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Redimensioning the Theory of Planned Behavior on Workplace Energy Saving Intention: The Mediating Role of Environmental Knowledge and Organizational Culture

Luis J. Camacho [1,*], Moises Banks [2], Satesh Sookhai [3] and Emely Concepción [2]

[1] School of Business, Empire State University, New York, NY 10013, USA
[2] School of Economic and Business Sciences, APEC University, Santo Domingo 10100, Dominican Republic; mbanks@adm.unapec.edu.do (M.B.); econcepcion@adm.unapec.edu.do (E.C.)
[3] Department of Management Studies, The University of the West Indies, St. Augustine BB11000, Trinidad and Tobago; satesh.sookhai@my.uwi.edu
* Correspondence: luis.camacho@sunyempire.edu

Abstract: This study extends the Theory of Planned Behavior (TPB) to examine the factors influencing the employees' intentions to save energy in the workplace (INSER), incorporating organizational culture (ORGCULT) and environmental knowledge (ENVKNOW) as mediating variables. Structural equation modeling (SEM) of survey data reveals that attitudes toward energy saving (ATESs) and perceived behavioral control (PERBCON) significantly predict INSER, while subjective norms (SUBNORMS) do not exert a direct effect. ORGCULT emerges as a strong mediator, highlighting its role in translating pro-environmental attitudes into actionable intentions. In contrast, ENVKNOW does not mediate the examined relationships, challenging the assumption that knowledge alone is sufficient to drive energy-saving behavior. These findings suggest that organizational commitment and leadership engagement exert a greater influence than peer norms or informational efforts in shaping sustainable workplace behaviors. From a practical perspective, the study underscores the importance of cultivating a sustainability-oriented organizational culture, implementing structural supports, and employing behavioral interventions beyond traditional awareness campaigns. Theoretically, it refines the TPB by illustrating that institutional factors may precede normative pressures in professional settings. Overall, the research contributes to the corporate sustainability literature by advocating for leadership-driven engagement strategies and policy-level interventions to promote long-term energy efficiency.

Keywords: intention to save energy in the workplace; theory of planned behavior; organizational culture; environmental knowledge; corporate sustainability

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1. Introduction

Workplace energy conservation is essential to global sustainability, as organizations are major energy consumers and contributors to carbon emissions [1,2]. Increasingly, businesses acknowledge the role of employees in achieving energy efficiency goals. Research shows that energy-saving behaviors at work can significantly reduce operational costs and environmental impact, positioning this as a critical area of study [3–5]. However, promoting such behaviors presents challenges, as employees typically lack direct financial incentives, unlike in household settings [6,7].

The Theory of Planned Behavior (TPB) [8] offers a well-established framework for understanding the psychological factors influencing the employees' intentions to conserve

energy. It posits that attitudes toward energy saving (ATESs), subjective norms (SUBNORMS), and perceived behavioral control (PERBCON) collectively shape behavioral intentions, which in turn affect the intention to save energy (INSER) [9,10]. Despite its strengths, researchers have called for contextual adaptations to better capture organizational influences on sustainability behavior [11].

Recent studies identify environmental knowledge (ENVKNOW) and organizational culture (ORGCULT) as influential in shaping energy-saving intentions in professional settings [1,12]. Employees with higher environmental awareness and who work in sustainability-oriented cultures are more likely to engage in conservation behaviors. However, these factors are not yet fully integrated into the TPB framework, highlighting the need for a more comprehensive model.

While TPB has been validated in predicting pro-environmental behavior, workplace energy use is often a collective responsibility rather than an individual financial concern [5,13]. This raises questions about the relative influence of individual attitudes versus organizational and contextual factors. Moreover, the mediating roles of environmental awareness and workplace norms within TPB remain underexplored [2,9].

This study addresses these gaps by extending TPB to include ORGCULT and ENVKNOW as mediating variables. First, although TPB emphasizes individual psychological predictors, organizational elements such as leadership and institutional policies also shape sustainability behavior [1]. Second, ENVKNOW's impact on INSER remains inconsistent across studies [14,15]. Third, SUBNORMS may exert weaker influence in workplaces where formal policies and leadership directives play a more significant role [10,16].

