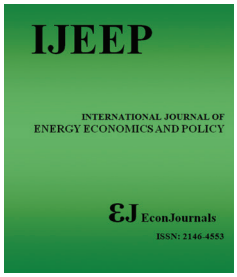

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Analysis of Energy Conservation Behavior at the Kuwaiti Academic Buildings

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ABSTRACT

Understanding user's behavior in buildings is crucial since user behavior significantly contributes to the overall building's energy consumption. Therefore, this study aims to identify a user's pro-environmental behavior, in particular, the energy conservation behavior (ECB) of university users in Kuwait. For this reason, this study creates a model whereby two variables, namely, environmental knowledge and awareness of consequences, are introduced and incorporated into the existing theory of planned behavior (TPB). The research data is acquired through questionnaires in keeping with Kuwait's social norms and culture. The extended TPB model is tested using numerical analysis problems in partial least square structural equation modeling (PLS-SEM) to investigate the following variables: energy conservation behavior, intention, subjective norm, attitude, perceived behavioral control, environmental knowledge, and awareness. Results show the indirect effects of the two above mentioned variables on conservation behavior. The results also reveal that societal pressure and cultures significantly affect the users' intention to engage in energy conservation behavior. The outcomes of this research suggest that there is a need to encourage energy conservation behavior changes in Kuwaiti academics' buildings by supporting the antecedents, as well as eliminating barriers to pro-environmental actions.

Keywords: Energy Conservation, Environmental Behavior, Higher Educational Institutes, Partial Least Square Structural Equation Modelling, Theory of Planned Behavior
JEL Classifications: Q49, P36, I230, Z130

1. INTRODUCTION

Kuwait vision 2035 encourages the implementation of a sustainable energy transition. This is why higher educational institutes (HEIs) should be held responsible for promoting the sustainable development associated with achieving these national transition goals. HEIs are influential institutions that benefit society to diffuse and apply sustainability practices, especially in the Kuwaiti community. Accordingly, an observation of users' behaviors in HEI buildings is a pathway towards identifying factors that drive and hinder their energy-environment motivations. These factors are fundamental in achieving environmental sustainability (Ashouri et al., 2019; Kollmuss and Agyeman, 2002; Steg and Vlek, 2009; Zhang et al., 2020). This is mainly because an inter-connected nature amongst HEI building users from staffs in all duties and capacities to students is highly contributory to an increase in energy intensity.

There is also an increasing focus on improving the pro-environmental behaviors (PEBs) i.e. the behaviors of individuals and organizations in decreasing their impacts on the environment, which have been defined as "*behaviors that consciously seeks to minimize the negative impact of one's actions on the natural and built world*" (Kollmuss and Agyeman, 2002). PEB takes many forms, for example, energy conservation, recycling (Mtutu and Thondhlana, 2016; Oliver et al., 2019) and energy consumption (Kaiser, 2006; Wang et al., 2014; de Leeuw et al., 2015; Tan et al., 2017; Obaidellah et al., 2019). The user behavior in

buildings has a substantial role in the total building's energy usage (Darby, 2006; Gilani et al., 2018; Guerra et al., 2009; Hong et al., 2016). For this reason, all the members of the university (from staffs to students) should be encouraged to adopt PEB to achieve an environmentally sustainable future.

The first step towards encouraging PEB is identifying major related factors that influence the users' PEB, as well as decisions promoting and constraining PEB (Kollmuss and Agyeman, 2002; Steg and Vlek, 2009). The following step is studying the users' energy consumption behaviors as they are the key to improving their PEB, more specifically for this study, the energy saving in Kuwait's academic buildings. This study is to understand the users' power-related PEB in terms of why some individuals adopt these behaviors and why in contrast, others reject them, which in turn, assists in finding a way to encourage the latter to follow the first (Mobley et al., 2010; Geiger et al., 2019).

Several authors within the PEB field put forward the notion that environmental knowledge and awareness affect the user's willingness to contribute to PEB (Özden, 2008; Steg et al., 2014; Safari et al., 2018; Dharmesti et al., 2020). Prior literature shows that that university users are inclined to be positively affected by the perceived environmental knowledge based on their adopted attitudes and engagement in PEBs (Asunta, 2003; Duerden and Witt, 2010; Harring and Jagers, 2018). Similarly, the role of environmental knowledge in promoting PEB is substantial among educators due to this knowledge's natures as intellectual stimulation and as a source of motivation (Ekborg, 2003; Goldman et al., 2014; Yavetz et al., 2014). (Ones and Dilchert, 2013) also discovered that high-level environmental knowledge is an antecedent of employees' PEBs intention within an organization. Those who have in-depth environment knowledge have higher probabilities in performing energy-saving behaviors in the workplace (Wiernik et al., 2018).

Moreover, the findings revealed that environmental awareness and environmental knowledge had been tested in the context of emerging and advanced nations in Europe (Ekborg, 2003), Asia (Ahamad and Ariffin, 2018; Safari et al., 2018), Africa (Mtutu and Thondhlana, 2016) and the USA (de Leeuw et al., 2015). In the case of emerging countries (Sudarmadi et al., 2001), the status of environmental education and awareness of different social groups in Indonesia was correlated to the enhancement of an individuals' likelihood to participate in PEBs.

Another study was done by (Vicente-Molina et al., 2013) in the case of emerging and advanced nations, namely, Mexico, United States, Spain and Brazil have shown the importance of environmental knowledge in improving users' engagement in PEBs. Overall, the findings revealed that environmental awareness and environmental knowledge were a crucial predictor of PEBs in all of the countries studied, additionally the influence of university education on pro-environmental behaviors (Bamberg and Möser, 2007; Bergman, 2016). As others have highlighted the need for HEIs to facilitate and promote education, research and training on the subject of PEB (Blanco-Portela et al., 2017; Cortese, 2003; Green, 2013).

Despite all the mentioned, little research and data had emerged about the PEB-related study focusing on energy conservation behavior (ECB) at the academic building in the existing studies within Kuwait. Many related works presented in the Kuwait Research has focused on residential buildings sector energy's consumption (Khan et al., 2019) and the behavior of households (Jaffar et al., 2018; Jaffar et al., 2019).

Due to the awareness of the missing information, this research intends to explore one of the key elements in PEB, namely, energy conservation in the context of HEI users, and specifically within Kuwait. Even though, most of the recent studies of HEI PEBs have been focusing on explaining the students related to their PEBs or the employees' to their PEBs. This research mainly focuses on all the members of the university from staffs to students (the users') energy-related PEB. In addition to this, this research seeks to slow explain the late adoption of ECB by Australian College of Kuwait (ACK) users aimed to understand the users' attitudes and behaviors. In addition to examine the mentioned factors, this research helps to understand the driver's user's ECB.

Finally, The research outcomes can also help to provide a useful reference to develop appropriate policy strategies in the context of HEI users that could assist in finding a way to encourage behavior change in the current Kuwaiti environment and reduce a nation's environmental impacts.

2. RESEARCH FRAMEWORK

This study has succeeded in generating a report on the energy-conservation behavior and its determinants at the Kuwaiti HEI buildings. The paper proceeds with a literature review presenting a summary of the theory of planned behavior (TPB) and indicators adapted from previous studies such as environmental knowledge and awareness. The report shows how specific environmental knowledge has influenced ECB among the Kuwaiti HEI buildings. Based on researches reviewed, a study concept and the advanced model development modification of the TPB, as well as hypothesis testing, are proposed. Following an overview of the methodology. First, a survey was conducted on all users, staffs and students alike, inside the ACK in order to gain an insight into their subjective norms, attitudes, perceived control, and intentions to increase in the conservation behavior at the campus. Then, this study employs the numerical procedure in structural equation modelling Partial Least Squares PLS-SEM tool for stable and reliable results. The findings and discussions are presented.

2.1. The TPB

Theory of planned behavior (TPB), by Icek Ajzen is One of those widely accepted theories is the outlined and is beneficial for predicting of human's pro-environmental behavior. This theory states that the behavioral intention is the most important factors that predict behavior. This behavioral intention is driven by three variables, which are attitudes, subjective norms and perceived behavioral (Ajzen, 1985; 1991; 2011).

The theoretical research model used to explore PEB in university users from a Kuwait higher education context identifies the

factors that influence user's behavior, their perception of energy conservation, and attitudes towards various intensive energy consuming behavior. TBP has been extended by including environmental knowledge and awareness of consequences as possible predictors and mediators. All constructs to extend the theory of planned behavior indicators inspired from previous studies (Wang et al., 2014; Tan et al., 2017).

