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# Intention to Use Green IT among Students

Tho Guan Choon[1], Dr. Ainin Sulaiman[2], Hisham Mallasi[3]
Faculty of Business and Accountancy,
University of Malaya, Malaysia
[1]thoguanchoon@gmail.com, [2]ainins@um.edu.my, [3]hishamm@gmail.com

**Abstract-** *This research incorporates the Theory of planned behavior and Personality theory to examine factors influencing Green IT adoption by Malaysian students. The 5 variables from TPB, namely attitude towards Green IT, subjective norms toward Green IT, perceived behavioral control towards Green IT, intention to use Green IT behaviors and actual Green IT behavior. From the Personality theory, two variables i.e. consideration of future consequences and openness to experience were included. Empirical data was collected from 542 valid questionnaires. The results reveal that, all the variables influence the adoption of Green IT however attitude towards Green IT shows the strongest effect on intention to Green IT adoption while experience shows the weakness effect.*

**Keywords-** *Information Technology; Green IT; Adoption; Student*

## 1. INTRODUCTION

Green Information Technology (IT) refers to the environmentally perspective of IT. It is defined as the study and practice of designing, manufacturing, using, and disposing of IT equipment such as computers, servers, monitors, printers, storage devices, and networking and communications systems in a way of more efficient and effective way with no or minimal environmental impact (Dedrick, 2010).

Harmon et al. (2010) highlighted that the adoption of Green IT have increased over the years because of the increase in equipment power density, cooling requirements, energy costs, restrictions on energy supply and access, low server utilization rates, and the growing awareness of IT's impact on the environment.

In the past few years there have been studies (Lin & Ho, 2011; Molla & Abareshi, 2011; Chen et al. (2011) that examine factors influencing Green IT adoption. Many of which focused on adoption by organizations. (Eklim & Rahim, 2008; Molla & Abareshi, 201; Syzdykbayeva, 2009; Ishak & Ahmad, 2011). There are limited studies that examine factors influencing Green IT adoption at the individual level. Thus, thisstudy focusses on Green IT adoption from the individual perspectives. Hence, it addresses the following question 'What factors are influencing the behavioral intention and actual adoption of Green IT among students?' A review of the literature illustrated that there are many models that were used to measure behavioral intention such as Theory of Reason Action (TRA), Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI). This study combined the TPB model with personality traits to answer the research question. Personality traits were added as it had been said that they have an influence in Green IT adoption (Gholami et al. (2013). To the researchers knowledge the combined framework has not been tested elsewhere thus adds to the existing literature.

The paper proceeds by proving a background of the study whereby models used in behavioral studies are discussed. This is followed by the development of the hypotheses and the methodology used. The findings of the study is presented next followed by the discussion and conclusion whereby the limitation and future directions and discussed.

## 2. BACKGROUND OF STUDY

The Theory of Planned Behavior (Ajzen, 1991), an extension of the TRA, tackles the original model's limitations in dealing with behaviors over which people have incomplete volitional control. The model suggests that in addition to attitudinal and normative influence, a third element, perceived behavioral control (PBC), also influences behavioral intentions and actual behavior. Thus it can be summarized that TPB extends TRA to account for conditions in which individuals do not have full control over their behavior.

The main variables in this model are namely attitude - beliefs about the consequences of performing the behavior multiplied by his or her evaluation of these consequences (Fishbein & Ajzen, 1975), Subjective Norm - "The person's perception that most people who are important to him or her think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975) and Perceived Behavioral Control - an individual's perceived ease or difficulty of performing the particular behavior (Ajzen, 1988). Conner and Sparks, (2005) and Ajzen (2002) found that external variables to TPB Model are potential antecedents to the formation of social cognitions and have effects on behavior and intention.

In their respective aggregates, behavioral beliefs produce a favorable or unfavorable attitude toward the behavior;normative beliefs result in perceived social

pressure or subjective norm; and control beliefs give rise to PBC.

From the review of the literature, it was found that not many behavioural studies i.e. intention to use and actual use (Gholami et al. (2013) used personality traits as a factor that influences behavior. Therefore this study included two of the variables proposed by Gholami et al (2013) i.e., consideration of future consequences and openness to study intention to use and actual usage of Green IT among students. The following section discusses each construct and the development of hypothesis for each of them.