This research proposes an extended TPB model incorporating individual and organizational factors to better explain INSER. Specifically, it examines the influence of ATESs, SUBNORMS, and PERBCON on INSER and the mediating effects of ORGCULT and ENVKNOW.

By contextualizing TPB within organizational settings, this study enhances the model's explanatory power and offers practical insights for promoting sustainability in corporate environments. The findings aim to guide policymakers and business leaders in designing interventions that align with corporate social responsibility goals [1,2].

The remainder of the paper is organized as follows: the literature review discusses TPB and the roles of ORGCULT and ENVKNOW; the methodology outlines the research design and analytical approach; the results present key findings; the discussion interprets the results, addresses limitations, and explores implications; and the conclusion summarizes contributions and offers recommendations for future sustainability initiatives.

2. Literature Review

Workplace energy conservation is increasingly recognized as a key strategy for reducing carbon emissions and lowering operational costs [17]. Organizations are major energy consumers, and employee behavior is critical in achieving energy efficiency goals [18]. The TPB is widely used to explain energy-saving behaviors in organizational settings. It posits that ATESs, SUBNORMS, and PERBCON shape an individual's intentions to conserve energy, predicting actual energy-saving behavior [8].

An ATES is a key determinant of workplace energy conservation. Research indicates that employees with a positive attitude toward energy conservation are likelier to adopt energy-saving practices. This aligns with findings that pro-environmental attitudes strongly predict workplace energy-saving intentions [3]. Additionally, SUBNORMS, or the social pressures employees experience regarding energy-saving behavior, influence conservation efforts. However, some studies suggest that SUBNORMS have a weaker

impact in workplace settings where energy costs are borne collectively by organizations rather than individuals.

Energy conservation is a global concern, particularly in developing countries, where a high energy consumption exacerbates environmental degradation and economic strain. Organizations can reduce their energy consumption through technological advancements and by fostering energy-efficient behaviors among employees [19]. The expanded TPB model offers valuable insights into the behavioral drivers of workplace energy conservation, helping organizations design more effective interventions to encourage sustainable energy practices.

2.1. Theory of Planned Behavior on Intention to Save Energy in the Workplace

The TPB is a widely used psychological framework that predicts intentional behavior based on three primary components: ATESs, SUBNORMS, and PERBCON. This theory has been instrumental in understanding various behaviors, including workplace energy-saving intentions. TPB suggests that individuals' intentions to conserve energy are shaped by their attitudes toward conservation, the perceived social pressure to engage in such behaviors, and confidence in their ability to perform energy-saving actions [8]. Recent studies have extended TPB by incorporating additional variables to enhance its predictive power in workplace energy conservation. Researchers have found that descriptive norms, personal moral norms, environmental knowledge, and organizational culture significantly improve the model's ability to explain energy-saving behaviors [1,2,9,11,20]. These extensions are crucial, as they account for factors beyond individual intention, such as workplace culture and ethical considerations, which influence long-term energy conservation practices. One of the key determinants of energy-saving behavior is attitude, as employees with positive attitudes toward conservation are more likely to adopt energy-efficient practices. Additionally, social norms influence behavior, though their impact varies. While SUBNOMS—social pressure from peers—are weak predictors in some studies, descriptive norms (observing colleagues engaging in energy-saving behaviors) and personal moral norms (an individual's sense of ethical responsibility toward conservation) have been identified as more potent motivators [2,21].

PERBCON is another critical factor in predicting energy-saving intentions. Employees who feel they have control over energy-saving actions, such as adjusting office lighting or reducing unnecessary energy consumption, are likelier to engage in these behaviors [11,12]. Conservation efforts are more effective when organizations provide employees with the necessary infrastructure and autonomy to make energy-conscious decisions. In addition to psychological factors, habit formation plays a crucial role in workplace energy conservation. Research suggests that habitual behaviors can moderate the relationship between TPB constructs and energy-saving intentions, emphasizing the need for sustained interventions that encourage routine conservation practices [11,21]. When employees develop energy-saving habits, these behaviors become automatic, reducing the reliance on conscious decision-making.

