Pilot Study Analysis for Energy Conservation Behaviour Using Value-Belief-Norm (VBN) Theory in Malaysian Universities Perspective

Aidil Syukri Shaari[1,2*], Mohd Sofian Rosbi[1], Ernie Che Mid[2]

[1]Faculty of Business and Communication, Universiti Malaysia Perlis, 01000 Kangar, Perlis, Malaysia

[2]Centre of Excellence for Renewable Energy (CERE), Faculty of Electrical Engineering & Technology, Universiti Malaysia Perlis, 02600 Arau, Perlis, Malaysia

***Corresponding Author**

DOI: https://dx.doi.org/10.47772/IJRISS.2024.814MG0043

Received: 04 December 2024; Accepted: 09 December 2024; Published: 09 January 2025

ABSTRACT

Climate change and global warming, primarily driven by CO_2 emissions from fossil fuel consumption, cause critical global issues requiring urgent attention. Energy conservation is essential for reducing energy use and promoting energy conservation behavior to address this issue. This research aims to determine the factors associated with influencing energy conservation behavior focusing on academic staff from Malaysian public universities. The study utilized the Value-Belief-Norm (VBN) theory to predict pro-environmental behavior (PEB) focusing on energy conservation behavior. A questionnaire study was conducted among 100 respondents, aged 21 to 60 years old. The data analysis using SPSS shows that the skewness values for all variables fall within the range of -1 to +1, suggesting statistical significance and alignment with a normal distribution. Furthermore, the Cronbach's alpha values obtained from the statistical test for internal reliability were all greater than 0.6, indicating an acceptable level of internal consistency for all variables. The Kaiser-Meyer-Olkin (KMO) values for all variables exceed 0.5, and Bartlett's test of sphericity is significant ($p<0.05$), confirming the suitability of the data for factor analysis. Additionally, Pearson correlation analysis reveals that value (V), belief (B), and personal norms (PN) have statistically significant positive relationships with energy conservation behavior (ECB). The findings of this study support the hypothesis that there is a positive correlation between Value(V), Belief(B), and Personal Norms (PN) toward Energy Conservation Behavior (ECB). In addition, the outcome of the pilot study indicated that the questionnaire exhibited satisfactory reliability and validity for further research. The contribution of this study is it provides fundamental knowledge about energy conservation for the university management level to develop better policies to achieve a green environment.

Keywords: Value, Belief and Norms (VBN) Theory, energy conservation behavior, Sustainable development goal (SDG), university

INTRODUCTION

In recent times, global warming and climate change have emerged as increasingly critical issues on the global agenda among researchers and the media. The shifting climate and rising atmospheric temperatures have influential effects on water resources, agricultural production, and the overall economy of nations.

Environmental sustainability faces threats from various issues, including global warming, urban air pollution, water scarcity, environmental noise, and the decline in biodiversity, which substantially impact the yield and quality of agricultural outputs (Priss et al., 2023). Carbon dioxide (CO_2) emissions, chiefly arising from the combustion of fossil fuels and industrial operations, while human development presents key challenge to achieving environmental sustainability and exacerbates the imbalance between energy supply and demand (Ulucak & Baloch, 2023). Among the various sectors, the building sector is one of the largest energy consumers, significantly contributes to global energy use, representing about one-third of total energy usage worldwide (González-Torres et al., 2022). Buildings encompassing residential areas, schools, universities, offices, healthcare facilities, and industrial complexes, have emerged as pivotal contributors to energy consumption. The building sector contributes around 19% of global energy-related greenhouse gas emissions, which have been a major cause of global warming over the past five decades, and accounts for 36% of total CO_2 emissions worldwide (Fathi, 2024). These underscore the critical role of buildings in the global energy landscape. On the other hand, tertiary institutions such as universities have a significant impact on energy consumption which have a lot of facilities such as lecture halls, student dormitories, laboratories, and lecturers' offices. Therefore, addressing energy consumption in these sectors is essential for fostering sustainable practices and reducing their environmental impact.

In the last few years, universities have increasingly recognized their environmental impact and are actively working to integrate sustainability into their operations. An illustrative example of this is seen in the considerable energy demands of university facilities, such as laboratories, lecture halls, and dormitories. Due to high energy consumption, universities face significantly higher energy costs. This scenario places a substantial financial burden on universities, highlighting the urgent need for energy conservation strategies and sustainable practices to reduce operational costs and promote environmental responsibility across campuses. According to (Latif et al., 2019), the Malaysian government is required to allocate approximately RM 2.7 billion annually to cover the energy consumption costs of universities. As a result, many universities in Malaysia have started to implement a crucial step toward enhancing energy conservation and formulating effective energy planning strategies for campus buildings to promote sustainable practices across their campuses to reduce their overall environmental footprint. These efforts are essential for aligning university operations with broader sustainability goals.

There are two approaches to reducing energy use in workplaces: either by improving technology or by changing employee behavior (Harputlugil & de Wilde, 2021). Technological advancements are commonly the primary strategy adopted by businesses, as they enable the quantification of energy savings, providing a basis for justifying investments and estimating outcomes before implementation. Nonetheless, technology alone cannot guarantee energy savings, as buildings are operated by people. Hence, attention must also be given to the human aspects of energy conservation. While technological solutions can significantly enhance energy efficiency, their effectiveness depends on proper utilization. Without appropriate user engagement, these technologies may fail to deliver the intended outcomes. Based on this situation, it is quite clear that efforts to reduce energy consumption cannot be successfully implemented without a corresponding change in individual behavior.

