value tendencies. Among the 39 factors, 3 factors—normative value (NV1), utility value (UV3) and expectancy (EXP1)—were removed and 36 factors were used for the analysis. Moreover, we evaluate the properties of the instrument in terms of reliability. The measure of reliability for the seven constructs was determined using Cronbach’s alpha (see <Table 3>). Cronbach’s alpha of 0.60 or higher are considered adequate. Looking at <Table 3>, Cronbach’s alpha of all constructs was greater than 0.60, indicating high reliability. <Table 3> also shows that the square roots of all the AVE values (i.e., the numbers on the diagonal) are greater than the correlations among constructs (i.e., the off-diagonal numbers), indicating sat-

isfactory discriminant validity of all constructs.

Since we collected all data in a cross-sectional survey, we carried out Harman’s one-factor test [Harman, 1967] to examine the possible issue of common method bias. Six factors emerged with eigenvalues greater than one in an unrotated principal-component analysis of all independent and dependent variables. While one factor contributing to more than 50% of total variance is considered an indication of common method bias, the first factor in our analysis accounts for only 39.9% of the total variance. This indicates that common method bias is not likely to be a serious problem in this study.

## 5.2 Testing the Structural Model

We conducted stepwise multiple regression method to test the hypotheses. As a first step, we multiplied degree of each value by degree of expectancy. Then, to identify the moderating effect of perceived sustainability, the set of value×expectancy is multiplied by the degree of perceived sustainability. As a result, four value×expectancy and four value×expectancy×perceived sustainability are entered into the initial

<Table 3> Results of Reliability Testing

Constructs	Reliability	ADT	EV	HV	NV	UV	EXP	PS
ADT	0.951	<b>0.933</b>						
EV	0.915	0.634	<b>0.835</b>					
HV	0.925	0.491	0.413	<b>0.853</b>				
NV	0.914	0.455	0.748	0.531	<b>0.838</b>			
UV	0.924	0.461	0.511	0.645	0.524	<b>0.851</b>		
EXP	0.929	0.443	0.563	0.317	0.565	0.467	<b>0.860</b>	
PS	0.913	0.447	0.469	0.369	0.520	0.423	0.703	<b>0.861</b>

independent variables to analyze with step-wise regression method. The results are described in <Table 4>. NV, EV, UV×PS and HV×PS are dropped and the remains are left in the model.

Hypothesis 1-1 and 1-2-“Hedonic value and utility value have a positive influence on customers’ purchase intention of sustainable IT products”-were supported (respectively,  $t = 2.667$  ( $p = .008$ ),  $4.134$  ( $p = .000$ )). That is, the higher the customers self-enhancement values (value hedonic and utility values), the higher the participants’ intention to use sustainable IT products. Hence, all paths found in conventional EVM were supported in our extended EVM. When it comes to self-transcendent values, interestingly, hypothesis 2-1 and 2-2 on a positive relationship between self-transcendent values and adoption of sustainable products was not supported, just because the constructs were dropped during the step-wise regression analysis. It means that customers do not always adopt sustainable IT products. However, this does not mean that normative and eudemonic values are not related to sustainable IT adoption.

When it comes to Hypothesis 3-1 and 3-2,

perceived sustainability was clearly plays a moderating role according to the self-transcendent according to the results of <Table 4> (NV×PS and EV×PS).

<Table 5> Regression Analysis Result of Between EV and ADT

Model	Nonstandardized coefficient		Standardized coefficient	t
	B	S.D.	$\beta$	
1 (Cont.)	3.082	.244	.317	12.607*
EV	.329	.057		5.781*

a: dependant variable: ADT.

\*  $p < 0.01$ .

Note: EV indicates EV×EXP.

When it comes to hypothesis 2-2-a eudemonic value will have a positive influence on people’s adoption of sustainable IT products-seems to be negatively supported as shown in <Table 5> ( $\beta = -0.329$ ,  $p = .002$ ). However, when we examined an independent relation between eudemonic value and customers’ purchase intention of sustainable IT products, eudemonic value has a positive influence on people’s adoption of sustainable products as shown in <Table 5>. The result indicates that customers’ eude-

<Table 4> Regression Analysis Result of Between EU, EH, EE, EN-ADT

Model		Nonstandardized coefficient		Standardized coefficient	T	Statistics
		B	S.D.	B		
1	(Cont.)	2.380	.198	.206	12.031*	R = .574
	UV	.216	.081		2.667*	R <sup>2</sup> = .330
	HV	.371	.090		4.134*	Adjusted R <sup>2</sup> = .320
	NV×PS	.399	.103		4.19	F = 36.371
	EV×PS	-.329	.105		-3.34	-3.128*

a: dependant variable: ADT.

\*  $p < 0.05$ .

Note: UV, HV, NV and EV indicates UV×EXP, HV×EXP, NV×EXP and EV×EXP, respectively.

monic value has an opposite directional effect to their hedonic, utility, and normative values. Meanwhile, the regression model shows that F-value is 33.415( $p = .000$ ) with  $R^2 = .101$ .