Organizational and contextual factors also shape the employees' energy-saving behaviors. Organizational support, group norms, and workplace climate significantly influence conservation efforts. A positive organizational environment that encourages energy efficiency can either facilitate or hinder the employees' willingness to engage in conservation practices [10,12]. Companies that implement clear energy-saving policies, provide resources, and foster a culture of sustainability are more likely to achieve meaningful energy reductions.

Findings from these studies highlight several strategies for promoting workplace energy conservation. Enhancing organizational support, fostering positive group norms,

and increasing perceived behavioral control can significantly boost employees' intentions to conserve energy. Integrating personal moral and descriptive norms into organizational policies can reinforce energy-saving behaviors, leading to a more sustainable workplace [2,9,10]. By considering both psychological and organizational factors, businesses can develop more effective interventions to encourage long-term energy-efficient practices among employees.

2.2. Intention to Save Energy in the Workplace

In the recent years, pro-environmental behavior has become a growing societal concern [22]. Workplace energy conservation is crucial in reducing energy consumption and carbon emissions, contributing to environmental protection and public health [5]. Since workplaces account for a significant share of total energy use [23], they offer substantial opportunities for energy savings. Employees spend approximately 60–70% of their weekly time at work [2], positioning companies as key facilitators of energy conservation. However, achieving meaningful reductions requires regulatory compliance and active employee engagement [17].

Workplace energy-saving behaviors primarily involve reducing electricity consumption through conscious usage patterns. Simple actions, such as turning off air conditioning when leaving an office, contribute to energy efficiency [24]. Beyond environmental benefits, energy conservation also provides financial advantages by lowering operational costs and enhancing a company's competitiveness and profitability [20]. Given these economic and environmental implications, understanding employee engagement in energy-saving behaviors is essential for designing effective policies and interventions.

Several factors influence employees' intentions to save energy, including altruistic motivations, organizational support, personal norms, and personality traits. Altruism plays a key role, as employees often engage in energy-saving behaviors to benefit their organization and the environment, even with minimal personal gain. Additionally, impure altruism—where individuals experience a "warm glow" or personal satisfaction from their actions—contributes to energy-saving intentions. While motivations related to organizational and environmental benefits strengthen energy-saving behaviors, those driven by personal reputation concerns may weaken them [7].

The attitude-behavior-context model emphasizes the interplay between individual beliefs and external conditions in shaping energy-saving behaviors. Employees with pro-environmental attitudes and a perception of strong organizational support are more likely to engage in conservation efforts, even at the expense of personal convenience. Additionally, positive workplace norms encourage peer communication and collective action toward energy efficiency [10].

The extended TPB provides a valuable framework for analyzing the INSER. Key determinants include attitudes toward energy saving, subjective norms, perceived behavioral control, and personal moral norms. Among these, descriptive norms—observing colleagues engage in energy-saving behaviors—and personal moral norms—a sense of ethical responsibility—are powerful predictors. In contrast, subjective norms—perceived social expectations—may negatively influence actual behavior [2,9,11].

Organizational support and social pressures also shape energy-saving behaviors. When top management actively promotes energy conservation, employees are more likely to adopt energy-efficient practices. A positive organizational climate encourages sustainability-focused behaviors, while social pressures from supervisors or colleagues can further reinforce energy-saving habits [5,25].

Personality traits influence variations in energy-saving behaviors. Agreeableness is positively associated with direct energy-saving actions, as agreeable individuals are more cooperative and mindful of collective goals [26]. Additionally, demographic factors such as

age and work experience moderate the relationship between personality and energy-saving behaviors, indicating that tailored interventions may be more effective [26].