The IEA EBC Annex 53 project identifies six critical parameters that impact building energy consumption: occupant behavior, indoor environment, operation, and maintenance climate, building envelope, and building equipment (Yoshino et al., 2017). Among all the parameters, occupant behavior, in particular, presents a significant challenge, as it is a complex issue that intersects with psychology, sociology, economics, engineering, and design considerations (Bäcklund et al., 2023). Thus, this study seeks to discover the psychological factors that affect energy conservation behavior among academic staff in Malaysian public universities in Malaysia. Given that many environmental issues are closely linked to the actions and decisions of individuals, managing these behaviors becomes a key strategy for mitigating their negative environmental impacts. Thus, understanding and addressing the underlying behavioral factors are vital for achieving long-term environmental sustainability.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume VIII Issue XIV December 2024 | Special Issue on Management

As defined by Annex 66 of the International Energy Agency, occupant behavior can be understood as the movement and actions of individuals within a building. How people interact with and inhabit these spaces—commonly referred to as occupant behaviors—plays a critical role in influencing overall building performance. Research indicates that modifying energy-use behaviors can lead to substantial reductions in energy consumption, with potential savings of up to 30%. (Zhang et al., 2018). The critical impact of occupant behavior on energy consumption has been extensively recognized in academic research and has attracted considerable worldwide attention over the past decade (L. Li et al., 2021). Occupant behavior plays a crucial role in determining building energy consumption, often contributing to higher energy usage through actions such as leaving lights on, improper operation of HVAC (Heating, Ventilation, and Air Conditioning) systems, and inadequate management of windows. For instance, failing to turn off lights when exiting a room exemplifies such behaviors that can lead to unnecessary energy consumption, failing to deactivate the HVAC thus system in a building can significantly impact energy consumption when individuals exit a building. If the system continues running unnecessarily after occupants leave, it can lead to wasted energy and increased operational costs (Almeida et al., 2021).

The window and door-opening behaviors particularly, can lead to substantial energy losses, especially in climates where heating or cooling is necessary. This behavior affects the air change rate and thermal load, impacting the overall energy consumption of a building as it results in increased dynamic heat losses, resulting from excessive operational loads or inefficiencies, which pose a significant challenge to energy performance in buildings. These losses amplify thermal energy demands, particularly in systems like HVAC, leading to higher energy consumption and operational costs. Consequently, this leads to a higher demand for energy to heat the incoming air, thereby impacting overall energy efficiency (Tien et al., 2022).

These energy-related behaviors are a key contributing factor to the energy performance gap, a phenomenon characterized by actual energy consumption surpassing the predicted or estimated usage levels. Moreover, in shared office environments, individual energy consumption behaviors are frequently observable and can influence the actions of other employees. Certain devices, such as lighting and air conditioning systems, are commonly operated collectively by multiple users. Therefore, each employee should take into account the preferences and actions of colleagues before changing the operational status of office devices, as the use of certain equipment often results from a collaborative decision-making process.

Therefore, modifying employee behavior is identified as an important strategy to reduce energy consumption in the workplace environment. Therefore, this study aims to examine the psychology of employees in conservation behavior by using the environmental Value-Belief-Norm (VBN) theory, in addition, it helps to reduce environmental pollution, optimize energy use, and minimize electricity costs, in line with the objective sustainability goals.

THEORETICAL BACKGROUND AND HYPOTHESES

Value–Belief–Norm (VBN) Theory

The Value-Belief-Norm (VBN) theory was developed by Stern to explain behavior related to environmental protection. The theory highlights the important effect of personal values(V), environmental beliefs (B), and personal norms (PN) in explaining and predicting pro-environmental behavior. This framework argues that individuals engage in sustainable action when they see the adverse consequences of environmental degradation on themselves, society, and the biosphere (Stern, 2000). Recognition of such consequences fosters a sense of moral responsibility, which in turn motivates actions aligned with environmental sustainability. These insights play an important role in understanding and promoting behavioral shifts toward sustainability in various contexts.

The framework highlights the significant impact of personal values, environmental views, and societal norms as factors influencing sustainable behavior. The theory states that individuals' values influence their perspectives and views toward the environment, especially concerning ecological threats and responsibilities. As a result, these beliefs create personal norms—a feeling of moral obligation—that encourage people to act in behavior aligned with environmental sustainability. This theoretical model establishes a causal relationship where deeply rooted values inform beliefs about environmental accountability, fostering a commitment to actions that mitigate ecological threats. Academically, this framework is instrumental for analyzing and predicting sustainable behaviors in areas such as energy conservation, sustainable consumption, and resource management. This approach proves highly effective in analyzing and predicting sustainable behaviors across various domains, including energy conservation. Specifically, within the context of occupant behavior, personal values play a crucial role in shaping individuals to engage with their environments, particularly concerning energy consumption and sustainability practices.