## VI. Discussion

EVT has long been considered in attempting to understand the relationship between value and behaviors. The model considers both hedonic and utility values. In this paper, we argue that social values, such as normative and eudemonic values should also be considered in explaining the adoption of eco-IT products, which cannot be sufficiently explained only with utility value. This is because sometimes, eco-IT products are not better than general IT products in terms of utilitarian or hedonic metrics such as price or pleasure. Hence, we proposed an extended EVM which newly incorporates two social values: a normative value, originated from Schwartz's model of moral norm; and a eudemonic value from Stoic philosophy. These multi-dimensional value sets turns out to significantly affect the adoption behavior in this experiment.

The existence of normative or eudemonic values in adoption of sustainable IT products can also be understood by the theory of impression management [Giacalone and Resenfield, 1989]. Adoption of products with lower hedonic and/or utility values looks confusing when considering of traditional IS theories such as the technology adoption model (TAM). However, adopting sustainability principles is quickly becoming an important goal, since it is growing as a key social value. In light of theory impression management, the goal-oriented

activity of regulated information aims to influence the impression formed by an audience and eventually gain rewards. The rewards can be ingratiation-to be liked by the others; and even intimidation-to be heard and obeyed. To gain these rewards, the strategy of impression management consists of defensive and assertive strategies. The defensive strategy denotes the avoidance of a threatening situation. Ignoring the social norm for sustainability might be recognized as a source of loss of social stature for an individual. To avoid this "threat," the person can use or at least show the intention to use the sustainable IT products. This is well suited to the nature of normative value. Meanwhile, the second strategy, called assertive strategy in impression management, is related to expressive idealization of the self. This is another way of self-presentation to others, as well as self. This strategy is somewhat similar to the eudemonic value which comes from self-idealization rather than being lead by others.

Current research also provides a demonstration that a two-dimensional cognitive structure of IT product users' value has an important impact upon whether people act on their intentions to consume sustainable goods. We reasoned that people's sense of personal value to perform a behavior would influence the motivational force of intention in terms of the likelihood that decision would be translated into actual use.

Based on the regression analysis, we could now conclude that all of the values: utility, hedonic, normative, and eudemonic are positively related to the adoption of sustainable IT products. Based on these findings of the current study, the following practical suggestion

can be made: More sufficient and more accurate interpretation of human value structure would be possible when substantial study and normative study are combined in balance. For example, it would be more successful when private values are defined by conforming normative values with utilitarian and/or hedonic values. For example, saving money through health enhancement or tax deduction can also be emphasized in addition to saving energy. When advertisements campaign as being “good for business and good for the planet,” both utilitarian and normative values are being pursued.

Finally, it was interesting that the coefficients of utility value, hedonic value, normative value and eudemonic value were negatively related when explaining the adoption of sustainable products. However, when we consider simple regression by setting a eudemonic value as one independent variable, that eudemonic value positively affects adoption. This result implies two exclusive value sets: a value set with only eudemonic values, and one with utility, hedonic, and normative values. The two value sets are contradictory. For example, we can find consumers who are skeptical to an ad hawking “green”: *“You can clearly tell by the commercial that the company’s priority is to save money, not to save energy. It seems as if they do not care that by saving energy they are using less natural resources. Their priority is to save money for personal benefit.”* [Greenwashingindex, 2012]. The consumer’s argument clearly admits the discrepancy between eudemonic and utility value. When a promotion appeals to two value sets at the same time, the effect can be disappointing. In fact, most customers think it is normal that sustainable IT product would be

more expensive than general IT products. On the other hand, other than utility values like price, people in developed economies are also interested in hedonic values such as comfort and pleasure. If an advertisement attempts to promote sustainable IT products with a lower price, then customers may understand that the products may not be actually sustainable, which decreases the value of the product and hence risks being ignored. These people need to find a differential value, say pride as eudemonic value, from the sustainable IT products other than conventional values. Hence, a misfit arises between the values intentionally designed by the companies, versus the value of a sustainable IT product; consumers can ultimately negatively affect the adoption behavior. This symptom shows two exclusive paths to reach the adoption of sustainability IT products.

Meanwhile, the existence of two value sets delivers some interesting guidelines around educating for a green consumption. When a person has places more importance on a high eudemonic value than other values, educating the person about an environmental value would be helpful to increase the sustainable IT product consumption. However, in case the person has a utility value, discussing the benefits of sustainable IT products will work. Establishing differential educations for each of these two value groups is useful. Education is still one of the potential action items to restructure customer values for going greener.