Understanding these determinants enables organizations to develop targeted interventions that encourage energy-saving behaviors. Strengthening organizational support, fostering positive workplace norms, and reinforcing personal moral responsibility can significantly enhance the employees' commitment to conservation. Moreover, tailoring strategies based on individual personality traits and demographic characteristics can improve the overall effectiveness of energy-saving programs. Combining altruistic motivations, organizational influences, personal norms, and personality traits shapes workplace energy-saving behaviors. Addressing these factors allows organizations to foster a culture of energy efficiency, ultimately benefiting both the environment and long-term business sustainability.

2.3. Subjective Norms and Intention to Save Energy

SUBNORMS refer to the influence of perceived social expectations on an individual's behavior [27]. They shape how individuals believe they should act based on the expectations of others, ultimately affecting their decision-making and performance. Family, co-workers, and peers play a critical role in forming these norms, meaning their attitudes toward energy conservation can significantly impact an individual's intention to save energy [28,29]. Research suggests that SUBNORMS positively influence intentions toward pro-environmental behavior, as individuals tend to conform to the values and expectations of those around them [30]. Additionally, individuals who recognize the urgency of addressing climate change and feel a moral responsibility toward environmental protection are more likely to adopt energy-saving behaviors [31,32].

Social influence is a key driver of workplace behavior, particularly in structured environments where interactions with colleagues and supervisors shape the employees' decisions. SUBNORMS—perceived social pressure from peers—and ORGCULT often strongly predict pro-environmental behavior. Employees who perceive energy conservation is valued in their workplace are more likely to align their behaviors with this expectation. This aligns with the findings of [33], who argue that SUBNORMS significantly influence decision-making, particularly in professional settings where employees seek to conform to group expectations. Hence, we propose the following hypothesis:

H1a. *SUBNORMS have a significant and positive impact on INSER.*

Despite the consensus on the importance of SUBNORMS, empirical findings on their impact on workplace energy conservation remain inconsistent. Some studies confirm a strong positive correlation between SUBNORMS and energy-saving intentions. In contrast, others suggest their influence is limited in organizations with weak or unclear energy policies [2]. In workplaces with well-established sustainability policies and leadership commitment to energy efficiency, SUBNORMS tend to have a more substantial effect. Conversely, in environments where such initiatives are absent or poorly communicated, employees may feel less social pressure to engage in energy-saving behaviors.

Further supporting the role of SUBNORMS, [34] found that perceived social expectations positively influence employees' energy-saving behavior. These findings reinforce that workplace culture and peer influence are critical in shaping conservation efforts. Organizations that actively promote energy-saving behaviors through leadership, communication, and peer reinforcement can strengthen subjective norms, ultimately fostering a more sustainable work environment. Therefore, the following is hypothesized:

H1b. *SUBNORMS have a significant and positive impact on ENVKNOW.*

2.4. Attitude Toward Energy Savings and Intention to Save Energy

Attitude refers to an individual's behavioral tendencies and evaluation of a particular situation [35]. Within the TPB framework, attitude plays a crucial role in shaping behavioral intentions, as a positive attitude toward a specific action increases the likelihood of engaging in that behavior [27]. The ATES, for instance, influences the employees' willingness to adopt energy-saving practices. Behavioral beliefs determine these attitudes, where positive attitudes promote energy-saving behaviors, while negative attitudes discourage them [35,36]. Several studies have confirmed the link between pro-environmental attitudes and energy-saving behavior, demonstrating that individuals with more substantial environmental concerns are more likely to engage in conservation efforts [15,30]. Despite the theoretical significance of attitudes in shaping employee behavior, research has shown inconsistencies in their impact on workplace energy-saving behavior. While the TPB suggests that stronger pro-environmental attitudes increase the likelihood of engaging in energy-saving behaviors [8], empirical studies indicate that this relationship is often weaker in workplace settings than in household energy conservation [2]. This discrepancy arises because employees in professional settings typically do not directly bear the financial costs of energy consumption, reducing the personal incentive to engage in conservation efforts. Consequently, organizational policies, social norms, and structural constraints may influence workplace energy-saving behavior more than individual attitudes alone.