The VBN theory states that personal values are fundamental constructs that shape individuals' beliefs about environmental responsibility and influence their behavior. The construct of values is defined as enduring principles that transcend specific contexts, guiding the selection and evaluation of behaviors based on their relative importance. These principles ultimately lead to desired outcomes or behavioral patterns aligned with the values' objectives. Values reflect a person's character and act as consistent guides for behavior in different situations over time. The relationship between value and PEB is complex, with altruistic, biospheric, and egoistic value orientations each playing a distinct role in motivating these activities. Altruistic values represent a collective orientation toward the well-being of others and all living organisms. These values drive individuals to engage in PEB, motivated by a sense of responsibility to protect and sustain the natural world and support societal well-being (Xu et al., 2021). In the context of PEB, altruistic values play an essential role in determining attitudes and decisions that align with ecological preservation and energy conservation behavior.

The second category, biospheric values, emphasizes the well-being of the biosphere, the environment, and ecosystems. These values are directly associated with a heightened concern for environmental issues and are positively linked to pro-environmental intentions and behaviors (Gupta & Sharma, 2019). The third type of value, known as egoistic values, which are centered on one's self-interest, is less predictive of PEB. They have the potential to harm ecological worldviews and to limit the possibility of engaging in behaviors that are helpful to the environment (Balundė et al., 2020). Nevertheless, in other situations, egoistic incentives could be in line with environmental goals, especially when energy-efficient techniques result in cash savings or other personal advantages. Egoistic values can converge with environmental aims in certain situations, although pro-environmental behavior (PEB) is typically more strongly related to altruistic and biospheric values. A deeper understanding of the interplay between these value orientations can inform the development of interventions aimed at fostering sustainable behaviors across diverse value systems.

According to the Value-Belief-Norm (VBN) theory, beliefs are essential for understanding human behavior. These constructs help explain how individuals recognize the impact of their actions and the extent to which they attribute responsibility for environmental or social outcomes, thus influencing behavioral intentions and actions. (Schwartz, 1977) Two key types of beliefs—awareness of consequences (AC) and ascription of responsibility (AR)—have been identified as critical in understanding human behavior. AC refers to an individual's recognition of the negative consequences that may arise from failing to act pro-socially, while AR pertains to the individual's sense of responsibility for those outcomes. These beliefs are integral in shaping attitudes and behaviors related to social and environmental responsibility.

These beliefs subsequently lead to the establishment of personal norms (PN), which are essential in directing individuals' decisions and activities (Özekici, 2022). PN is referred to as the feelings and moral obligation of an individual to perform a certain act (Aprile & Fiorillo, 2023). PN is considered a significant motivator in promoting pro-environmental intentions and behaviors. These norms are fundamentally influenced by beliefs about human-environment relationships, the associated consequences, and the individual's sense of responsibility for participating in such behavior.

Hypothesis development

Value-Belief-Norm (VBN) Theory is a theory that works comprehensively to analyze the psychological processes that drive energy-related behavior by linking personal values, beliefs, and norms to pro-environmental actions. According to this theory, individuals' values form the foundation of their beliefs about environmental issues, which subsequently shape their norms and influence their behavior. By emphasizing the interconnection between these psychological constructs, the VBN theory helps to explain how value-driven beliefs and normative pressures can lead to the adoption of energy-efficient and environmentally responsible behaviors. (Stern et al., 1999) In this theory, value structures the beliefs that shape what individuals think are facts about an environmental issue, then builds norms and guides behavior. The identification of three main components: altruistic values (AV), biospheric values (BV), and egoistic values (EV). Individuals who demonstrate a strong inclination toward egoistic values tend to prioritize and evaluate outcomes based on their potential impact on personal benefits, such as financial gain, status, or comfort. In contrast, altruistic values focus on promoting the well-being of others, emphasizing empathy, social responsibility, and fairness. Meanwhile, biospheric values center on the importance of preserving the natural environment, underscoring the interconnectedness of ecosystems and the necessity of sustainable practices to ensure the health and longevity of the biosphere. Parallel to that (Sahin, 2013), the findings indicate that values (V) have a greater impact on feelings of responsibility for energy conservation. Similarly, the study by (Al Mamun et al., 2022) on the study found value (V) has a significant impact on pro-environmental beliefs. Based on the theory, we propose the following hypothesis:

H1: There is a positive correlation of Value (V) on Energy Conservation Behavior (ECB)

Environmental beliefs are tied to constructs like the New Environmental Paradigm (NEP) where NEPs are ecological worldviews and the higher a person scores on an NEP, then the more likely they will choose environmental sustainability in their decision-making processes. For example, individuals with high pro-environmental beliefs (B) may call for engagement in conservation work that is critical to sustainable development and helps alleviate environmental degradation. This statement supported by (Perera et al., 2022), suggests that pro-environmental concepts enhance awareness of consequences. People who hold pro-environmental beliefs (B) tend to be more inclined to participate in pro-environmental actions. In addition, study by (Mirza et al., 2023), pro-environmental beliefs (B) have been shown to significantly enhance awareness of the consequences of climate change, thereby encouraging environmentally conscious behaviors. These beliefs (B) play a fundamental role in promoting individuals' understanding of environmental issues and motivating actions that align with sustainable practices. We propose the following hypothesis based on the preceding discussion:

H2: There is a positive correlation of Belief(B) toward Energy Conservation Behavior (ECB)