The existence of the moderating effect of perceived sustainability between self-transcendence values and sustainable IT product adoption is successfully observed. In particular, if the people who have higher eudemonic or normative values are more likely to purchase sus-



tainable IT products when they perceive that the products are actually sustainable. However, the moderating effect was not found in case of other values. This implies that the people who have more utility, hedonic and normative values than eudemonic values may not actually appreciate the sustainability of sustainable IT products. Rather, they intend to adopt the product just because of its cost-effectiveness, fun, and/or conformation with social norms. Actually, not a few people are more interested in the money-saving features of the sustainable IT products than environmental and societal benefits. Even though these observations have been recently found, we verified these findings through the experiments. Hence, the thought that success will be accomplished because the product is green must be reconsidered. Rather, sophisticated education or any other value change management using social networking media is necessary to enhance the user's eudemonic value so that the educated consumer's perceived sustainability caused by advertisement or any other events works.

If perceived sustainability is correlated to individuals who place importance on a high eudemonic value, business strategies or tactics to enhance the perceived sustainability is key for any adopting decisions relating to sustainable IT products. For example, branding should be carefully considered because it is closely related to motivating individuals towards a purchase. In particular, since the essential part

of the branding is sustainability, the branding must focus on which values are embedded in the product.

When it comes to normative value, Theory of Reasoned Action (TRA) subjective norm has been explicitly considered as an independent construct [Fishbein and Ajzen, 1975], and Theory of Planned Behavior implicitly incorporated to connect adoption intention and actual adoption behavior [Ajzen, 1985]. Normative value clearly contributes to explain the gap between intention to use and actual usage. People whose intentions are more aligned with their normative value are more likely to perform behaviors compared with participants whose intentions are more aligned with their attitude [Godin *et al.*, 2005].

Additional research is needed to examine the role of eudemonic value in the sustainable IT adoption. In special, UTAUT2 model, which is an extension of UTAUT [Venkatesh, 2003], newly incorporate hedonic value, as well as habit and price value, because UTAUT2 focuses on adoption of individual IT such as personal information system and social network service [Venkatesh *et al.*, 2012]. So far UTAUT or UTAUT2 has focused on examining the adoption mechanism of information technology such as mobile technology [Eckhardt *et al.*, 2009] and websites [Venkatech *et al.*, 2012]. Hence, another research model for adopting individual sustainable IT product can draw its theoretical foundation from UTAUT2.

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## 〈Appendix A〉 Images and Survey Items

[Eco-phones]



<BlueEarth>

<EcoPhone>

Constructs	Items
Utilitarian Value (UV)	UV1: It is effective. UV2: It is helpful. UV4: It is necessary. UV5: It is practical. UV6: It is useful.
Hedonic Value (HV)	HV1: It is of fun. HV2: It is enjoyable. HV3: It is of pleasure. HV4: It is exciting. HV5: It is delightful. HV6: It is thrilling.
Eudemonic Value (EV)	EV1: It is right. EV2: It is moral. EV3: It is my pride. EV4: It is worthwhile. EV5: It is meaningful. EV6: It give me good feeling.
Normative Value (NV)	NV2: Others might approve that I use this phone. NV3: Others might encourage me. NV4: Others might speak well of me. NV5: I feel obligation to use this phone. NV6: I feel a sense of unity with who use same phone as me.
Expectancy (EXP)	EXP2: Using this phone might help to achieve a sustainability goal. EXP3: Using this phone is needed to maintain good environment. EXP4: By using this phone, I expect that next generation will live in a good basis of living. EXP5: Buying this phone will be expected to help to make a sustainable society. EXP6: Using this phone will be expected to help to make comfortable environment.

Perceived Sustainability (PS)	PS1: Using this phone will effect to personal sustainable development positively. PS2: Using this phone will effect to healthy Environment positively. PS3: Using this phone will effect to well-balanced society positively. PS4: Using this phone will effect to sustainable use of resources positively. PS5: Using this phone will effect to sustainable world positively.
Adoption (ADT)	ADT1: I am very likely to buy this phone. ADT2: If the choice of a cell phone was up to me, it would likely be a phone. ADT3: I would not hesitate to provide information about this phone. ADT4: I would use this phone.

### 〈Appendix B〉 Result of Factor Analysis

	ADT	EV	HV	NV	UV	EXP	PS
ADT1	0.866						
ADT2	0.874						
ADT3	0.819						
ADT4	0.864						
EV1		0.746					
EV2		0.779					
EV3		0.715					
EV4		0.771					
EV5		0.703					
HV1			0.792				
HV2			0.784				
HV3			0.718				
HV4			0.808				
HV5			0.810				
HV6			0.773				
NV2				0.654			
NV3				0.717			
NV4				0.706			
NV5				0.673			
NV6				0.672			
UV1					0.704		
UV2					0.739		
UV4					0.768		
UV5					0.821		
UV6					0.756		
Exp2						0.758	
Exp3						0.822	
Exp4						0.818	
Exp5						0.764	
Exp6						0.824	
PS1							0.754
PS2							0.734
PS3							0.789
PS4							0.710
PS5							0.739

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