

Investigating factors influencing generation Z's pro-environmental behavior to support the energy transition in Jakarta, Indonesia

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Abstract. The energy transition is crucial for mitigating climate change and achieving sustainable development and resilience. As the energy transition advances, generation Z will soon be responsible for taking care of the environment. This study aims to investigate the factors influencing generation Z's pro-environmental behavior (PEB) to support the energy transition, using the combination of the theory of planned behavior and PEB. Data were collected through an online questionnaire among 400 generation Z individuals living in Jakarta, Indonesia. The socio-demographic profile was assessed to ensure the respondents fit the target criteria. Partial least square structural equation modeling (PLS-SEM) was used to analyze the reliability and validity of the measurement model and conduct hypothesis testing. The results show that attitude, subjective norms, and perceived behavior control significantly influence generation Z's PEB to support the energy transition. Perceived behavior control was the most significant factor determining PEB, so measures and policies to increase generation Z's support should focus on PBC. This finding could enhance understanding and provide insights to formulate effective interventions to increase generation Z's support towards the energy transition. This study contributes to the energy transition discussion as included in the Sustainable Development Goals.

1 Introduction

Climate change is one of the greatest threats to Earth and its people. The primary goal of taking climate action is to meet the Paris Agreement target of keeping global temperature rise to no more than 1.5°C above the pre-industrial levels to prevent significant damage to the climate and the environment by reducing greenhouse gas emissions [1]. Through the Paris Agreement, it is hoped that the increase in the Earth's temperature will not exceed 2°C to prevent significant damage to the climate and the environment. If global warming exceeds the limit, it will cause rising sea levels, higher water temperatures, heavy rains and

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storms, and warmer climates, threats to food security and biodiversity. A key part of minimizing the impact of climate change is a shift in the energy sector. The energy transition involves a substantial reduction in the use of fossil fuels, widespread electrification, increased energy efficiency, and the development of renewable energy sources. The transition to cleaner energy sources is included in Sustainable Development Goals number 7, which aims to “Ensure access to affordable, reliable, sustainable and modern energy for all.” [2].

As generation Z enters the workforce as employees, activists, stakeholders, and policymakers, they will soon oversee climate management. Their awareness of the current environmental situation can promote sustainable development principles by adapting pro-environmental behavior to support the energy transition, such as using energy efficiently, switching to renewable energy technologies, and sanctioning environmentally harmful actions. Several studies have integrated the theory of planned behavior and the pro-environmental behavior concept to investigate young people’s (age 18-40) behavioral intention on low-carbon travel [3], young consumers’ (age 18-34) purchase behavior toward energy-efficient appliances [4], and generation Z’s (born between 1995 and 2010) intention to adopt green vehicles [5] and recycled clothing [6]. The novelty of this study lies in its focus on generation Z and the energy transition, which is lacking in previous studies despite the topic’s significance. Therefore, this study aims to narrow the gap by investigating the factors influencing generation Z’s pro-environmental behavior to support the energy transition.

2 Theoretical framework and research model

The theoretical framework of this study is based on the pro-environmental behavior concept and the theory of planned behavior. Pro-environmental behavior, or environmentally significant behavior, refers to a behavior that positively impacts the environment or is intended to benefit the environment. It includes environmental activism, non-activist behavior in the public sphere, private sphere environmentalism, and other behavior influencing people’s actions [7]. The theory of planned behavior (TPB) states that human behavior is guided by the intention to perform a certain behavior, driven by attitudes, subjective norms, and perceived behavioral control [8]. The TPB is a conceptual extension of the Theory of Reasoned Action (TRA) [9], which assumes that the intention to perform a behavior is driven by attitude towards the behavior and subjective norms. However, TRA presupposes that the behavior is under volitional control without recognizing requisite opportunities and resources [10]. The concept of TRA might not be enough to predict intention or behavior determined by non-volitional factors. Therefore, perceived behavioral control was added as a new construct for TPB to discover individual perceptions of their ability to perform a specific behavior and improve the theory’s predictability [7]. In this study, pro-environmental behavior (PEB) to support the energy transition is a dependent construct and function of three independent constructs: attitude towards the energy transition (AT), subjective norm (SN), and perceived behavioral control (PCB).