Personal norms (PN) as a key determinant of energy-saving behavior and are one of the strong predictors for both intention and behavior related to energy conservation. The norms, indicating a sense of personal obligation, can facilitate pro-environmental choice and contribute to sustainable energy behavior. These are internalized standards of behavior often rooted in a sense of responsibility and understanding the impact consequences. Individuals who feel a personal responsibility to conserve energy, are more likely to engage in energy conservation behaviors. Previous studies mention that personal norm (PN) was a significant predictor of energy-saving intention, accounting for almost 40% of the variance in intention (Heib et al., 2023). Moreover, the adoption of smart home technologies for energy efficiency is significantly shaped by personal norms (PN), which serve as the most significant predictor of the intention to utilize these systems (Zharova & Lee, 2022). This research proposes the following hypothesis:

H3: There is a positive correlation between Personal Norms (PN) on Energy Conservation Behavior (ECB).

In summary, the comprehensive framework outlining the proposed hypotheses is presented in Figure 1.

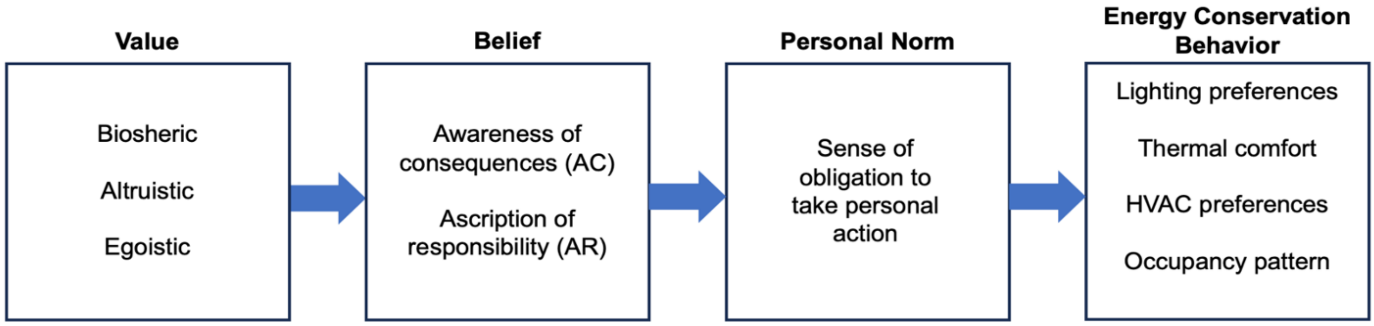

Figure 1: The framework model for this study

METHODOLOGY

Research Design

The research employs a deductive method, integrating a quantitative research design with a cross-sectional survey method. This approach is characterized by the collection of data through self-administered questionnaires, which is a common method in positivist research to gather empirical data for statistical analysis. The use of a cross-sectional design allows researchers to assess variables at a single point in time, providing a snapshot of the phenomena under study. This method is particularly useful for identifying patterns and correlations within the data, as demonstrated in various studies across different fields.

Respondent And Data Collection Procedure

This study aims to examine the factors influencing energy conservation behaviors among academic staff from public universities in Malaysia. Initially, 140 printed questionnaires were distributed to selected participants at Universiti Malaysia Perlis (UniMAP) as part of a pilot test. To increase response rates, an online survey was subsequently conducted using Google Forms, allowing for a broader reach and more comprehensive data collection. Around 140 questionnaires were distributed, 105 were returned, and 100 questionnaires passed the screening process and were considered valid. According to Z. Li et al. (2021), individuals with higher levels of education exhibit a strong commitment to environmental protection principles and are more likely to practice energy conservation within their professional environments. This study utilizes a simple random sampling method, ensuring that every individual in the population has an equal probability of being selected. The method enhances the reliability and generalizability of the findings, ensuring a representative sample for understanding energy conservation behaviors among academic staff. This approach eliminates any bias in the selection process and allows for a representative subset of the population to be included in the study.

Data Analysis Process

In this study, SPSS 27.0 was utilized to perform statistical analyses and examine energy conservation behaviors among academic staff. The data analysis began with a descriptive analysis to summarize the key characteristics of the dataset, followed by an assessment of the sample's reliability using Cronbach's alpha. Subsequently, normality analysis was conducted to evaluate the data distribution. Exploratory Factor Analysis (EFA) was subsequently conducted to verify the scale's convergent and discriminant validity, thereby evaluating its structural stability. In addition, this study evaluated the linear relationships between the independent variables and the dependent variable using Pearson’s Correlation Coefficient analysis.

RESULTS AND DISCUSSION

This study aims to assess energy conservation behaviors among academic staff, emphasizing the factors that influence their participation in energy conservation behavior within Malaysian public universities. The data were collected using a structured questionnaire survey, meticulously designed to provide comprehensive insights into the values, beliefs, and personal norms of academic staff concerning energy conservation. The results section is systematically organized into four analytical components: descriptive statistics, normality test, reliability, and validity analysis.

Demographic Characteristics of Respondents

A comprehensive overview of the characteristics of the total 100 respondents who participated in this study is presented in Table 1. The demographic information includes such as marital status, education level, job position, and years of service. Gender distribution among respondents was balanced, with an equal representation of 50% female and 50% male participants. The data on marital status revealed that a substantial majority of the respondents, totaling 89 respondents (89%) of the sample, were married. In contrast, a smaller segment of the participants, comprising 11 respondents (11%) of the sample, reported are single. This distribution highlights that most respondents were married, with a comparatively minor proportion identifying as single.