The TPB literature review investigated in given context of the current study:

2.1.1. Attitude

In this study, attitude is defined as users' negative or positive emotions or beliefs regarding conserving energy consumption at the university. Several studies indicated that pro-environmental attitudes possess a strong influence on pro-environmental behavior. (Wells et al., 2016) presented that attitude impacts the environmental behavior of tourism sector employees at home and work. Another study by (Bergman, 2016) showed that attitude positively impacts the sustainable consumption of university students. In a different research, (Cotton et al., 2016) found that there is no difference between the UK and Portugal university students environmental behaviors, and that attitudes have positive effect on environmental behaviors. In a different research done by (Martinsson et al., 2011), it was found that attitude is significant for the environmental behaviors of Swedish households. These studies further demonstrate the impact on pro-environmental behavior.

2.1.2. Subjective norms

Based on (Ajzen and Fishbein, 2005) subjective norms is defined as social pressure in terms of involving or not in a specific behavior. In this research, it is considered as users' perceptions of critical university management as well as colleagues' and friends' expectations for them to conserve energy in this research. The intention in pro-environmental behavior is associated with the determinants of TPB, which is nested in social and cultural layers. Subjective norms play an essential part in changing energy consumption behavior and participation in energy-saving activities. (Midden and Ritsema, 1983) indicated that subjective norms have an influence on ECB. (Thøgersen and Grønhøj, 2010) showed that ECB is affected by the perception of family members. (Steg et al., 2014; Wang et al., 2014) concluded that societal values impact the level of importance given to energy behaviors by individuals. Also, (de Leeuw et al., 2015) proved that subjective norms contributed to the variance in intentions to show pro-environmental behaviors. Similarly, (Lee and Tanusia, 2016) studied and concluded that subjective norms possess positive impact on the intentions of university students. Subjective norms were explicitly developed for Kuwait's academics building by considering the research nature and local context of Kuwait's inhabitant's societal values.

2.1.3. Perceived behavioral control (PBC)

(Thøgersen and Grønhøj, 2010) defined PBC as perception of ease or difficulty of conserving-energy. PBC has been explained widely in the literature. (Chan, 1998) concluded that perceived control, subjective norm, and attitude form 44% of intention variance. (de Leeuw et al., 2015) highlighted the significant impact of PEB on intention and behavior. (Obaidellah et al., 2019) noted that PBC is significantly related to the intention of university users.

2.1.4. Intention

According to the TPB, intention ultimately guides the performance of the behavior. this behavioral intention is determined by attitudes, subjective norms and perceived behavioral (Ajzen, 1985; 1991; 2011).

Following (Ajzen and Fishbein 1980) contended that TPB would also include external variables as mediators of behavior. The TPB has been extended by adding environmental knowledge and awareness of consequences into the model (Echegaray and Hansstein, 2017).

2.1.5. Environmental knowledge

Environmental knowledge (EK) is defined as the level of information that helps individuals understand environmental issues and get familiar with its impact on society and the environment (Mostafa, 2007). In this study, it is decided to include EK in our model. In the literature, there are many pieces of evidence of the strong positive influence on environmental intention and PEBs (Bamberg and Möser, 2007; Halkos and Matsiori, 2017; Hines et al., 1987; Pothitou et al., 2016; Taufique et al., 2017). Many studies had claimed that individuals having EK such as GHG emissions, knowledge about energy-saving behaviors, and environmental values are more likely to perform actions in environment-friendly action issues enhances (Kaiser and Shimoda, 1999; Kaiser and Fuhrer, 2003; Frick et al., 2004). (Levine and Strube, 2012) confirmed that attitudes and PEB indirectly affected by the knowledge about energy and environmental concerns. Analyses by (Pothitou et al., 2016) found that attitudes highly correlated with EK and knowledge about energy-saving behaviors. Another study by (Lorenzoni et al., 2007) proved that a lack of knowledge and the confusion created by conflicting information are existing barriers of PEB.

2.1.6. Awareness of consequences

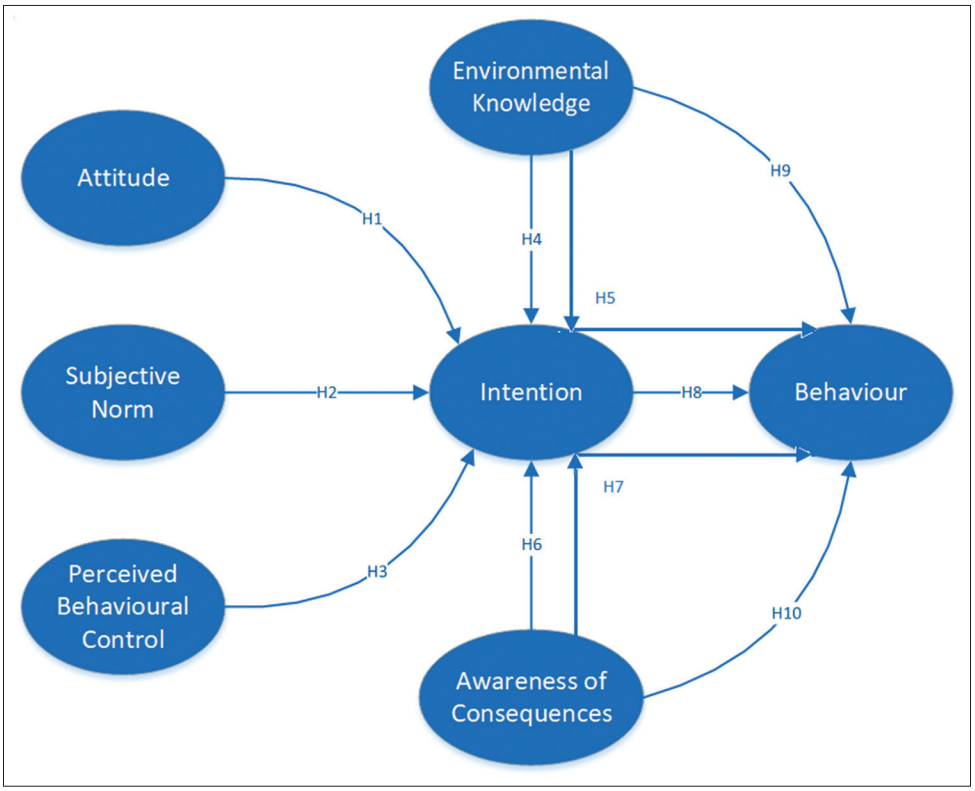
In this study, we focus on knowledge of consequences as defined by (de Groot and Steg, 2008), "*whether someone is aware of the negative consequences for others or for other things one values when not acting pro-socially*." Within the PEB literature (Abrahamse and Steg, 2009; de Groot and Steg, 2008; Hansla et al., 2008a; 2008b; Steg et al., 2014), knowledge about consequences is a crucial factor as a determinant for intentions to perform pro-environmental actions. When people have an awareness of the consequences of their harmful behaviors, they are more willing to contribute to PEB (Özden, 2008; Vicente-Molina et al., 2013; Steg et al., 2014; Bergman, 2016; Liobikienė and Juknys, 2016; Safari et al., 2018). Contrariwise, if people are not conscious of the consequences of their harmful behaviors, of energy consumption specifically, they are less inclined to contribute to PEB.

2.2. Conceptual Model and Hypotheses

2.2.1. Conceptual model

In the following sections, the extension model of the TPB and hypotheses are described, as shown in Figure 1. Knowledge was used as an indicator of behavioral intentions for exploring ECB.

Figure 1: An expanded theory of planned behavior model to map the relationships between the users' energy beliefs, attitudes, behaviors and their environmental knowledge



2.2.2. Hypotheses

From the TPB theory and current literature, the following hypotheses were formulated regarding users' energy behaviors in Kuwait's higher educational institutions:

- H_1: Attitude toward conserve energy has a positive influence on users' intention to conserve energy
- H_2: Subjective norms have a positive influence on user's intention to conserve energy
- H_3: Perceived behavioral control influence the intention to conserve energy at university
- H_4: Environmental knowledge influence the intention of user's energy conservation behaviors (ECBs)
- H_5: Intention mediates between environmental knowledge and user's ECBs
- H_6: Awareness of consequences has a significant influence on user's intention to conserve energy
- H_7: Intention mediates between awareness of consequences and user's ECBs
- H_8: The intention to conserve energy predicts user's ECBs
- H_9: Environmental knowledge will influence the actual user's ECBs
- H_{10}: Awareness of consequences will influence actual user's ECBs.