## 3. DEVELOPMENT OF HYPOTHESES

Attitude as defined by Fishbein and Ajzen (1975) as beliefs about the consequences of performing the behavior multiplied by his or her evaluation of these consequences which included either positive or negative belief of an individual about performing a specific behavior. In the context of Green IT, it measures the extent to which an individual is aware and interested about Green IT. An individual with a more positive attitude towards innovative technology is more likely to adopt such technologies and practices (Sadaf et al. (2013). Hence, the following hypothesis is proposed:

**H1: Attitude has a direct positive effect on the intention to use Green IT**

Fishbein and Ajzen (1975) suggested that subjective norm is the person's perception that most people who are important to him or her think he should or should not perform the behavior in question. Prior research has validated the effect of social norm on behavioral intention based on TRA and TPB model (Amin et al. (2007); Rocheleau, 2013; Sadaf et al. (2013). As for Malaysia's context, Amin et al (2007)'s research suggested that, subjective norm to be important construct that explains the adoption of mobile banking in Malaysia. An individual who perceive greater social pressure to practice Green IT have more positive intention towards it. Thus the following hypothesis is proposed:

**H2: Subjective norm has a direct positive effect on the intention to use Green IT**

Perceived behavioral control is defined as "an individual's perceived ease or difficulty of performing the particular behavior" (Ajzen, 1991). In other words, it is the individual's perception that he or she possessed the necessary skills, resources or opportunities to successfully perform the activity. If people are given necessary and sufficient level of actual control over the behavior, they will realize their intention when the opportunity arises (Rocheleau, 2013; Sadaf et al. (2013). The perceived individual control of events influences their intention to use Green IT. Based on the above arguments, the following hypothesis is proposed:

**H3: Perceived behavioral control has a direct positive effect on the intention to use Green IT**

Strathman, Gleicher, Boninger, and Edwards (1994) defined Consideration of Future Consequences (CFC) as reflecting ''the extent to which people considers the potential distant outcomes of their current behaviors and the extent to which they are influenced by these potential outcomes" (Strathman et al. 1994, p. 743). Strathman et al. (1994) provided an evidence of the influence of CFC on behaviors and attitudes. It showed that individuals with greater interest in the environment scoring a high CFC with less in favor of increased offshore oil drilling.

An assumption made base on the consideration of future consequences scale – there are differences in individual's decision making process on how they to consider future outcomes in deciding their present behavior; and the differences are clear and reliable. A high degree of importance being placed on the CFC will lead to a higher CFC, while risking future negative consequences in order to meet short term goals indicates a low CFC. The higher the CFC, the more likely the individual would use Green IT (Gholami et al. (2013). As such, the following hypothesis is proposed:

**H4: Consideration of future consequences has a direct positive effect on the intention to use Green IT**

Openness to Experience has been defined as "a broad dimension of personality manifested in a rich fantasy life, aesthetic sensitivity, awareness of inner feelings, need for variety in actions, intellectual curiosity, and liberal value systems" (McCrae & Costa 1986, p. 145). Individuals who are appreciative of novel ideasand new experiences, desire to explore and understand things that are unfamiliar to them, and adopting unconventional ways to solve problems and the potential for improving on the past are categorized with high Openness to Experience (Costa & McCrae, 1992; McCrae & Costa, 1997). According to Digman (1990), highly open people are those with the characteristic of intellectual curiosity, creativity, flexible thinking, and culture.

In contrast, individuals who are low on Openness to Experience are more conservative, reluctant to change and find familiar ways of doing things to reduce uncertainty (George & Zhou, 2001). They usually demonstrate lower levels of divergent thinking and this consistent with what McCrae (1987)'s found whereby Openness to Experience is associated with divergent thinking and creativity.

Individuals are different in term of the level of Openness to Experience to the use of Green IT due to the different background and life experiences (Gholami et al. (2013). Thus, the following hypothesis is proposed:

**H5: Openness to experience has a direct positive effect on the intention to use Green IT**

Previous studies have shown that behavioral intentions have positive influence on actual behavior (Rocheleau, 2013; Sadaf et al. (2013). According to Azjen (1991), intention is the immediate antecedent of behavior. As such, the following hypothesis is proposed:

**H6: Intention has a direct positive effect on actual Green IT behavior**.

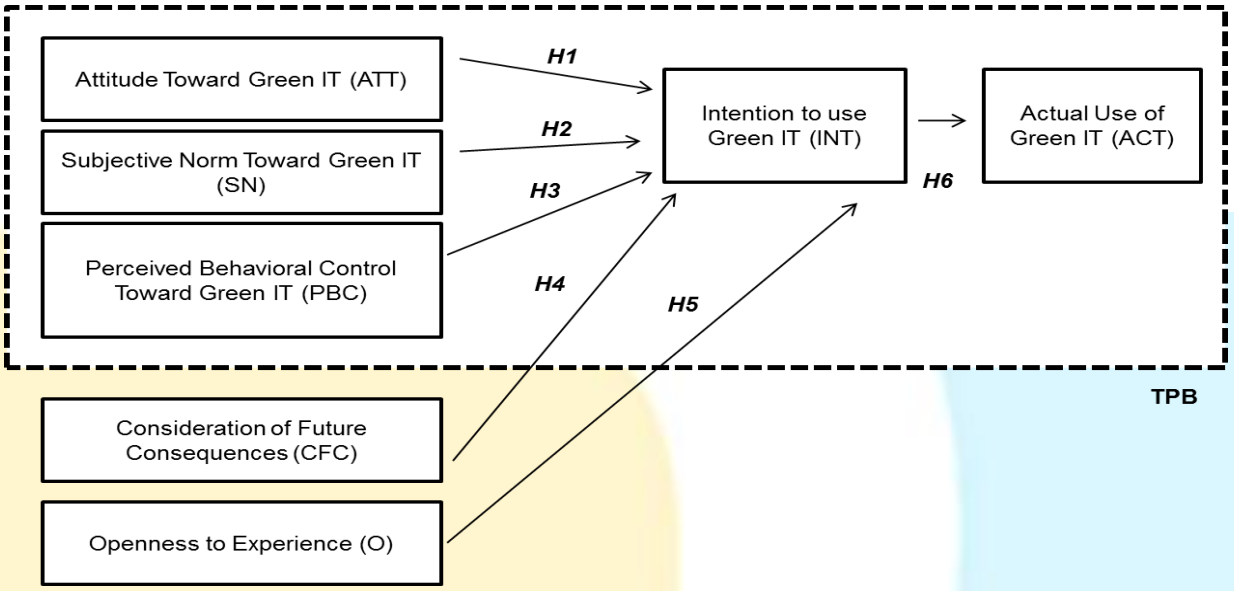


**Figure1 Summarizes the Research Model adopted for the research and the hypotheses developed.**

## 4. METHODOLOGY

The empirical data was collected via survey questionnaire. The questionnaire consists of measurement items (based on the research model) adopted from three main sources. Measurement item for Attitude (5 items), Subjective Norm (6 items), Perceived Behavioral Control (4 items), Intention to use (3 items) and Actual Usage (2 items) were adopted from Chow & Chen (2009). They adopted TPB's measurements developed by Ajzen (1991) and modified it to suit the Green IT context. The sixth variable, Consideration of Future Consequences (CFC) was assessed using the12-item scale developed and validated by Strathman, Gleicher, Boninger, and Edwards (1994). Finally, Openness to Experience was measured using Li, Tan, Teo and Tan (2006)'s four items. All items were measured using a five-point Likert-type scale with anchors from ''strongly agree'' to ''strongly disagree''. Besides the items mentioned, the respondents' demographic data such as gender, age and the program they are attending were also captured.

The questionnaires were distributed to students in the Business Faculty of a Malaysian institution of higher learning. The students were targeted primarily due the fact that they are daily IT users therefore their actions toward Green IT will be significant. Moreover, they represent the future generation, whereby Green IT adoption is more crucial them to ensure a more sustainable environment.

The questionnaires were pre-tested with a small group of selected target respondents. A pilot study was also conducted via online survey forms to Faculty's Students Group Emails to determine whether it is feasible to proceed with the main study. Only 48 students responded to the online survey. The dataset was analyzed and was found to be reliable (Conbrach alpha value more than 0.7 for all constructs).

Due to the limitation of time and resources, convenience sampling method was used. Although the questionnaires were pilot tested using online survey, the response rate is rather low. Subsequently, printed questionnaires were distributed to the Faculty's students (undergraduate and postgraduate). The questionnaires were distributed at the beginning of the class and were collected at the end of the class. A total of 800 questionnaires were distributed i.e. 300, 300 and 200 to MBA, BAcc and BBA students respectively.