In the context of education level, around 57 respondents (57%) hold a Doctor of Philosophy (PhD) degree, and the remaining 43 respondents (43%) hold a master's degree. Next, the academic ranks of respondents show 42 respondents (42%) both for lecturers and senior lecturers, 15 respondents (15%) as associate professors, and a small minority of 1 respondent (1%) as full professors. The results indicate that the majority of respondents in this study involved senior lecturers and lecturers, reflecting their predominant representation in the sample.

Table 1: Descriptive statistics of respondents

Construct	**Section**	**Frequency**	**Valid percent**	**Cumulative Percentage (%)**
Marital status	Single	11	11.0	11.0
	Married	89	89.0	100.0
Education level	Master's degree	43	43.0	43.0
	Doctor of Philosophy	57	57.0	100.0
Job position	Lecturer	42	42.0	42.0
	Senior lecturer	42	42.0	84.0
	Associate Professor	15	15.0	99.0
	Professor	1	1.0	100.0
Years of service	Below 1 years	5	5.0	5.0
	1-5 years	23	23.0	28.0
	6-10 years	51	51.0	79.0
	11- 15 years	20	20.0	99.0
	16- 20 years	1	1.0	100.0

Moreover, the data on work experience among the respondents showed significant variation. A small portion, only 5 respondents which contributes to (5%) had less than one year of working experience. Meanwhile, 23 respondents who contributed (23%) had between 1 to 5 years of working experience, 51 respondents who contributed (51%) had between 6 to 10 years of experience, 20 respondents who contributed (20%) had between 11 to 15 years' experience, and lastly, only 1 respondent which contributes to (1%) had between 16 to 20 years of experience. In addition, this research subsequently evaluated the characteristics of normal distribution for each variable included in the analysis. The three independent variables (IV) in this study are Value (V), Belief (B), and Personal Norms (PN), while the dependent variable (DV) is energy conservation behavior (ECB). Table 2 presents the normality analysis result of the factors examined in this study.

Table 2: Descriptive analysis of the variable

Variable	Mean	Standard deviation	Skewness	S. E	Kurtosis	S. E	Normal distribution
Value (V)	4.6720	0.39340	-0.574	0.241	2.650	0.478	Yes
Belief (B)	4.4060	0.32592	-0.364	0.241	0.145	0.478	Yes
Personal Norms (PN)	4.2760	0.41757	-0.466	0.241	0.146	0.478	Yes
Energy conservation behavior (ECB)	4.1240	0.49464	-0.541	0.241	0.587	0.478	Yes

The first independent variable, Value (V), has a mean of 4.6720 and a standard deviation of 0.39340. A small standard deviation means the data points are closely grouped around the mean, while a large standard deviation shows that the data points are more spread out from the mean. The skewness value for the distribution of the variable value (V) is -0.574, indicating a slight negative skew and a minor asymmetry toward the left. As the skewness value falls within the acceptable range for normal distribution (-1 to +1), the data distribution for the variable value (V) adheres to the assumptions of normality. The kurtosis score of 2.650 suggests that the data distribution for the variable value (V) aligns with a normal distribution. Given that the kurtosis for a normal distribution typically falls within the range of -3 to +3, this value confirms that the distribution adheres to the assumptions of normality.

The second independent variable is belief (B) which exhibits a mean is 4.4060 with a standard deviation of 0.32592. A smaller standard deviation indicates that the data points are closely clustered around the mean, whereas a larger standard deviation means the data points are more spread out. The skewness value typically falls between -1 and +1, for a normal distribution, which indicates the distribution is symmetrical. Subsequently, the result for belief (B) shows the value is -0.364, indicating a minor negative skew, meaning the distribution is slightly skewed to the left. The data distribution for belief (B) adheres to a normal distribution. The kurtosis value for a normal distribution is generally expected to fall within the range of -1 to +1. With a kurtosis value of 0.145, the data distribution for belief (B) aligns with this criterion, confirming its conformity to a normal distribution.

The next variable, personal norms (PN), shows a mean value of 4.2760 with a standard deviation of 0.41757. In descriptive statistics, standard deviation measures the extent of data dispersion around the mean, with values approaching zero indicating minimal variability. Skewness values within the range of -1 to +1 are indicative of a normal distribution, and the skewness value for personal norms (PN) was -0.364, confirming its adherence to normality. Additionally, the kurtosis value for personal norms (PN) was 0.146, which falls within the acceptable range of -1 to +1 for normal distributions, further validating the normality of the data.

Furthermore, the normality of DV energy conservation behavior (ECB) shows a mean value of 4.1240 with a standard deviation of 0.49464. The skewness value is -0.541, indicating a slight negative skewness in the data. The kurtosis value was 0.587, suggesting that the distribution has slightly lighter tails compared to a normal distribution. These values are close to 0, which aligns with the characteristics of a normal distribution. Based on the explanations provided by (Hair et al., 2010), data is considered to follow a normal distribution if the value of skewness is less than 2 and the value of kurtosis is less than 7.