3. RESEARCH METHOD

3.1. Questionnaire

The questionnaire surveys conducted over three stages: pilot questionnaire surveys, pretest of the questionnaire surveys, and the main questionnaire surveys for behavioral intention towards user's ECB.

3.1.1. Pilot study

The pilot study was applied by examining 13 faculty members from Kuwait with different backgrounds and 25 diploma and bachelor's degree ACK students. Participants responded to the survey was 92% of faculty members and students.

The pilot study participant feedback used to evaluate the clarity of the items. Consequently, changes were made including some minor changes such as clarifications in wording, restructuring the survey, reduction of redundant questions, and shorten the questionnaire. The pilot study outcomes were evaluated for their validity and reliability.

3.1.2. Pretest

The pretesting has been conducted to determine the strengths and weaknesses of the survey by eliminating any possible inaccurately items addressed with the survey. Moreover, to evaluate the qualities of all variables that produce reliable data of the TPB constructs.

3.1.3. Questionnaire

The survey used some questions from previously published surveys with minor modifications adapted from (Ajzen, 1991; Ajzen and Fishbein, 2005; de Leeuw et al., 2015; Macoevi, 2015; Frick et al., 2004; Steg et al., 2014). Modifications were made to the survey question to optimize its validity for the Kuwaiti context.

Survey was conducted in February 2020 at ACK. The final survey included a total of 52 questions divided into seven sections about knowledge, awareness of consequences, attitude, PBC, social norms, intention and ECBs. The participants guarantee

confidentiality and anonymity to provide honest answers to all questions.

A five-point Likert scale from strongly disagree to strongly agree was used for all the variables. Shuffled across domains for all items is considered to ensure the validity of the responses. A summary of the factors, definition, items is shown in Table 1.

3.2. Statistical Analysis

3.2.1. Structural equation modeling (SEM)

Partial least squares (PLS) approach used in this study. The reasons behind choosing PLS: first, it is increasingly being applied to many fields of research, for instance, behavioral sciences (do Valle and Assaker, 2016; Hair et al., 2012; Nitzl et al., 2016). Second, when it is compared to other SEM techniques, PLS-SEM allows estimating a complex model with many indicator variables and constructs (Sarstedt et al., 2017; Hair et al., 2019). Third, it allows testing multiple relationships between latent construct involving mediating and moderating factors and accounts for measurement errors along with hierarchical constructs (Astrachan et al., 2014; Sarstedt et al., 2017). Fourth, the PLS-SEM has no assumption about a large sample size of the data, or the independence of observations (Rigdon, 2016).

PLS technique was applied to examine the proposed model presented in Figure 1. It includes two steps: The first step is reliability and validity tests, which were assessed by measuring outer-model. The second step is inner-model, which is measured to test the influence of independent variables on the dependent variable (Hair et al., 2017).

3.2.2. Data analysis

Both SPSS 25.0 and the partial least square structural equation modeling (PLS-SEM) used to processes The Data collected from the questionnaires.

3.2.2.1. Sample size

Minimal requirements on sample size is required since a small sample would lead to the inaccurate use of PLS-SEM. To avoid small sample size problems, this work sample size is 245. This number is higher than the minimum requirement of (Hair et al., 2017), power tables. The study sample also satisfies the (Kock and Hadaya, 2018) rule of the minimum required sample size.

3.2.2.2. Characteristics of the sample

The demographic data is shown below in Table 2.

3.2.3. PLS-SEM analysis

The data obtained in this study is analysed following the procedure recommended by (Hair et al., 2014; Sarstedt et al., 2017).

3.2.3.1. Measurement model evaluation

- Validity and reliability analysis

Multiple indicators measured each item latent variables in the model, and all of the measures were eventually checked for validity and reliability. The measurement model reliability evaluation is based on indicators reliability internal consistency (Cronbach's alpha), and combined reliability (CR). Discriminant validity and convergent validity were used in order to test the indicators of each construct measure. Furthermore, the discriminant validity of the latent constructs according to cross-loadings and Fornell–Larcker criterion is assessed. Finally, common method bias is assessed by checking variance inflation factors (VIFs).

- Cronbach's α

As a criterion for precision, α coefficient is used as the judgment standard to measure the consistency between the variables in the same dimensions and the overall consistency of the measurement scale to test the reliability of the questionnaire as shown in Table 3. After the reliability test is performed, this study carries out an item trimming process for items with weak values. Accordingly, some of the items have been adjusted, and some other have been removed from the questionnaire for the reliability test results. These results led to questionnaire results with constructs that have only strong items. These findings helped to reduce the questionnaire length and improved the overall α from 0.817 to 0.922. When α of the item is higher than 0.7, it indicates that the reliability of the variable data is adequate. When α values for items ranged from 0.708 to 0.863, the results indicated the satisfactory level of with a median of 0.87.

- Composite reliability (CR) and average variance extracted (AVE)

Furthermore, single variable reliability was computed based on the standardized loadings. As advised by (Hair et al., 2019), if standardized factor loading of all the items were above 0.7, the results to be seen as acceptable. On the other hand, working with a constant of less than 0.7 should be removed. As shown in Table 3, the threshold value that is adequate for the loading was 0.7. The factor values of the items of this study range between 0.708 and 0.863. Results showed evidence of unidimensionality and all the survey statements were significantly associated with their constructs.

Assessing consistency evaluation, the reliability for constructs using both α and CR. As advise by (Bagozzi and Yi, 2012), composite the reliability of the underlying constructs values exceeds the recommended values of 0.70. As shown in Table 3, the CR value of the items ranged between 0.803 and 0.933 which revealed strong reliability.

- Convergent validity

Convergent validity is demonstrating a correlation between the two measures; precisely, it measure correlation level of variable items the same construct (Hair et al., 2014). For this study work, convergent validity was assessed the most widely known and used tool for this purpose by following (Fornell and Larcker, 1981). Fornell-Larcker convergent validity can be determined by factor loading, the construct reliability value (CR and α), and the average variance extracted (AVE). The values of indicator loadings and the construct reliability value should be more than the minimum threshold of 0.7. Also, the values of the average variance calculated should be more than the critical value of 0.5 for each construct.

Factor loading value and combined reliability for all items are in the interval above 0.7 as shown in Table 3. The values of

Table 1: Summary of factors, items, and referenced literature

Factors	Items	Referenced literature
Attitudes (A)	• I think saving energy at the university would be easy for me • I believe it is easy to conserve energy • I believe energy conservation should be a university priority • I think energy conservation is the university responsibility, not my responsibility • I think that people should conserve energy	(Ajzen and Fishbein 2005; Ajzen 1991; Van den Berg 2007; de Leeuw et al. 2015; Macoevi, 2015; Thondhlana and Hlatshwayo (2018)
Subjective norms (SN)	• People who are important to me think I should reduce energy consumption for saving Kuwait environment • The social vibe encourages me to reduce energy consumption for saving Kuwait environment • The top university management does not encourage me to reduce energy consumption for saving Kuwait environment • Most people who are important to me take steps to reduce energy consumption for saving Kuwait environment • Most people who are important to me support my effort to reduce energy consumption for saving Kuwait environment	(Ajzen, 1991; Ajzen and Fishbein, 2005; Clement et al., 2014; de Leeuw et al., 2015; Macovei, 2015)
Perceived behavioral control (PBC)	• I have enough environmental knowledge for discriminating between responsible and harmful behavior • I have the needed willpower and understanding to reduce energy consumption • I have the resources, time, and opportunity to conserve energy at my university • My personal contribution is very important to reduce energy consumption at my university • I believe that I am responsible for reducing energy for Kuwait's environmental protection	(Ajzen and Fishbein 2005; Ajzen 1991; de Leeuw et al., 2015; Macovei, 2015)
Intention (I)	• I am willing to pay more attention to my energy consumption at my university if top university management showed interest • I would engage in energy conservation if I knew the environmental benefit of my action • I would engage in energy conservation if others were also doing it • I will conserve energy even if it is less comfortable to protect the Kuwait environment • I am willing to engage in energy conservation for Kuwait environmental protection	(Ajzen and Fishbein 2005; Ajzen 2006; Steg and Vlek 2009)
Environmental knowledge (EK)	• I know more about energy conservation than the average person does • I understand the environmental phrases and symbols • I am very knowledgeable about environmental issues • I know that energy conservation helps reduce global warming • I am very knowledgeable about efficient energy use	(Dunlap et al., 2002; Frick et al., 2004; DeWaters and Powers, 2011)
Awareness of consequences (AWC)	• I am aware of the importance of energy conservation toward the future of the environment • I am concerned about human behavior, and it's a huge environmental impact • I am concerned about massive energy consumption and its consequences on Kuwait • I am concerned about air pollution in Kuwait and its consequences • I am concerned about my behavior in relationship with environmental impact	(Sudarmadi et al., 2001; Harland et al., 2007; Steg et al., 2014)
Energy conservation behavior (ECB)	• I turn off lights in common area rooms when I am the last person to leave • I unplug chargers and other small electronic devices when not in use • I avoid printing hard copy versions of documents and prefer electronic communication • I inform the Building Energy Management System if my office or area seems unusually cold or hot, or I have trouble regulating the temperature • I use the stairs rather than the lifts	(de Leeuw et al., 2015; Markowitz et al., 2012; Macoevi, 2015)

AVE are more than the critical value of 0.5, which suggests that the survey had sufficient convergent validity. These values indicate good convergent validity and the internal consistency of the measurement model.