H2a. *The ATES has a significant and positive impact on INSER.*

Interestingly, research highlights a spillover effect between household and workplace energy-saving behaviors. Employees who practice energy conservation at home will likely carry these habits into the workplace [37]. This suggests that personal environmental behaviors extend beyond individual settings and influence workplace actions. However, in cases where employees lack energy-saving habits in their personal lives, they may be less inclined to adopt such behaviors at work, regardless of their stated attitudes toward conservation. This finding challenges the assumption that workplace attitudes alone drive energy-saving behavior. It underscores the need for broader interventions that promote energy-conscious lifestyles at home and in the workplace.

The relationship between ATESs and INSER in the workplace has been further explored in studies emphasizing the role of ORGCULT. Employees are more likely to act on their pro-environmental attitudes if they perceive that their energy-saving efforts are recognized and valued within their organization [38,39]. This highlights the importance of fostering a workplace culture supporting sustainability initiatives. Organizations seeking to improve energy efficiency should promote pro-environmental attitudes at work and encourage employees to adopt sustainable behaviors in their personal lives, reinforcing positive spillover effects that contribute to long-term sustainability goals. Therefore, the following is hypothesized:

H2b. *The ATES has a significant and positive impact on ORGCULT.*

Employees who value energy conservation are typically more motivated to learn about sustainability practices. This knowledge-seeking behavior enhances their environmental literacy, enabling them to make informed decisions. Studies suggest that a pro-environmental mindset positively influences the acquisition of ENVKNOW [15,30]. Thus, the following is hypothesized:

H2c. *The ATES has a significant and positive impact on ENVKNOW.*

2.5. Perceived Behavioral Control and Intention to Save Energy

PERBCON refers to the difficulty an individual experiences when attempting to perform a specific behavior and their perceived ability to execute it successfully [25,29]. It encompasses an individual's control over their actions and confidence in achieving the desired behavior [23]. When individuals decide to take a specific action, their internal ability to assess the necessary steps influences their perception of the difficulty involved [28]. This means that when individuals possess sufficient knowledge or resources to complete a task, their confidence in performing that behavior increases, leading to a greater likelihood of action [40].

In workplace settings, however, employees often struggle with ambiguous leadership directives, which can reduce their perceived control over energy-saving behaviors [35]. For example, if energy conservation guidelines are unclear or decision-making is centralized, employees may feel powerless to influence workplace energy use. Studies indicate that PBC significantly affects energy-saving intentions, as employees who feel empowered and capable of implementing conservation measures are more likely to act on them [16]. Furthermore, workplace environments with strong support for energy-saving initiatives reinforce the relationship between PERBCON and INSER, resulting in environmental benefits, organizational efficiency, and greater employee engagement [35,41]. Therefore,

H3a. *PERBCON has a significant and positive impact on INSER.*

As a core component of the TPB, PERBCON is often linked to energy-saving behaviors, with research suggesting that employees with a greater perceived control over energy use—such as access to energy-efficient technologies or the autonomy to make conservation decisions—are more likely to engage in energy-saving practices [8]. However, empirical findings indicate that PERBCON does not always predict INSER due to institutional constraints [2]. In organizations where energy use is centrally managed by leadership, employees may feel that their actions have little impact, diminishing their motivation to conserve energy.