Reliability Test

The reliability test, often known as consistency, pertains to the extent to which repeated measurements of the same object using the same method yield consistent findings. To quantify reliability, the Cronbach's alpha coefficient is frequently employed, particularly in questionnaire-based studies. Cronbach's alpha is a measure of internal consistency, assessing the extent to which individual items within a scale are correlated and collectively represent a single underlying construct. In general, a Cronbach's alpha coefficient exceeding 0.6 is deemed acceptable for indicating adequate reliability, especially in exploratory studies or the initial construct development stage (Hair Jr et al., 2019). Reliability analyses were conducted using SPSS 27.0, as indicated in Table 3.

Table 3: Cronbach's alpha reliability test result

Construct	Items	Cronbach's alpha value	Internal consistency status
Value(V)	5	0.809	Very good
Belief(B)	3	0.605	Moderate
Personal norms (PN)	5	0.764	Good reliability
Energy conservation behavior (ECB)	5	0.771	Good reliability

The reliability analysis demonstrates encouraging outcomes for the constructs being examined. The Value (V) construct, comprising five items, demonstrates strong internal consistency, as evidenced by a high Cronbach's alpha coefficient of 0.809, suggesting very good reliability. For the construct belief (B), the first analysis shows below 0.6, the items lower need to be deleted to increase Cronbach alpha. After deleting 2 items, the result demonstrates moderate reliability in Cronbach's alpha coefficient, which is 0.605, which shows moderate internal consistency. Next, the personal norm (PN) construct, comprising five items, shows good reliability, with a Cronbach's alpha coefficient of 0.764. The reliability tests measure the degree of consistency of the instrument used. In addition, Cronbach's Alpha value for the energy conservation behavior (ECB) scale was **0.771,** indicating good reliability.

Validity Test

This section of the study focuses on the validation of the questionnaire. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity are essential components of this validation process, as they assess the adequacy of the sample data for conducting factor analysis. A KMO value greater than 0.5 and Bartlett's test significance level below 0.005 show a strong connection between the data, meaning the variables are closely related to each other (Field, 2013). This validation process is essential for ensuring the reliability and validity of the questionnaire. Table 4 provides the KMO values and Bartlett and the test results for each construct analyzed in this study:

Table 4: The KMO and Bartlett test result

Construct	KMO	Sampling adequacy	Bartlett test	Factor analysis suitability
Value(V)	0.821	Acceptable	<0.000	Acceptable
Belief(B)	0.583	Acceptable	<0.000	Acceptable
Personal norms (PN)	0.776	Acceptable	<0.000	Acceptable
Energy conservation behavior (ECB)	0.759	Acceptable	<0.000	Acceptable

Based on the result, the analysis results indicate that the KMO value for the value (V) is 0.821, suggesting a sufficient level of sampling adequacy. The Bartlett test for value (V) yields a p-value of 0.000, indicating a considered eminently satisfactory for factor analysis. The p-value of Bartlett's Test is 0.000, which is below the required significance level of 0.05. Thus, the high KMO values near 1.0 are clear enough and suitable for factor analysis. Likewise, the KMO value for the belief (B) is 0.583, which suggests that the sample adequacy is satisfactory. The Bartlett test for belief (B) yields a p-value of 0.000, indicating a satisfactory level of appropriateness for factor analysis. Consequently, the KMO result for personal norms (PN) is 0.776, which suggests an appropriate level of sample adequacy. The Bartlett test for personal norms (PN) yields a p-value of 0.000, indicating a satisfactory level of appropriateness for factor analysis. Furthermore, the (KMO) measure of sampling adequacy for the energy conservation behavior (ECB) scale was 0.759, and Bartlett's test of sphericity was significant, with a p-value of 0.000, confirming the suitability of the data for further analysis.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume VIII Issue XIV December 2024 | Special Issue on Management

Additionally, this study assessed the total variance explained for each variable. For validity, the total variance explained (TVE) should exceed 50%. This measure indicates the proportion of variance, expressed as a percentage, that each component contributes relative to the overall variance of all variables. The variance explained by a principal component is determined by dividing the variance of that particular component by the total variance across all components. This ratio indicates the proportion of the dataset's overall variability that is accounted for by the individual principal component, providing a measure of its contribution to the overall data structure. Table 5 presents the analysis of the TVE for each variable in this study.

Based on the result, the TVE results for Value (V) is 56.957%, which exceeds the commonly accepted threshold of 50% in exploratory factor analysis, indicating that the items are reliable and adequate (Field, 2013). Similarly, the Belief (B) construct shows a TVE of 61.557%, surpassing the 50% threshold, confirming the reliability and adequacy of the items used for this construct. For Personal Norms (PN), the TVE is 52.766%, again exceeding the 50% benchmark, validating the reliability and sufficiency of the items as measurement indicators. Finally, the TVE for Energy Conservation Behavior (ECB) is 52.340%, meeting the required threshold and affirming the reliability and validity of the measurement items for this construct.

Table 5: Result of Total Variance Explained (TVE)

Variable	**Total variance explained (TVE>50%)**	**Reliability of items in measuring a variable**
Value (V)	56.957	Comply with requirement
Belief (B)	61.557	Comply with requirement
Personal norms (PN)	52.766	Comply with requirement
Energy conservation behavior (ECB)	52.340	Comply with requirement

Pearson's Correlation Coefficient

This study evaluated the linear relationships between the independent variables and the dependent variable using Pearson's correlation coefficient. The Pearson correlation coefficient is a statistical measure used to assess the strength and direction of the linear relationship between two variables. Table 6 illustrates the result between the independent variables and the dependent variable.