- Discriminant validity

Discriminant validity indicates the level of how much the latent variable is differentiated from other variables. The assessment of the discriminant validity carried out through cross-loading of

indicators, Fornell-Larcker criterion, and the Heterotrait-monotrait (HTMT) ratio of correlation.

The Cross loadings indicators are tested for measuring the discriminant validity. By looking at the cross-loading, the factor loading indicators construct shall not show equivalent variance as any of the different constructs that are more than its AVE-value with the condition that the threshold value of factor loading is higher than 0.70. Often, the AVE used to quantify the measurement error of indicator variable, which should be with an amount larger than 0.5. Nevertheless, for the discriminant validity justification, the AVE values should be higher than the values of latent variables this shown in Table 4.

Table 2: Demographic data of respondents

Gender	Percentage	Frequency
Male	(48.1)	188
Female	(51.9)	203
Position at ACK		
Faculty	(17.9)	70
Staff	(29.9)	117
Student	(52.2)	204

The second discriminant validity testing used the Fornell-Larcker testing system and Heterotrait-Monotrait (HTMT) ratio. The discriminant validity assessment has been tested using the HTMT ratio of correlations to overcome situations lack discriminant validity.

Table 5 shows the Fornell-Larcker criterion test of the model. As shown in the table, it can be noted that the square root of the average variance extracted for each variable cross-loading values are less than the outer loadings values, which suggest a good discriminant validity (Henseler et al., 2015). This confirms the sufficient discriminant validity of the study measurement model, and the structural model was assessed with confidence.

According to (Richter et al., 2016) and (Henseler et al., 2015) suggest using a value of 0.9 as the threshold, as indictors for a lack of discriminant validity. This study concludes that a lack of discriminant validity is not evident, and all of the constructs are satisfactory.

3.2.3.2. Structural model

The SEM-PLS the process and steps used to test the inner structural model in the present study. This procedure includes analyzing predictive relevance of the model (Q^2), goodness-of-fit (GOF), coefficient of determination (R^2), and path

Table 3: Reliability and validity measure of correlations, AVE, and reliability coefficients

Factor	Survey items	Standardized loadings	Cronbach's alpha	CR	AVE
Attitude	A1	0.831	0.816	0.803	0.845
	A2	0.839			
	A3	0.863			
	A4	0.829			
	A5	0.833			
Subjective norm	SN1	0.805	0.825	0.846	0.867
	SN2	0.708			
	SN3	0.800			
	SN4	0.784			
	SN5	0.748			
Perceived behavioral control	PBC1	0.720	0.887	0.890	0.866
	PBC2	0.810			
	PBC3	0.769			
	PBC4	0.859			
	PBC5	0.837			
Awareness of consequences	AW1	0.872	0.813	0.899	0.821
	AW2	0.781			
	AW3	0.709			
	AW4	0.739			
	AW5	0.845			
Environmental knowledge	EK1	0.789	0.873	0.907	0.845
	EK2	0.791			
	EK3	0.819			
	EK4	0.807			
	EK5	0.859			
Intention	I1	0.837	0.902	0.933	0.903
	I2	0.810			
	I3	0.859			
	I4	0.769			
	I5	0.859			
Energy conservation behaviors	ECB1	0.805	0.900	0.907	0.876
	ECB2	0.708			
	ECB3	0.800			
	ECB4	0.784			
	ECB5	0.748			

AVE: Average variance extracted

Table 4: Cross-loadings of variables

Items	Environmental knowledge	Awareness of consequences	Attitude	Subjective norms	Perceived behavioral control	Intention	Behavior
EK1	0.739	0.158	0.151	0.185	0.183	0.395	0.151
EK2	0.778	0.203	0.152	0.142	0.179	0.418	0.179
EK3	0.760	0.209	0.154	0.199	0.165	0.462	0.173
EK4	0.831	0.226	0.233	0.179	0.182	0.465	0.205
EK5	0.839	0.244	0.182	0.227	0.237	0.419	0.214
AW1	0.236	0.749	0.433	0.235	0.177	0.159	0.151
AW2	0.195	0.784	0.421	0.236	0.220	0.186	0.237
AW3	0.166	0.708	0.388	0.195	0.229	0.184	0.233
AW4	0.193	0.800	0.454	0.215	0.203	0.214	0.180
AW5	0.155	0.748	0.419	0.249	0.237	0.215	0.213
A1	0.213	0.205	0.747	0.210	0.233	0.404	0.205
A2	0.196	0.151	0.794	0.186	0.196	0.417	0.236
A3	0.190	0.179	0.769	0.253	0.234	0.405	0.123
A4	0.203	0.173	0.778	0.189	0.142	0.387	0.234
A5	0.206	0.205	0.843	0.181	0.234	0.452	0.214
SN1	0.237	0.214	0.268	0.837	0.391	0.214	0.198
SN2	0.239	0.198	0.171	0.720	0.500	0.206	0.233
SN3	0.150	0.233	0.202	0.810	0.417	0.226	0.108
SN4	0.137	0.108	0.218	0.769	0.394	0.175	0.187
SN5	0.211	0.210	0.237	0.859	0.472	0.221	0.180
PEC1	0.522	0.520	0.502	0.509	0.859	0.491	0.213
PEC2	0.476	0.471	0.517	0.503	0.789	0.488	0.205
PEC3	0.405	0.380	0.414	0.399	0.791	0.394	0.236
PEC4	0.417	0.410	0.418	0.391	0.819	0.419	0.173
PEC5	0.405	0.358	0.405	0.422	0.807	0.427	0.142
I1	0.214	0.193	0.235	0.187	0.173	0.739	0.402
I2	0.206	0.186	0.215	0.180	0.246	0.872	0.452
I3	0.226	0.246	0.218	0.213	0.215	0.781	0.516
I4	0.175	0.097	0.161	0.205	0.175	0.845	0.378
I5	0.221	0.246	0.223	0.236	0.238	0.709	0.487
ECB1	0.196	0.144	0.252	0.123	0.147	0.355	0.715
ECB2	0.151	0.190	0.253	0.234	0.179	0.405	0.769
ECB3	0.217	0.213	0.231	0.233	0.205	0.404	0.843
ECB4	0.173	0.181	0.210	0.206	0.234	0.452	0.747
ECB5	0.186	0.189	0.205	0.203	0.236	0.387	0.794

Table 5: Measurement results of discriminant validity

Fornell-larcker criterion	EK	AWC	ATT	SN	PBC	I	ECB
EK	0.818						
AWC	0.223	0.761					
ATT	0.258	0.243	0.746				
SN	0.492	0.324	0.266	0.810			
PBC	0.260	0.287	0.242	0.572	0.833		
I	0.680	0.555	0.265	0.526	0.547	0.809	
ECB	0.598	0.560	0.258	0.233	0.290	0.524	0.783
Heterotrait-monotrait ratio (HTMT)	**EK**	**AWC**	**ATT**	**SN**	**PBC**	**I**	**ECB**
EK	-						
AWC	0.223	-					
ATT	0.492	0.524	-				
SN	0.258	0.324	0.266	-			
PBC	0.260	0.287	0.242	0.572	-		
I	0.561	0.555	0.265	0.526	0.547	-	
ECB	0.215	0.519	0.304	0.395	0.290	0.243	-

coefficients (β value). Besides, it is used for determining the significance of path coefficient bootstrapping procedure applied to examine the significance of path coefficients as recommended (Sarstedt et al., 2017) employing the (Streukens and Leroi-Werelds, 2016) recommendation for a sample size typically about 5000 to boost the level of accuracy.