After one month of data collection, six hundred and two questionnaires were collected back, however only 542 responses were used for analysis as the remainder contained incomplete responses. As mentioned earlier, the questionnaires were distributed to the Business Faculty students which consist of three programs i.e. MBA, BBA and BAcc. The valid responses consists of 34% MBA, 44% BAcc and 22% BBA students. This is reflective of the current student composition. The number of female respondents is 69% compared with male respondents, 31%. This percentage is reflective of the actual population of the Faculty's student whereby approximately seventy percent of undergraduate students are female. Since sixty six percent of the respondents were undergraduate students, the majority of the respondents are from the age range of 20-29.

### 4.1 Reliability and validity of research constructs

The dataset was subjected to the reliability test and it was found that all the variables in this study have Cronbach's alpha greater than 0.7: Attitude toward green ($\alpha = 0.887$), Subjective norm ($\alpha = 0.837$), Perceived Behavioral Control ($\alpha = 0.824$), Openness ($\alpha = 0.752$), Intention to Green IT ($\alpha = 0.867$) and Actual Behavior ($\alpha = 0.916$) which according to Hinton et al. (2004) indicates high reliability.

Only Consideration of Future Consequences has a value of 0.662, which according to Nunnally (1978) is still an acceptable level.

## 5. FINDINGS

### 5.1 Normal or Body Text Relationship between variables

The Pearson correlation coefficient was used to determine the degree of linear association of two variables. According to Hair et al. (2003), Pearson correlation coefficient (r) indicates the magnitude and direction of the association between two variables. The result in Table 1 indicated that Attitude and Subjective norm have moderate positive correlation with Intention to use Green IT i.e r=0.493 and 0.408 respectively. The correlation table also indicated moderate positive correlation with Intention to Green IT for (r=0.342). Both Openness and Consideration of Future Consequences have weak Perceived Behavioral Control positive correlation with Intention to Green IT, with r=0.265 and 0.177 respectively.

**Table 1. Correlations among constructs**

| Correlations (N=542) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **ATT** | **SN** | **PBC** | **O** | **CFC** | **INT** | **ACT** |
| **ATT** | 1 | | | | | | |
| **SN** | .468** | 1 | | | | | |
| **PBC** | .285** | .534** | 1 | | | | |
| **O** | .217** | .295** | .279** | 1 | | | |
| **CFC** | .140** | -.008 | -.011 | .094* | 1 | | |
| **INT** | .493** | .408** | .342** | .265** | .177** | 1 | |
| **ACT** | .377** | .446** | .404** | .197** | .081 | .547** | 1 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The analysis also illustrated a high correlation between Actual Use and Intention to use, moderate correlation between Actual Use and Attitude, Subjective Norm, and Perceived Behavioral Control (r= 0.377, 0.446 and 0.404 respectively) and low correlation between Actual Use with Openness (r=0.917). The results also illustrated no significant correlation between Actual Use and Consideration of Future Consequences (r=0.81, p=0.61).

### 5.2 Factors influencing Green IT adoption

Multiple regression was carried out to examine the relationship between the independent variables and dependent variable. First regression analysis was performed with Intention as the dependent variable, and Attitude, Subjective norm, Perceived Behavioral Control, Consideration of Future Consequences, Openness and Intention as predictor variables. Second regression analysis was performed with Actual Behavior as the dependent variable, and Intention as predictor variables. The adjusted $R^2$ value was 0.326 and 0.300 respectively (Table 2). Base on the 542 responses, the result showed significant outcomes: (F (5, 542) = 51.748, p< 0.05) and (F (1, 542) = 230.945, p< 0.05) as illustrated in Table 3.

All predictor variables were found to be significant as indicated in Table 4 (p< 0.05). Beta value in Table 4 also indicated that, Attitude has the highest effect on the explanation of variances of Intention (β=0.349), followed by Subjective norm (β=0.143), Perceived Behavioral Control (β=0.141), Consideration of Future Consequences (β=0.122) and Openness (β=0.097). In addition, the predictor variable, Intention was found to be significant at 0.05 (p< 0.05) as showed in Table 4. Beta value in Table 4 also indicated Beta value of 0.547 (β=0.547) in explaining variances of Actual behavior. Hence, it can be summarized that H1 to H5 were supported i.e. Attitude, Subjective Norm, Perceived Behavioral Control, Consideration of Future Consequences and Openness has a direct positive effect on the Intention to use Green IT and Intention to use Green IT in turn has a direct positive effect on actual Green IT behavior (H6 is supported).