Table 6: Linear relationship between independent variables and dependent variables

Dependent variable	**Parameter**	**Value(V)**	**Belief(B)**	**Personal norms (PN)**
Energy conservation behavior	Pearson correlation	0.199	0.344	0.361
	Significant value (2-tailed)	0.000	0.000	0.000
	Number of observations, N	100	100	100
A linear relationship between independent variable and dependent variable		All constructs show positive and significant		

Based on the result, the Pearson correlation analysis revealed that the coefficient for value (V) was 0.199, with a significant value of 0.000 indicating a weak positive correlation. As the significance value is less than the chosen alpha level of 0.05, this confirms a significant and positive linear relationship between value (V) and energy conservation behavior (ECB). Consequently, the Pearson correlation coefficient for belief (B) was 0.344, suggesting a moderate positive correlation, with a significant value of 0.000. This result indicates a significant and positive linear relationship between belief (B) and energy conservation behavior (ECB). Therefore, for personal norms (PN), the Pearson correlation coefficient was 0.361, indicating a moderate positive correlation, with a significant value of 0.000. The findings confirm a significant and positive linear relationship between personal norms (PN) and energy conservation behavior (ECB).

CONCLUSION

This study seeks to identify the key factors that influence energy conservation behavior, with a specific focus on academic staff from public universities in Malaysia. Based upon the Value-Belief-Norm (VBN) Theory, the study aims to understand the impact of three key independent variables—Values (V), Beliefs (B), and Personal Norms (PN)—on energy conservation behavior in the workplace. A simple random sampling method was utilized to ensure equal probability of selection for all individuals within the target population. The analysis results are summarized as follows:

The analysis demonstrates that the data distributions for all variables meet the criteria for normality based on skewness and kurtosis values. Specifically, value (V) (skewness=−0.574, kurtosis=2.650), belief (B) (skewness=−0.364, kurtosis=0.14), personal norms (PN) (skewness=−0.466, kurtosis=0.146), and energy conservation behavior (ECB) (skewness=−0.541, kurtosis=0.478) fall within the acceptable range, with skewness values between -1 and +1. These findings confirm the suitability of the dataset for further statistical analysis.

The Cronbach's alpha value for the Value (V) construct is 0.809, indicating strong internal consistency and reliability for the scale measuring this variable. For the Belief (B) construct, Cronbach's alpha is 0.605, suggesting a moderate but acceptable level of internal consistency. Next, Cronbach's alpha for Personal Norms (PN) is 0.764, demonstrating good internal consistency, meaning the items within this scale are highly interrelated. Furthermore, Cronbach's alpha for energy conservation behavior (ECB) is 0.771. Overall, the four constructs—Value, Belief, Personal Norms, and energy conservation behavior—show acceptable to good internal consistency, with their Cronbach's alpha values supporting the reliability of each construct. This indicates that the internal consistency of all four constructs is adequate for further analysis.

The KMO values for Value (V) (0.821), Belief (B) (0.583), Personal Norms (PN) (0.776), and energy conservation behavior (ECB) (0.759) suggest varying levels of sampling adequacy for factor analysis. While Value (V), Personal Norms (PN), and energy conservation behavior (ECB) show good to excellent KMO values, the Belief (B) construct has a marginal KMO value. However, this is still within the acceptable range for exploratory factor analysis (EFA). Bartlett's test of sphericity results for all four constructs yields a p-value of 0.000, indicating an acceptable level for factor analysis.

Based on the Pearson correlation analysis, the constructs of value (V), belief (B), and personal norms (PN) all demonstrate statistically significant positive relationships with energy conservation behavior (ECB). The correlation for value (V) (0.199) reveals a weak but significant positive relationship, indicating that values have a limited influence on energy conservation behavior (ECB). In contrast, belief (B) (0.3.44) demonstrates a moderate positive correlation, suggesting a more substantial role of beliefs in influencing such behavior. Similarly, personal norms (PN) (0.361) exhibit a moderate positive correlation, highlighting their significant impact on promoting energy conservation behavior (ECB).

This finding illustrates that all three constructs' interconnectedness positively contributes to energy conservation behavior, in which belief and personal norms emerge as stronger predictors compared to value.

ACKNOWLEDGMENTS

The authors acknowledge to Universiti Malaysia Perlis for support which contributed significantly to the successful completion of this study.

REFERENCES

1. Al Mamun, A., Hayat, N., Masud, M. M., Makhbul, Z. K. M., Jannat, T., & Salleh, M. F. M. (2022). Modelling the significance of Value-Belief-Norm theory in predicting solid waste management intention and behavior. Frontiers in Environmental Science, 10, 906002.