- Predictive relevance of the model (Q^2)

Predictive relevance of the considered model to evaluate the structural model predictive ability produced by using cross-validated redundancy for the model's endogenous variables using a blindfolding technique (Hair et al., 2014). The Q^2 values measured were found all positive ranging from 0.458 to 0.531, which is higher

than the limit and implies that the path model has a capability to be predictive for the endogenous construct (Hair et al., 2014).

- Coefficient of determination (R^2)

The coefficients of determination R^2 was obtained to examines how differences in the construct which can be explained by the predictor variable. Literature indicates that the minimum threshold level of R^2 value as 0.10 (Hair et al., 2016). The modelled constructs explain a moderate amount of all endogenous latent variables of 64.9% variance of intention, and ECB (59.0%).

- Effect size (f^2)

Cohen's f^2 is a standardized test of the effect size. It is very informative as it allows the evaluation of local effect size. According to Cohen's guidelines, $f^2 \geq 0.02$ indicate small effect size, $f^2 \geq 0.15$ indicate medium effect size, and $f^2 \geq 0.35$, indicate large effect size. The effect sizes based on the calculated coefficients of determination came out to be 0.53 and 0.73, respectively.

- Goodness-of-Fit (GOF)

In this study, to overcome a lack or absence of a most effective common fit, indices in partial least square (PLS) are compared to the linear structural relations (LISRE) analyzed with AMOS technique in CB-SEM. The global goodness of fit (GOF) statistic for this study model was examined using (1) (Tenenhaus et al., 2005).

$$GOF = \sqrt{AVE} \times R^2 \quad (1)$$

Following (Wetzels et al., 2009), the GOF criteria of small: 0.1, medium: 0.25, and large: 0.36. The model's overall GOF is equal to 0.629, suggesting a secure model fit. Furthermore, the GOF index using the respective AVE and R^2 for each dependent variable in structural equation modelling to identify model goodness-of-fit values shown in Table 3 were obtained. Thus, it could be concluded that the study PLS path modelling has an appropriate overall fit.

- Variance inflation factors (VIF)

Common method bias (CMB) is a phenomenon that occurs because of the measurement tool used in an SEM study. In the PLS-SEM analysis, the collinearity test used to identify the CMB of a model based on variance inflation factors (VIFs) (Kock and Lynn, 2012). For the collinearity were computed purpose of detecting the presence of bias the regression results before examining the structural relationships. The variance inflation factor values are critical indicators of collinearity issues.

Possible collinearity issues arise when VIF is more than 3.5, and ideally, values should be less than the advised threshold value of 3 (Kock and Lynn, 2012). As shown in Table 6, results show no collinearity, the VIF values for all constructs were lower than 3.

3.2.3.3. Hypothesis analysis

The next step is to test the hypotheses after testing the measurement and structural models are validated. As presented in Table 7, the outcomes of PLS-SEM analysis show considerable support for proposed hypotheses at a significance level of 0.001. The work

Table 6: Variance inflation factors of variables

Construct	VIF value
EK	2.347
AWC	2.621
ATT	1.739
SN	2.347
PBC	1.501
I	2.418
ECB	2.581

Table 7: Summary of mediation analyses (5000 bootstrap samples)

Hypothesis	(H)	H5	H7
Independent variable	IV	EK	AWC
Mediating variable	MV	I	I
Dependent variable	DV	ECB	ECB
Effect of IV on MV	α	0.769**	0.769**
Effect of MV on DV	β	0.631**	0.624**
Direct effect	c'	0.098 (ns)	0.091 (ns)
Indirect effect	α β	0.502**	0.480**
	99% CI	0.061-0.223	0.047-0.234
Total effect	C	0.6**	0.57**
Variance accounted for	VAF	0.836	0.841
Mediation type		Full	Full
Significance support		Yes	Yes

EK: environmental knowledge, AWC: awareness of consequences, I: intention, ECB: energy conservation behavior, ns=non-significant, **P<0.001

takes in the path analysis with the structural model. First, the path coefficient between users' AWC and EK with ECB was not significant. Hence, H_9 and H_{10} were not supported. In other words, AWC and EK does not necessarily reduce users' ECB.

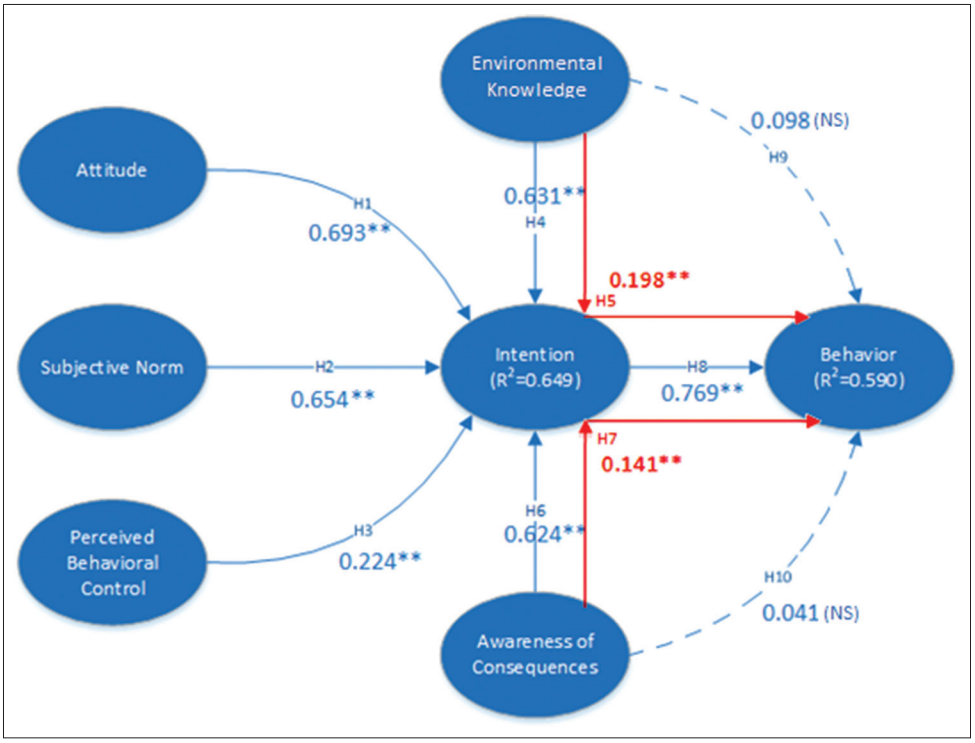
We also found that intention strongly influences users' ECB, which is in support of H8 ($\beta = 0.769$, $P < 0.001$). H_1 (Attitude and subjective norm) has a positive impact and statistically significant effect on the intention to conserve energy with values ($\beta = 0.693$, $P < 0.001$) and H_2 ($\beta = 0.654$, $P < 0.001$). Furthermore, perceived behavioral control has a moderate impact on intention indicated by H_3 values ($\beta = 0.224$, $P < 0.001$). H_4 (environmental knowledge) which has values of ($\beta = 0.631$, $P < 0.001$) and H_6 (awareness of consequences) which has values of ($\beta = 0.624$, $P < 0.001$) have a similar relative impact on intention. Accordingly, people will have more intention to perform Energy consumption behaviors. Figure 2 shows the partial least squares (PLS) analysis results of the theoretical model with standardized beta coefficients.

3.2.3.4. Mediating impact

This study employed smart PLS 2.0.M3 Statistical methods to then the hypothesis was tested that the mediating effect analysis macro PROCESS developed by (Hayes, 2013) Results showed a confidence interval of 95% for the mediators. Summary of mediation analyses is shown in Table 7.

We examined the total (c) and direct effects of knowledge on behavior and awareness of consequences on the behavior. In Table 7, the calculated total effect shows a significant positive effect of energy knowledge on ECBs is (c = 0.6**). Same for to the environmental knowledge and intention and the intention and energy conservation behavior are also a significant positive

Figure 2: Partial least squares analysis results of the theoretical model with standardized beta coefficients



effect. However, environmental knowledge has no significant direct effects on ECBs when the intention is included. The total effect of environmental knowledge over ECBs shows a significant influence. In contrast, direct effects are not significant, suggesting that intention fully mediates the relationship between environmental knowledge and ECBs. Full mediation occurs when the indirect effect is significant the direct effect c' is not significant, which is in support of H_5.