**Table 2. Regression Analysis – Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| Regression Analysis I: Predictors – (Constant), ATT, PBC, CFC, SN, O, dependent variable INT | | | | |
| 1 | 0.571 | 0.326 | 0.319 | 0.44764 |
| Regression Analysis II: Predictors – (Constant), INT, dependent variable ACT | | | | |
| 2 | 0.547 | 0.300 | 0.298 | 0.71930 |

**Table 3. Regression Analysis – ANOVA**

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Regression Analysis I: Predictors – (Constant), ATT, PBC, CFC, SN, O, dependent variable INT** | | | | | |
| Regression | 51.847 | 5 | 10.369 | 51.748 | .000 |
| **Regression Analysis II: Predictors – (Constant), INT, dependent variable ACT** | | | | | |
| Regression | 119.490 | 1 | 119.490 | 230.945 | .000 |

**Table 4. Regression Analysis – Coefficients**

| Model | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | t | Sig. |
| **Regression Analysis I: Dependent variable INT** | | | | | |
| (Constant) | .706 | .237 | | 2.980 | .003 |
| ATT | .361 | .042 | .349 | 8.539 | .000 |
| PBC | .122 | .037 | .141 | 3.309 | .001 |
| CFC | .179 | .053 | .122 | 3.385 | .001 |
| SN | .131 | .042 | .143 | 3.096 | .002 |
| O | .091 | .036 | .097 | 2.550 | .011 |
| **Regression Analysis II: Dependent variable ACT** | | | | | |
| (Constant) | .026 | .232 | | .112 | .911 |
| INT | .866 | .057 | .547 | 15.197 | .000 |

**All hypotheses were tested and supported and this suggested that all independent variables significantly explained the dependent variable. Figure 2 summaries the results.**