Employees who believe individual efforts contribute to collective energy efficiency are likelier to develop conservation habits and engage in energy-saving behaviors. This underscores the importance of workplace engagement programs that empower employees by increasing their confidence to make meaningful contributions to sustainability efforts. Organizations can strengthen the employees' PERBCON and encourage long-term conservation behaviors by fostering a workplace culture that values individual energy-saving actions. Therefore, based on the discussion, the following is hypothesized:

H3b. *PERBCON has a significant and positive impact on ENVKNOW.*

2.6. Environmental Knowledge and Intention to Serve Energy

ENVKNOW indirectly influences the individuals' INSER to engage in conservation efforts, making it a crucial factor in models that predict environmental behavior [15,42]. In that tenor, reference [35] argues that even though most enterprises prioritize supporting energy-saving measures in the workplace, some employees fail to take practical action because they do not fully grasp the benefits of reducing carbon dioxide emissions. So, it must be considered that the development of behavioral intentions encompasses several key components, including cognitive elements, emotional influences, behavioral aspects, and loyalty; therefore, a person's behavioral intention is positively correlated with the aggressiveness of their attitude towards a particular behavior [35]. Conversely, a more negative attitude towards a behavior typically results in a lower behavioral intention. Hence,

H4a. *ENVKNOW has a significant and positive impact on INSER.*

ENVKNOW shapes the individuals' intentions and behaviors toward INSER. Understanding the connection between environmental awareness and energy-saving intentions is essential for developing effective strategies that promote sustainability. Research consistently highlights that individuals with excellent environmental knowledge are more likely to engage in energy-efficient behaviors. Studies have shown that residents with a strong understanding of environmental issues adopt energy-saving practices more readily, particularly in household settings [43]. Additionally, objective ENVKNOW has been found to help individuals overcome psychological barriers to energy conservation, facilitating more sustainable energy consumption patterns [14]. These findings reinforce the importance of knowledge as a foundation for encouraging long-term behavioral changes.

H4b. *ENVKNOW mediates the relationship between the ATES and INSER.*

The relationship between ENVKNOW, attitudes, and behavioral intentions is complex. While some studies indicate a weak direct correlation between knowledge and behavior, they highlight the role of attitudes as a mediating factor that shapes energy-saving intentions [15]. ENVKNOW and SUBNORMS in workplace settings significantly influence the employees' intentions to save energy [20]. This suggests that although knowledge alone may not always lead directly to pro-environmental behaviors, it is critical in fostering awareness and attitudes that encourage energy conservation. Therefore, a combination of education, workplace culture, and normative influences is necessary to create a meaningful shift in energy-saving behavior.

Educational initiatives to improve energy literacy are fundamental to fostering energy conservation behaviors. Studies indicate that targeted educational programs can significantly shape individuals' pro-environmental attitudes, particularly among younger populations. Research in Vietnam found that young adults actively seek to enhance their knowledge of energy-saving practices, and their perceptions and socio-demographic backgrounds influence their willingness to engage in conservation behaviors [44]. Similarly, research conducted in Malaysia revealed that secondary school students demonstrated low energy conservation knowledge, indicating the need for stronger environmental education policies [45]. These findings highlight the necessity of incorporating energy education into school curricula and public awareness campaigns to build a culture of sustainability from an early stage.

ORGCULT and SUBNORMS also play a crucial role in shaping energy conservation behaviors. Companies prioritizing sustainability initiatives in workplace environments create an atmosphere where employees are more likely to adopt energy-saving practices [1]. Furthermore, social psychological factors, such as PERBCON and SUBNORMS, mediate the relationship between environmental concern and conservation intentions, particularly in corporate settings [46]. This suggests that organizations should provide environmental education and foster a workplace culture that reinforces sustainable behaviors through leadership support, peer influence, and institutional policies.

The literature consistently underscores the significance of ENVKNOW in promoting energy-saving intentions and behaviors. While knowledge alone may not always result in direct action, it serves as a critical foundation for overcoming psychological barriers and enhancing the effectiveness of educational and organizational strategies. Future research should continue to explore the interplay between knowledge, attitudes, and social norms to develop more effective interventions for energy conservation. By integrating education, workplace culture, and social influence, policymakers and organizations can create a

sustainable framework that encourages long-term energy-efficient behaviors across various contexts. Therefore, based on the discussion, the following is hypothesized:

H4c. *ENVKNOW mediates the relationship between SUBNORMS and INSER.*

H4d. *ENVKNOW mediates the relationship between PERCON and INSER.*

2.7. Organizational Culture on Intention to Save Energy

ORGCULT is pivotal in shaping workplace behavior, including energy conservation. It encompasses the shared values, beliefs, and practices influencing employees' engagement with sustainability initiatives. Research suggests that organizations with a sustainability-focused culture are more likely to foster pro-environmental behaviors as employees align their habits with their priorities [47]. When energy conservation is embedded within an organization's culture, employees are more inclined to adopt energy-saving behaviors, reinforcing a collective commitment to sustainability.