Following the same above procurer to analyze H_7. We tested the total effect of awareness of consequences on ECBs, which is a significant positive effect (c = 0.57**). Also, path of awareness of consequences on intention and the path of intention on ECBs were tested; both of which were concluded to be significant. Nevertheless, direct effects are not significant, of awareness of consequences on ECB when containing intention. Therefore, this proves full mediation of the intention between awareness of consequences and ECB; thus, works in support of H_7.

Furthermore, we attempt to explain the variance in for (VAF) index; this determines effect (c) of the causal relationship between variables EK and ECB. Partial mediation occurs when VAF values are in the rage of 20–80% and full mediation for the values exceed 80%. The results presented in this study show that VAFs for the indirect effect were 83.6% and 84.1%, respectively. We assumed that the intention fully mediates the relationship between EK and PEB. These outcomes support H_5 and H_7 (both displaying full mediation).

4. DISCUSSIONS AND IMPLICATIONS

This study explored the impact of user's pro-environmental behaviors on ECBs at a Kuwaiti academic building. Before analyzing the impact, we identified the variables: subjective norm, attitude, perceived behavioral control, environmental knowledge, behavioral intention, and behavior by using an expanded model of the TPB. The model was tested, and it was found that it is statistically significant. Also, the usefulness of the extension model to explain intention for energy conservation behavior was validated.

The results show that attitude has the strongest impact on intention among all variables. It shows that users' attitudes toward energy conversion are positively related to the intention to converse energy. Several studies have verified this result (Chan, 1998; Kaiser and Wilson, 2004; Martinsson et al., 2011; Cotton et al., 2016) by showing that people with a positive attitude have more intention to conserve energy. It is found that attitude is the most significant variable which impacts intention. The attitude being the most significant factor reflects that individual cognitive development is more effective on intention than other factors such as social pressure. The increasing attitude of university users in terms of environment and energy conservation will positively help to develop more intention for conservation behavior. Therefore, measures should aim to spread positive attitudes, such as developing positive mindsets towards the intention of energy conservation in universities, which could be done through written and verbal communication tools.

The impact of subjective norm on users' intention to conserve energy is significant. These results indicate that users have more intention for energy conversation behavior when they think others have positive expectations about them, and vice versa in case of no such expectation from others. This finding goes well along with previous studies results (Lee, 2011; Alias et al., 2013; Kilic and Dervisoglu, 2013; Swaim et al., 2014; Tan et al., 2017; Wang

et al., 2014), which have found that subjective norm impacts environmental, behavioral intention. It was shown in this study by subjective norms that users are influenced by their social networks in terms of intention. It means that they are more likely to conserve energy when they observe others conserving energy in their networks and were expected to do the same by them. Thus, it would be helpful to identify influential members of academic, social networks to lead the university users for increasing the intention for energy conservation and then showing conservation behavior. Also, other helpful strategies include distributing examples showing positive and negative behaviors in terms of energy conservation through communication channels in the society, which will form social influence on not only academic networks but on all communities.

Results show that there is a strong correlation between PBC and the intention to conserve energy at Kuwaiti academics' buildings. It was found that PBC also has an impact on intention. This impact shows the importance of developing policies and plans by governments and institutes to facilitate the demonstration of energy conservation intention and behavior by users and removing the barriers in front of these practices.

Two additional variables, which are environmental knowledge (EK) and awareness of consequences (AWC), were added as an extension to the model in this study based on the literature. The results indicate that both variables have a significant impact on users' intention to conserve energy. Increase in the resources and understanding of energy conservation advantages will increase the intention for energy conservation. This outcome is consistent with previous studies (de Leeuw et al., 2015; Obaidellah et al., 2019). On the other hand, both do not possess a direct effect on ECB. However, it does not mean that EK and awareness of consequences have zero impact on ECB. H_5 and H_7 are verified, and they indicate that both of those variables have an indirect impact on ECB through intention. The coefficients of EK and awareness of consequences on ECB through mediating impact of intention were 0.198 and 0.141, respectively. They were greater than the coefficients of direct impacts (0.098 and 0.041, respectively) on ECB. This result confirms the findings of previous studies regarding the importance of intention factor, which showed the mediating role of intention in showing ECB (Kaiser et al., 2005; Levine and Strube, 2012; Pan et al., 2018). All these results confirm that there is a crucial role of intention as an intermediate affecting the impact of all variables on ECB with 64.9% variance and direct impact on ECB with 59.0% variance.

Environmental knowledge and awareness of consequences will be influencing users' energy conservation. For this purpose, applying measures for education is essential for increasing EK. Adding energy conservation into the curriculum will be useful to increase knowledge about energy conservation and related practices as it was suggested by (Poškus, 2019).

5. CONCLUSIONS

This study examined the user's ECBs at Kuwaiti academic building using expanded model of the theory of planned behavior. Results showed that the expanded model of the theory of planned behavior explained 59.7% of the variance in the user's ECBs. Such analysis has the potential be insightful for the higher education stakeholders to comprehend the various underlying factors that play roles to the sustainable development of higher education organizations in Kuwait. Likewise, understanding in advance the potential obstacles in the integration of sustainable practices calculated from the perspective of users. Furthermore, identification of the behaviors and groups involved can play a role in supporting sustainability.

The measurements of the attitude to behavior confirmed the strong intention to perform ECBs. Despite the measurements of environmental knowledge and awareness of consequences have no direct effect on ECBs of academic users. Still energy consumption awareness and knowledge have a positive impact on intention.

6. FUTURE WORK AND LIMITATION

In our future work, we could apply a PLS-SEM Multigroup Analysis for staff, faculty and students. This would be by including an assessment of the measurement characteristics of the constructs by involving the MICOM procedure, to assess differences between users' energy consumption behaviors.

One limitation of this study is the study sample, which are mostly related to the size of the university's population. It is suggested that including other higher education institutions in future studies.

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REFERENCES

Abrahamse, W., Steg, L. (2009), How do socio-demographic and psychological factors relate to households' direct and indirect energy use and savings? Journal of Economic Psychology, 30(5), 711-720.

Ahamad, N.R., Ariffin, M. (2018), Assessment of knowledge, attitude and practice towards sustainable consumption among university students in Selangor, Malaysia. Sustainable Production and Consumption, 16, 88-98.

Ajzen, H., Fishbein, M. (1980), Understanding Attitudes and Predicting Social Behavior. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I. (1985), Intentions to Actions: A Theory of Planned Behavior. In: Action Control. Berlin, Heidelberg: Springer. p11-39.

Ajzen, I. (1991), The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179-211.