2. Almeida, L. M., Tam, V. W. Y., & Le, K. N. (2021). Occupant behaviour and its relation to climate in Australia. Proceedings of the Institution of Civil Engineers-Engineering Sustainability, 174(4), 174–188.
3. Aprile, M. C., & Fiorillo, D. (2023). Other-regarding preferences in pro-environmental behaviours: Empirical analysis and policy implications of organic and local food products purchasing in Italy. Journal of Environmental Management, 343, 118174.
4. Bäcklund, K., Molinari, M., Lundqvist, P., & Palm, B. (2023). Building Occupants, Their Behavior and the Resulting Impact on Energy Use in Campus Buildings: A Literature Review with Focus on Smart Building Systems. Energies, 16(17), 6104.
5. Balundė, A., Poškus, M. S., Jovarauskaitė, L., Sarid, A., Farangitakis, G., Knippels, M.-C., Hadjichambis, A. C., & Paraskeva-Hadjichambi, D. (2020). Values, Beliefs and Environmental Citizenship.
6. Fathi, M. (2024). Sustainability and Energy Efficiency in Buildings: A Review. Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 16(2), 3123002.
7. Field, A. (2013). Discovering statistics using IBM SPSS statistics. sage.
8. Gupta, A., & Sharma, R. (2019). Pro-environmental behaviour of adventure tourists: an applicability of value belief norm theory. Tourism: An International Interdisciplinary Journal, 67(3), 253–267.
9. González-Torres, M., Pérez-Lombard, L., Coronel, J. F., Maestre, I. R., & Yan, D. (2022). A review on buildings energy information: Trends, end-uses, fuels and drivers. Energy Reports, 8, 626-637.
10. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis: Pearson College division. Person: London, UK.
11. Hair Jr, J., Page, M., & Brunsveld, N. (2019). Essentials of business research methods. Routledge.
12. Harputlugil, T., & de Wilde, P. (2021). The interaction between humans and buildings for energy efficiency: A critical review. Energy Research & Social Science, 71, 101828.
13. Heib, S., Hildebrand, J., & Kortsch, T. (2023). Energy saving behavior in university organizations: The value of norm constructions in a “rational choice” action model. Frontiers in Psychology, 14, 1082061.
14. Latif, A. F., Ahmad, N. A., Abdullah, M. R., Ismail, A., & Ghani, A. A. A. (2019). A review on energy performance in Malaysian universities through building information modelling (BIM) adaptation. IOP Conference Series: Earth and Environmental Science, 291(1), 12033.
15. Li, L., Sun, W., Hu, W., & Sun, Y. (2021). Impact of natural and social environmental factors on building energy consumption: Based on bibliometrics. Journal of Building Engineering, 102136.
16. Li, Z., Di, Z., & Zitan, L. (2021). Analysis of Employees' Energy Conservation Behaviour in the Office Buildings - Based on the Structural Equation Model. IOP Conference Series: Earth and Environmental Science, 766(1). https://doi.org/10.1088/1755-1315/766/1/012073
17. Mirza, S., Dr. Faiza Latif, & Shabana Asghar. (2023). Relationship Among Climate Change Awareness and Online Media, Environment-Friendly Beliefs and Behavior. Journal of Arts & Social Sciences, 10(1), 69–78. https://doi.org/10.46662/jass.v10i1.332
18. Özekici, Y. K. (2022). Extending value-belief and norm theory with social identity for preventing food waste at restaurants. Turizm Akademik Dergisi, 9(1), 273–291.
19. Perera, C. R., Kalantari, H., & Johnson, L. W. (2022). Climate change beliefs, personal environmental norms and environmentally conscious behaviour intention. Sustainability, 14(3), 1824.
20. Priss, O., Pugachov, M., Pugachov, V., Yaremko, I., & Shchabelska, V. (2023). The development of the world economy and the impact of the global food crisis 2022-2023. Economic Affairs, 68(1s), 35–42.
21. Sahin, E. (2013). Predictors of Turkish Elementary Teacher Candidates' Energy Conservation Behaviors: An Approach on Value-Belief-Norm Theory. International Journal of Environmental and Science Education, 8(2), 269–283.
22. Schwartz, S. H. (1977). Normative influences on altruism. Advances in Experimental Social Psychology, 10(C), 221–279. https://doi.org/10.1016/S0065-2601(08)60358-5
23. Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. Journal of Social Issues, 56(3), 407–424.

24. Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. Human Ecology Review, 81–97.
25. Tien, P. W., Wei, S., Calautit, J. K., Darkwa, J., & Wood, C. (2022). Enhancing the detection performance of a vision-based window opening detector. Cleaner Energy Systems, 3, 100038.
26. Ulucak, R., & Baloch, M. A. (2023). An empirical approach to the nexus between natural resources and environmental pollution: do economic policy and environmental-related technologies make any difference? Resources Policy, 81, 103361.
27. Xu, Y., Li, W., & Chi, S. (2021). Altruism, environmental concerns, and pro-environmental behaviors of urban residents: a case study in a typical Chinese city. Frontiers in Psychology, 12, 643759.
28. Yoshino, H., Hong, T., & Nord, N. (2017). IEA EBC annex 53: Total energy use in buildings—Analysis and evaluation methods. Energy and Buildings, 152, 124–136.
29. Zhang, Y., Bai, X., Mills, F. P., & Pezzey, J. C. V. (2018). Rethinking the role of occupant behavior in building energy performance: A review. Energy and Buildings, 172, 279–294.
30. Zharova, A., & Lee, H.-E. (2022). Understanding User Perception and Intention to Use Smart Homes for Energy Efficiency: A Survey. ArXiv Preprint ArXiv:2212.05019.