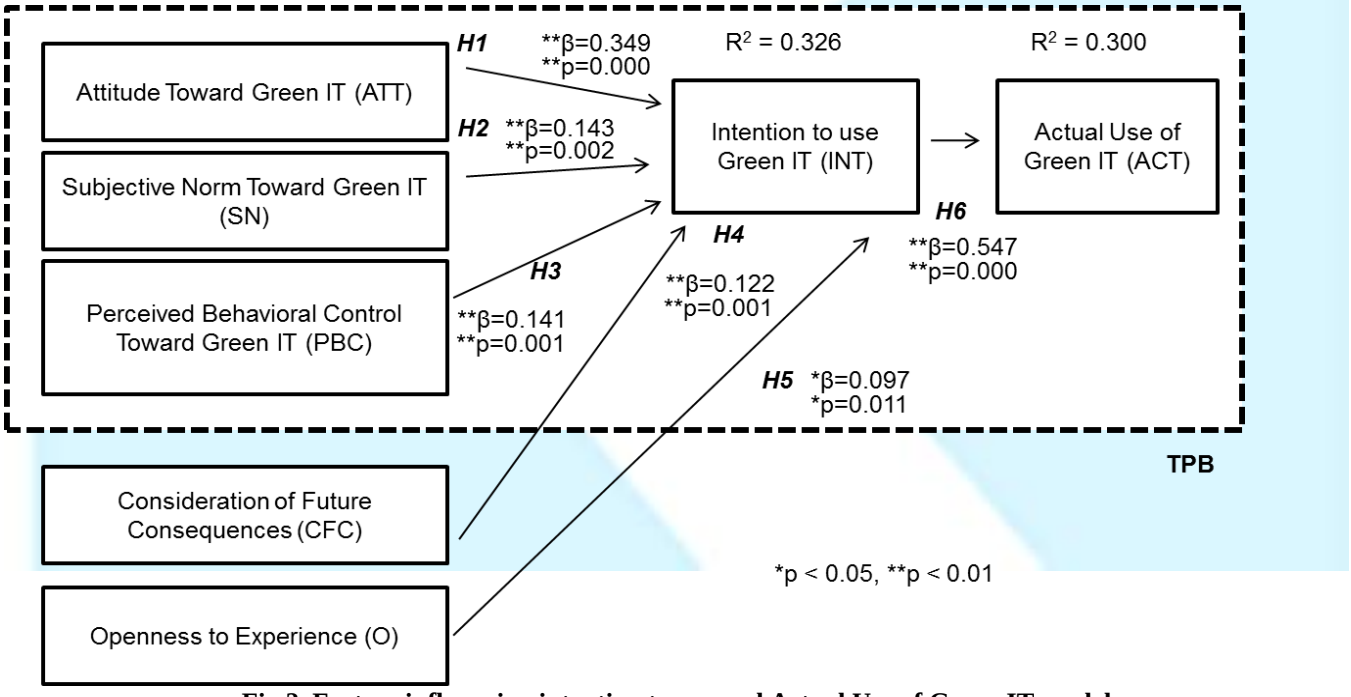


**Fig 2. Factors influencing intention to use and Actual Use of Green IT model**

## 6. DISCUSSION

Based on the analysis of the data collected, attitude appears to be the most significant factor affecting IT users' adoption intention of Green IT. This indicates the important role of attitude in Green IT acceptance
decision making by IT individual users. This signifies the importance of attitude cultivation and management in technology adoption. This finding is concurrent to the study carried out by Hamari and Koivisto (2013) and Sadaf et al. (2013).

Subjective norms have the second highest impact on the adoption intention after attitude. This indicates that, IT users are likely to place more weight on opinions of others or look at the influence of people in their social environment on his behavioral intentions. Similar results were found by Rochelau (2013) i.e. subjective norm influences intention to use. However, there are studies that found the opposite. For example, Sadaf et al. (2013) found no relationship between subjective norm and intention to use.

Perceived behavioral control appears to have less influence on behavioral intention as compared to attitude and subjective norms. This is probably due to the activities of being "Green" in IT like powering off the PC when not in use, using e-mail to minimize paper use, etc are not complicated and IT users have the high level of control in these behaviors most of the time. This finding concurs with what Sadaf et al. (2013) and Rocheleau (2013) found from their studies.

The results of this research suggests that Consideration of Future Consequences, which is one of the frequently adopted measures of individual's future perspective in social psychological research (Petrocelli, 2003; Rappange et al. (2009), is related to environmental concerns and importance of being "Green" in IT. It indicates the impact of individual consideration on the potential future outcomes of their current behavior to Green IT adoption.

Openness which refers to people's willingness to make adjustments to existing attitudes and behaviors once they have been exposed to new ideas or situations (Digman, 1990), is also been found impacting the adoption intention in this research. Openness is the lowest items in term of influencing level in this research. Gholami et al. (2013) also found that CFC and openness are enablers to Green IT adoption among senior managers.

In addition, from Figure 2, it can also be seen that Intention to use do influence actual usage. This occurrence was also illustrated by Sadaf et al. (2013) and Rocheleau (2013). Therefore it can be summarized that Intention to use Green IT among the students eventually lead to actual usage of Green IT among them.

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## 7. CONCLUSION

Many previous studies on behavior (i.e. intention to use and actual use) apply one adoption model or theory as their research model. Many have used TAM (Lopez, 2013), TRA (Conner & Spark, 2005), DOI (Gruber & Koutroumpis, 2013) and UTAUT2 (Murugesh-Warren et al. (2013) in their studies. This study however incorporated TPB with personality traits as a research model to study Green IT intention to use and the actual use.

The dataset obtained from 542 students revealed several findings. The TPB factors i.e. attitude, subjective norms and perceived behavioral control have a significant influence on intention to use Green IT.

The study also found that consideration of future consequences has a direct positive effect on the intention to use Green IT. Likewise, it was also illustrated that Openness to experience also have an impact on intention to use Green IT, however it is less significant as compared to other factors in the research model, nevertheless its importance cannot be ignored. Finally the study have also illustrated that intention to use has a direct effect on actual use of Green IT among the students.

As with any other study, this study also has its limitations. First, empirical data was collected from Malaysian students in one institution of higher learning, thus generalization may be limited. Second, the respondents may have difficulties rating his behavior accurately as the Green IT concept is still relatively new to them. Perhaps if asked within the next couple of years their answers may change as Green IT becomes more established.

Despite the limitation the study makes an original contribution by combining personality traits with Theory of Planned Behavior to study the factors that influence Green IT adoption. The research model developed in this study can be used by other researchers in future adoption studies of different segments of the population.

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