3 Methodology

This study used questionnaires to collect responses from generation Z individuals (age 18-26 as of 2023) in Jakarta, Indonesia. The 2020 Indonesian census [11] defined those born between 1997 and 2012 as generation Z. The census reported that the total population of generation Z individuals in Jakarta is 2,297,094 people. The required sample size for this study was calculated using the Taro Yamane formula [12], which resulted in 400

respondents. The data was collected online from December 2022 to January 2023, and strictly shared with generation Z individuals who have completed high school. Previous studies indicated that education level affects an individual’s environmental knowledge, attitude, and PEB [13-15]. Therefore, this study assumed that higher-educated generation Z individuals better understand PEB and the energy transition issue. The questionnaire was made online using Google Forms and distributed online through messaging applications and social media. The study context was presented to the respondents before filling out the questionnaire to gain their consent. The questionnaire was written in Indonesian and includes socio-demographic information (sex, age, education, and occupation) and multiple choices questions regarding PEB to support the energy transition, using AT, SN, and PBC constructs. Questionnaire participants responded to the questions based on a 5-type Likert scale, ranging from 1 = “strongly disagree”, 2 = “disagree”, 3 = “neutral”, 4 = “agree” to 5 = “strongly agree”. The valid 400 responses were analyzed with partial least squares structural equation modeling (PLS-SEM) using SmartPLS 3.0 software to assess the measurement model, discriminant validity, and bootstrapping to gain hypothesis testing results. Socio-demographic information was analyzed descriptively.

4 Results and discussion

4.1 Socio-demographic profile

The socio-demographic profile of respondents is presented in Table 1. Among 400 respondents in this study, 57% (n = 228) are female and 43% (n = 172) are male. The majority of the respondents are between the age of 20 and 24 (47.75%), followed by ages 25-26 (36.75%) and ages 18-19 (15.50%). More than half of the respondents hold bachelor’s degrees or diploma 4 (58.75%), while 24.5% of the respondents hold high school diplomas. Most of the respondents are employees or business owners (71.50%), followed by students (24.50%). This result indicates that all respondents are in accordance with the desired criteria, which is higher-educated generation Z.

Table 1. Socio-demographic profile.

Category	Item	Frequency	Percentage
Sex	Female	228	57
	Male	172	43
Age	18-19	62	15.50
	20-24	191	47.75
	25-26	147	36.75
Education	High school	98	24.50
	Diploma 1/2/3	54	13.50
	Bachelor’s degree/Diploma 4	235	58.75
	Master’s degree	13	3.25
Occupation	Student	98	24.50
	Employee/business owner	286	71.50
	Homemaker	10	2.50
	Unemployed	6	1.50

4.2 Measurement model analysis

The result of the measurement model analysis is presented in Table 2. Items with loading factors lower than 0.4-0.5 should be eliminated [16]. The accepted value of Cronbach’s alpha and composite reliability (CR) is above 0.7 [17,18]. The average variance extracted

(AVE) have a recommended value of 0.5 (50%) [19]. All values in Table 2 are according to the recommendations. Therefore, all items in the constructs have achieved construct reliability and convergent validity.

Table 2. Measurement model.

Construct	Item	Factor Loading	Cronbach's Alpha	CR	AVE
Attitude towards energy transition (AT)	AT1	0.780	0.855	0.896	0.634
	AT2	0.829			
	AT3	0.819			
	AT4	0.779			
	AT5	0.772			
Subjective norms (SN)	SN1	0.826	0.827	0.884	0.656
	SN2	0.797			
	SN3	0.826			
	SN4	0.791			
Perceived behavioral control (PBC)	PBC1	0.743	0.791	0.857	0.545
	PBC2	0.740			
	PBC3	0.733			
	PBC4	0.698			
	PBC5	0.775			
Pro-environmental behavior (PEB)	PEB1	0.825	0.875	0.909	0.666
	PEB2	0.815			
	PEB3	0.802			
	PEB4	0.801			
	PEB5	0.837			

4.3 Discriminant validity assessment

The discriminant validity of the constructs was assessed with the Fornell & Larcker criterion and the heterotrait-monotrait (HTMT) ratio. The Fornell-Larcker criterion (Table 3) shows the values of square root AVE of each construct that should have greater values than the correlations with other constructs, both horizontally and vertically [20]. The square root AVE values of all constructs suggest appropriate discriminant validity. The HTMT ratio (Table 4) has a threshold value of 0.9 which indicates adequate discriminant validity [21]. The HTMT values of the constructs in the model are lower than the threshold, establishing discriminant validity.

Table 3. Fornell & Larcker criterion.

	AT	PBC	PEB	SN
AT	0.796			
PBC	0.667	0.738		
PEB	0.638	0.693	0.816	
SN	0.364	0.401	0.472	0.810

Table 4. Heterotrait-monotrait ratio.

	AT	PBC	PEB	SN
AT				
PBC	0.807			
PEB	0.734	0.829		
SN	0.427	0.495	0.547	

4.4 Hypothesis test

The hypothesis test was done using the bootstrapping method in SmartPLS 3.0 at 5,000 subsamples and 5% significance, resulting in path analysis. The result is shown in Table 5 and indicates that AT ($\beta = 0.253, p < 0.05$), SN ($\beta = 0.199, p < 0.05$), and PBC ($\beta = 0.424, p < 0.05$) have a significant influence on PEB. Thus, all hypotheses are supported. The graphical display of the path analysis is displayed in Figure 1.