Ajzen, I. (2006), TPB Questionnaire Construction 1 Constructing a Theory

of Planned Behavior Questionnaire.
Ajzen, I. (2011), The theory of planned behaviour: Reactions and reflections. Psychology and Health, 26(9), 1113-1127.
Ajzen, I., Fishbein, M. (2005), The influence of attitudes on behavior. In: The Handbook of Attitudes. Abingdon, United Kingdom: Routledge, Taylor and Francis Group. p173-221.
Alias, R., Hashim, Z., Farzana, N., Mariam, S. (2013), Energy conservation behaviour among university students. Global Journal of Business and Social Science Review, 1(2), 127-134.
Ashouri, M., Haghighat, F., Fung, B.C.M., Yoshino, H. (2019), Development of a ranking procedure for energy performance evaluation of buildings based on occupant behavior. Energy and Buildings, 183, 659-671.
Astrachan, C.B., Patel, V.K., Wanzenried, G. (2014), A comparative study of CB-SEM and PLS-SEM for theory development in family firm research. Journal of Family Business Strategy, 5(1), 116-128.
Asunta, T. (2003), Knowledge of Environmental Issues: Where Pupils Acquire Information and how it Affects their Attitudes, Opinions, and Laboratory Behaviour. No. 221.
Bagozzi, R.P., Yi, Y. (2012), Specification, evaluation, and interpretation of structural equation models. Journal of the Academy of Marketing Science, 40(1), 8-34.
Bamberg, S., Möser, G. (2007), Twenty years after hines, hungerford, and tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. Journal of Environmental Psychology, 27(1), 14-25.
Bergman, B.G. (2016), Assessing impacts of locally designed environmental education projects on students' environmental attitudes, awareness, and intention to act. Environmental Education Research, 22(4), 480-503.
Blanco-Portela, N., Benayas, J., Pertierra, L.R., Lozano, R. (2017), Towards the integration of sustainability in higher education institutions: A review of drivers of and barriers to organisational change and their comparison against those found of companies. Journal of Cleaner Production, 166, 563-578.
Chan, K. (1998), Mass communication and pro-environmental behaviour: Waste recycling in Hong Kong. Journal of Environmental Management, 52(4), 317-325.
Clement, C.A., Henning, J.B., Osbaldiston, R. (2014), Integrating factors that predict energy conservation: The theory of planned behavior and beliefs about climate change. JSD Journal of Sustainable Development, 7(6), 46.
Cortese, A.D. (2003), The critical role of higher education in creating a sustainable future higher education can serve as a model of sustainability by fully integrating all aspects of campus life. Need for a new human perspective. Planning for Higher Education, 31(3), 15-22.
Cotton, D., Shiel, C., Paço, A. (2016), Energy saving on campus: A comparison of students' attitudes and reported behaviours in the UK and Portugal. Journal of Cleaner Production, 129, 586-595.
Darby, S. (2006), The Effectiveness of Feedback on Energy Consumption. Oxford: University of Oxford.
de Groot, J.I.M., Steg, L. (2008), Value orientations to explain beliefs related to environmental significant behavior. Environment and Behavior, 40(3), 330-354.
de Leeuw, A., Valois, P., Ajzen, I., Schmidt, P. (2015), Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: implications for educational interventions. Journal of Environmental Psychology, 42, 128-138.
DeWaters, J.E., Powers, S.E. (2011), Energy literacy of secondary students in New York State (USA): A measure of knowledge, affect, and behavior. Energy Policy, 39(3), 1699-1710.
Dharmesti, M., Merrilees, B., Winata, L. (2020), I'm mindfully green: Examining the determinants of guest pro-environmental behaviors (PEB) in hotels. Journal of Hospitality Marketing and Management, 29(7), 1-18.
do Valle, P.O., Assaker, G. (2016), Using partial least squares structural equation modeling in tourism research. Journal of Travel Research, 55(6), 695-708.
Duerden, M.D., Witt, P.A. (2010), The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior. Journal of Environmental Psychology, 30(4), 379-392.
Dunlap, R.E., Bechtel, R., Churchman, A. (2002), Environmental sociology. In: Handbook of Environmental Psychology. Hoboken, New Jersey: John Wiley and Sons. p160-171.
Echegaray, F., Hansstein, F.V. (2017), Assessing the intention-behavior gap in electronic waste recycling: The case of Brazil. Journal of Cleaner Production, 142, 180-190.
Ekborg, M. (2003), How student teachers use scientific conceptions to discuss a complex environmental issue. Journal of Biological Education, 37(3), 126-132.
Fornell, C., Larcker, D.F. (1981), Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of Marketing Research, 18(3), 382-388.
Frick, J., Kaiser, F.G., Wilson, M. (2004), Environmental knowledge and conservation behavior: Exploring prevalence and structure in a representative sample. Personality and Individual Differences, 37(8), 1597-1613.
Geiger, S.M., Geiger, M., Wilhelm, O. (2019), Environment-specific vs. general knowledge and their role in pro-environmental behavior. Frontiers in Psychology, 10, 718.
Gilani, S., O'Brien, W., Gunay, H.B. (2018), Simulating occupants' impact on building energy performance at different spatial scales. Building and Environment, 132, 327-337.
Goldman, D., Yavetz, B., Pe'er, S. (2014), Student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies. International Journal of Environmental and Science Education, 9(4), 369-383.
Green, T.L. (2013), Teaching (Un) sustainability? University sustainability commitments and student experiences of introductory economics. Ecological Economics, 94, 135-142.
Guerra, S.O., Itard, L., Visscher, H. (2009), The effect of occupancy and building characteristics on energy use for space and water heating in dutch residential stock. Energy and Buildings, 41(11), 1223-1232.
Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M. (2016), A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks, CA: SAGE.
Hair, J.F., Risher, J.J., Sarstedt, M., Ringle, C.M. (2019), When to use and how to report the results of PLS-SEM. European Business Review, 31(1), 2-24.
Hair, J.F., Sarstedt, M., Hopkins, L., Kuppelwieser, V.G. (2014), Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. European Business Review, 26(2), 106-121.
Hair, J.F., Sarstedt, M., Ringle, C.M., Gudergan, S.P. (2017). Advanced Issues in Partial Least Squares Structural Equation Modeling (PLS-SEM). Thousand Oaks, CA: SAGE.
Hair, J.F., Sarstedt, M., Ringle, C.M., Mena, J.A. (2012), An assessment of the use of partial least squares structural equation modeling in marketing research. Journal of the Academy of Marketing Science, 40(3), 414-433.
Halkos, G., Matsiori, S. (2017), Environmental attitude, motivations and values for marine biodiversity protection. Journal of Behavioral and Experimental Economics, 69, 61-70.
Hansla, A., Gamble, A., Juliusson, A., Gärling, T. (2008a), Psychological