The influence of ORGCULT on INSER is closely linked to ENVKNOW and ATESs. Reference [1] that a strong ORGCULT directly enhances ENVKNOW and ATESs, fostering sustainability-related organizational citizenship behavior. Employees in workplaces emphasizing sustainability develop a stronger awareness of environmental issues and are more likely to take voluntary actions to reduce energy consumption. This suggests that cultivating an ORGCULT that prioritizes environmental responsibility can significantly enhance employees' engagement in conservation efforts.

The literature highlights that ORGCULT, ENVKNOW, and ATESs are critical determinants of workplace energy conservation [1,11–13]. While the TPB provides a well-established framework for understanding energy-saving intentions, additional factors such as ORGCULT, sustainability-related citizenship behaviors, and habit formation enhance its predictive power. Employees are more likely to engage in conservation efforts when sustainability is integrated into their daily work routines, making energy efficiency a habitual practice rather than an occasional effort.

Organizations should prioritize several strategies to enhance energy-saving behaviors in the workplace effectively. First, fostering a sustainability-oriented organizational culture can create a strong foundation for long-term conservation efforts. Second, increasing the employees' environmental knowledge through training and knowledge-sharing initiatives can improve their ability to implement energy-saving practices. Third, encouraging positive attitudes toward energy conservation through awareness campaigns and leadership support can strengthen the employees' commitment to sustainability. Finally, supporting habit formation by embedding energy-saving behaviors into daily routines ensures conservation becomes a standard workplace practice. By integrating these strategies, organizations can create a workplace environment where energy conservation is deeply ingrained in employees' behaviors. Establishing a culture that prioritizes sustainability enhances organizational efficiency and contributes to broader environmental goals, ensuring long-term sustainability in the workplace. Therefore, based on the discussion, the following is hypothesized:

H5a. *ORGCULT has a significant and positive impact on INSER.*

H5b. *ORGCULT mediates the relationship between ATESs and INSER.*

This study adopts a causal modeling approach grounded in the Theory of Planned Behavior (TPB), wherein ATESs, SUBNORMS and PERBCON influence INSER through

defined pathways. The proposed extended model offers a theoretically grounded and directionally structured framework, positioning individual-level psychological constructs—ATESs, SUBNORMS, and PERBCON—as antecedents to key organizational and cognitive mediators: ORGCULT and ENVKNOW. These mediators, in turn, shape the employees' INSER. The model delineates a unidirectional progression from internal beliefs and perceptions to external contextual factors, culminating in behavioral intention. This structure is consistent with established behavioral and organizational theories and underscores the study's commitment to a theoretically coherent causal inference. Figure 1 exhibits the research model.