Table 5. Hypothesis testing.

Hypotheses	Path Correlation	Coefficient (β)	P-value (sig.)	Result
H ₁	AT → PEB	0.283	0.000	Supported
H ₂	SN → PEB	0.199	0.000	Supported
H ₃	PBC → PEB	0.424	0.000	Supported

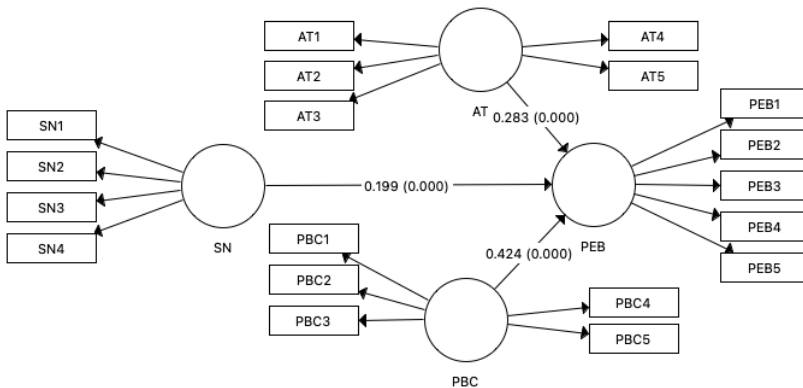


Figure 1. Path analysis of the research model.

This study found that AT towards the energy transition, SN, and PBC significantly influence generation Z's PEB to support the energy transition, which aligns with previous findings [13,22]. The findings indicated that generation Z individuals with a positive AT towards the energy transition and its policy tend to behave pro-environmentally and support the issue. Measures should be taken to increase generation Z individuals' favorable attitude toward the energy transition and enhance their awareness and concern regarding environmental issues by highlighting the importance of transitioning to clean energy and the impacts of climate change through education, seminars, and other channels. Reflecting on Ajzen's postulates of TPB [8], only relying on AT to predict PEB is insufficient, and therefore, other factors (SN and PBC) should be considered.

Although having an influence, SN was found to have the least power to predict generation Z's PEB. Similar to the previous finding [13,14], generation Z individuals would support the energy transition to some extent when people closest to them also practice or motivate them to do it. On the other hand, generation Z has independent minds and might not be easily influenced by others. Thus, generation Z should recognize people's success stories of implementing PEB, such as the benefits of using rooftop solar panels in their residences to reduce electricity bills. However, not all generation Z individuals can choose to support the energy transition due to other factors, e.g., financial resources, so it may be more suitable for them to voice their opinion, ideas, and feedback on the current energy transition policies and as catalyst for a more robust energy transition policies in the future, while also urging stakeholders to adapt energy transition measures.

PBC has the most substantial impact on PEB in this model (Figure 1). Thus, among all constructs, PBC is the main determining factor of generation Z's PEB to support the energy

transition. Confirming the previous study [3,13,14], the outcome of this study suggested that generation Z expects to have a high ability to control their behavior because they tend to be independent thinkers. This relates to the lower predicting power of SN, where generation Z's decision to perform PEB is not easily influenced by those close to them [3]. There is a need to create a condition that facilitates generation Z individuals to behave pro-environmentally and remove barriers to increase their support for the energy transition. This requires systemic cooperation between the public, government, and other stakeholders to synergize their efforts for the energy transition. Intervention strategies to increase generation Z's support should prioritize this aspect, such as engaging them in decision-making. Policymakers can increase generation Z representation in decision-making, then explicitly state how generation Z's contributions are considered in a particular policy, and how it would affect them. The government can also increase generation Z's support toward the energy transition by offering incentives to make renewable energy sources or energy-efficient appliances more affordable and accessible.

5 Conclusion

This study investigated the factors influencing generation Z's PEB to support the energy transition. Using the TPB and PEB concepts, this study found that generation Z's AT, SN, and PBC influenced their PEB to support the energy transition through the identified pathways. Based on the result, each construct influences PEB differently. PBC was found to have the most significant impact on generation Z's PEB, suggesting the importance of facilitating generation Z individuals to support the energy transition at ease and removing barriers that may hinder their support. It should be noted that the scope of this study limits to generation Z living in Jakarta, so it might not be generalizable to other areas in Indonesia or other countries as the development and awareness of the energy transition would be different. Future studies can add more constructs to enhance the TPB model's predictability, such as environmental awareness [13], environmental risk perception, and perceived moral obligation [3] of generation Z, including the relationship between constructs.

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