determinants of attitude towards and willingness to pay for green electricity. Energy Policy, 36(2), 768-74.
Hansla, A., Gamble, A., Juliusson, A., Gärling, T. (2008b), The relationships between awareness of consequences, environmental concern, and value orientations. Journal of Environmental Psychology, 28(1), 1-9.
Harland, P., Staats, H., Wilke, H.A.M. (2007), Situational and personality factors as direct or personal norm mediated predictors of pro-environmental behavior: Questions derived from norm-activation theory. Basic and Applied Social Psychology, 29(4), 323-334.
Harring, N., Jagers, S.C. (2018), Why do people accept environmental policies? The prospects of higher education and changes in norms, beliefs and policy preferences. Environmental Education Research, 24(6), 791-806.
Hayes, J.R. (2013), The Complete Problem Solver. Abingdon: Routledge.
Henseler, J., Ringle, C.M., Sarstedt, M. (2015), A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115-135.
Hines, J.M., Hungerford, H.R., Tomera, A.N. (1987), Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. The Journal of Environmental Education, 18(2), 1-8.
Hong, T., Taylor-Lange, S.C., D'Oca, S., Yan, D., Corgnati, S.P. (2016), Advances in research and applications of energy-related occupant behavior in buildings. Energy and Buildings, 116, 694-702.
Jaffar, B., Oreszczyn, T., Raslan, R. (2019), Empirical and modelled energy performance in Kuwaiti Villas: Understanding the social and physical factors that influence energy use. Energy and Buildings, 188-189, 252-268.
Jaffar, B., Oreszczyn, T., Raslan, R., Summerfield, A. (2018), Understanding energy demand in Kuwaiti Villas: Findings from a quantitative household survey. Energy and Buildings, 165, 379-389.
Kaiser, F.G. (2006), A moral extension of the theory of planned behavior: Norms and anticipated feelings of regret in conservationism. Personality and Individual Differences, 41(1), 71-81.
Kaiser, F.G., Fuhrer, U. (2003), Ecological behavior's dependency on different forms of knowledge. Applied Psychology, 52(4), 598-613.
Kaiser, F.G., Hubner, G., Bogner, F.X. (2005), Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior. Journal of Applied Social Psychology, 35(10), 2150-2170.
Kaiser, F.G., Shimoda, T.A. (1999), Responsibility as a predictor of ecological behaviour. Journal of Environmental Psychology, 19(3), 243-253.
Kaiser, F.G., Wilson, M. (2004), Goal-directed conservation behavior: The specific composition of a general performance. Personality and Individual Differences, 36(7), 1531-1544.
Khan, I., Jack, M.W., Stephenson, J. (2019), Identifying residential daily electricity-use profiles through time-segmented regression analysis. Energy and Buildings, 194, 232-246.
Kilic, D.S., Dervisoglu, S. (2013), Examination of water saving behavior within framework of theory of planned behavior. International Journal of Secondary Education, 1(3), 8-13.
Kock, N., Hadaya, P. (2018), Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. Information Systems Journal, 28(1), 227-261.
Kock, N., Lynn, G. (2012), Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. Journal of the Association for Information Systems, 13(7), 546-580.
Kollmuss, A., Agyeman, J. (2002), Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? Environmental Education Research, 8(3), 239-260.
Lee, J.W.C., Tanusia, A. (2016), Energy conservation behavioural intention: Attitudes, subjective norm and self-efficacy. IOP Conference Series: Earth and Environmental Science, 40, 012087.
Lee, K. (2011), Understanding Hong Kong adolescents' environmental intention: The roles of media exposure, subjective norm, and perceived behavioral control. Applied Environmental Education and Communication, 10(2), 116-125.
Levine, D.S., Strube, M.J. (2012), Environmental attitudes, knowledge, intentions and behaviors among college students. The Journal of Social Psychology, 152(3), 308-326.
Liobikienė, G., Juknys, R. (2016), The role of values, environmental risk perception, awareness of consequences, and willingness to assume responsibility for environmentally-friendly behaviour: The lithuanian case. Journal of Cleaner Production, 112, 3413-3422.
Lorenzoni, I., Nicholson-Cole, S., Whitmarsh, L. (2007), Barriers perceived to engaging with climate change among the UK public and their policy implications. Global Environmental Change, 17(3-4), 445-459.
Markowitz, E.M., Goldberg, L.R., Ashton, M.C., Lee, K. (2012), Profiling the pro-environmental individual: A personality perspective. Journal of Personality, 80(1), 81-111.
Martinsson, J., Lundqvist, L.J., Sundström, A. (2011), Energy saving in Swedish households. the (relative) importance of environmental attitudes. Energy Policy, 39(9), 5182-5191.
Midden, C.J.H., Ritsema, B.S.M. (1983), The meaning of normative processes for energy conservation. Journal of Economic Psychology, 4(1-2), 37-55.
Mobley, C., Vagias, W.M., DeWard, S.L. (2010), Exploring additional determinants of environmentally responsible behavior: The influence of environmental literature and environmental attitudes. Environment and Behavior, 42(4), 420-447.
Mostafa, M.M. (2007), Gender differences in egyptian consumers? Green purchase behaviour: The effects of environmental knowledge, concern and attitude. International Journal of Consumer Studies, 31(3), 220-229.
Mtutu, P., Thondhlana, G. (2016), Encouraging pro-environmental behaviour: Energy use and recycling at rhodes university, South Africa. Habitat International, 53, 142-150.
Nitzl, C., Roldan, J.L., Cepeda, G. (2016), Mediation analysis in partial least squares path modeling. Industrial Management and Data Systems, 119(9), 1849-1864.
Obaidellah, U.H., Danaee, M., Mamun, M.A.A., Hasanuzzaman, M., Rahim, N.A. (2019), An application of TPB constructs on energy-saving behavioural intention among university office building occupants: A pilot study in malaysian tropical climate. Journal of Housing and the Built Environment, 34(2), 533-569.
Macoevi, O.I. (2015), Determinants of consumers' pro-environmental behavior toward an integrated model. Journal of Danubian Studies and Research, 5(2), 261-275.
Oliver, J., Benjamin, S., Leonard, H. (2019), Recycling on vacation: Does pro-environmental behavior change when consumers travel? Journal of Global Scholars of Marketing Science, 29(2), 266-280.
Ones, D.S., Dilchert, S. (2013), Measuring, understanding, and influencing employee green behaviors. In: Huffman, A.H., Stephanie, R., editors. Green Organizations: Driving Change with IO Psychology. New York: Routledge. p115-148.
Özden, M. (2008), Environmental awareness and attitudes of student teachers: An empirical research. International Research in Geographical and Environmental Education, 17(1), 40-55.
Pan, S.L., Chou, J., Morrison, A.M., Huang, W.S., Lin, M.C. (2018), Will the future be greener? The environmental behavioral intentions of university tourism students. Sustainability, 10(3), 634.
Poškus, M.S. (2019), Predicting and Promoting Adolescents' Pro-Environmental Behavior in Different Big Five Trait Clusters,

Doctoral Dissertation. Lithuania: Mykolas Romeris University.
Pothitou, M., Hanna, R.F., Chalvatzis, K.J. (2016), Environmental knowledge, pro-environmental behaviour and energy savings in households: An empirical study. Applied Energy, 184, 1217-1229.
Richter, N.F., Carrion, G.C., Roldán, J.L., Ringle, C.M. (2016), European management research using partial least squares structural equation modeling (PLS-SEM): Editorial. European Management Journal, 34(6), 589-597.
Rigdon, E.E. (2016), Choosing PLS path modeling as analytical method in European management research: A realist perspective. European Management Journal, 34(6), 598-605.
Safari, A., Salehzadeh, R., Panahi, R., Abolghasemian, S. (2018), Multiple pathways linking environmental knowledge and awareness to employees' green behavior. Corporate Governance, 18(1), 81-103.
Sarstedt, M., Ringle, C.M., Hair, J.F. (2017), Partial least squares structural equation modeling. In: Homburg, C., Klarmann, M., Vomberg, A., editors. Handbook of Market Research. Berlin, Germany: Springer. p1-40.
Steg, L., Bolderdijk, J.W., Keizer, K., Perlaviciute, G. (2014), An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. Journal of Environmental, 38, 104-115.
Steg, L., Vlek, C. (2009), Encouraging pro-environmental behaviour: An integrative review and research Agenda. Journal of Environmental Psychology, 29(3), 309-317.
Streukens, S., Leroi-Werelds, S. (2016), Bootstrapping and PLS-SEM: A step-by-step guide to get more out of your bootstrap results. European Management Journal, 34(6), 618-632.
Sudarmadi, S., Suzuki, S., Kawada, T., Netti, H., Soemantri, S., Tugaswati, A.T. (2001), A survey of perception, knowledge, awareness, and attitude in regard to environmental problems in a sample of two different social groups in Jakarta, Indonesia. Environment, Development and Sustainability, 3(2), 169-183.
Swaim, J.A., Maloni, M.J., Napshin, S.A., Henley, A.B. (2014), Influences on student intention and behavior toward environmental sustainability. Journal of Business Ethics, 124(3), 465-484.
Tan, C.S., Ooi, H.Y., Goh, Y.N. (2017), A moral extension of the theory of planned behavior to predict consumers' purchase intention for energy-efficient household appliances in Malaysia. Energy Policy, 107, 459-471.
Taufique, K.M.R., Vocino, A., Polonsky, M.J. (2017), The influence of eco-label knowledge and trust on pro-environmental consumer behaviour in an emerging market. Journal of Strategic Marketing, 25(7), 511-529.
Tenenhaus, M., Vinzi, V.E., Chatelin, Y.M., Lauro, C. (2005), PLS path modeling. Computational Statistics and Data Analysis, 48(1), 159-205.
Thøgersen, J., Grønhøj, A. (2010), Electricity saving in households a social cognitive approach. Energy Policy, 38(12), 7732-7743.
Thondhlana, G., Hlatshwayo, T.N. (2018), Pro-environmental behaviour in student residences at rhodes university, South Africa. Sustainability, 10(8), 2746.
Van den Berg, H. (2007), Feeling and Thinking in Attitudes. Amsterdam: University of Amsterdam.
Vicente-Molina, M.A., Fernández-Sáinz, A., Izagirre-Olaizola, J. (2013), Environmental knowledge and other variables affecting pro-environmental behaviour: Comparison of university students from emerging and advanced countries. Journal of Cleaner Production, 61, 130-138.
Wang, Z., Zhang, B., Li, G. (2014), Determinants of energy-saving behavioral intention among residents in Beijing: Extending the theory of planned behavior. Journal of Renewable and Sustainable Energy, 6(5), 053127.
Wells, V.K., Taheri, B., Gregory-Smith, D., Manika, D. (2016), The role of generativity and attitudes on employees home and workplace water and energy saving behaviours. Tourism Management, 56, 63-74.
Wetzels, M., Odekerken-Schröder, G., van Oppen, C. (2009), Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. MIS Quarterly, 33(1), 177-195.
Wiernik, B.M., Ones, D.S., Dilchert, S., Klein, R.M. (2018), Individual antecedents of pro-environmental behaviours: Implications for employee green behaviours. In: Research Handbook on Employee Pro-Environmental Behaviour. Cheltenham, UK: Edward Elgar Publishing. p63-82.
Yavetz, B., Goldman, D., Pe'er, S. (2014), How do preservice teachers perceive "environment" and its relevance to their area of teaching? Environmental Education Research, 20(3), 354-371.
Zhang, Y., Bai, X., Mills, F.P. (2020), Characterizing energy-related occupant behavior in residential buildings: Evidence from a survey in Beijing, China. Energy and Buildings, 214, 109823.