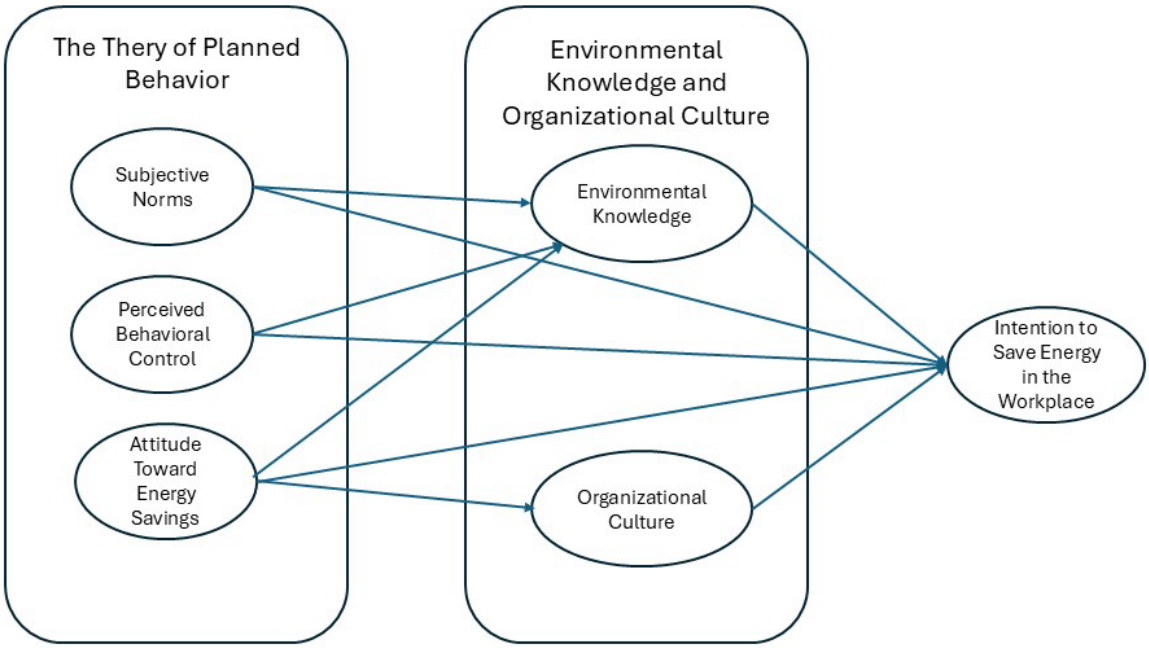


Figure 1. Research model.

3. Materials and Methods

Research on workplace energy conservation in the Dominican Republic is essential for fostering sustainable development and improving economic efficiency. The country's tropical climate and limited regulatory framework present unique challenges, and implementing energy efficiency strategies is crucial. Addressing these issues can lead to significant energy savings, cost reductions, and enhanced environmental sustainability.

A primary aspect of energy conservation involves improving building efficiency. Studies indicate that optimizing building envelopes can reduce thermal loads by up to 40%, significantly lowering the electricity costs associated with maintaining thermal comfort [19,48]. Given the high energy demands for cooling in tropical climates, these improvements are vital for long-term sustainability. Additionally, top management plays a crucial role in fostering energy-saving behaviors among employees. Research suggests that employees are more likely to adopt energy-efficient practices when leadership actively supports conservation initiatives and integrates them into organizational culture [49]. Reduced energy consumption also enables businesses to lower operational costs, enhancing profitability and market competitiveness [20]. Organizations that implement energy-efficient practices achieve financial stability and contribute to broader sustainability goals. Beyond economic benefits, energy conservation has significant social and environmental impacts. Lower energy consumption reduces greenhouse gas emissions and pollution, improving public health and environmental quality [20].

Despite these benefits, the Dominican Republic faces challenges in advancing energy conservation. The country lacks specific regulations promoting energy efficiency, underscoring the need for policy development and public awareness campaigns [19]. Additionally, environmental knowledge does not appear to influence the employees' energy-saving intentions, highlighting the need for targeted educational initiatives to foster engagement [20].

This study adopts a quantitative research design to examine the relationships between the constructs within workplace settings. The study employs a cross-sectional, survey-based approach to collecting data from employees across different industries, allowing for a robust analysis of the factors influencing workplace INSER.

Measurement Instruments and Operationalization of Variables

The survey instrument comprises validated scales adopted from prior studies, ensuring measurement reliability and construct validity. Each variable was assessed using a 7-point Likert scale, ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). Measures for ATESs, SUBNORMS, and PERBCON were derived from [8], while ORGCULT was evaluated using the scale developed by [49]. ENVKNOW was assessed based on [50], and INSER was adopted from prior research by [2]. A pilot study involving 50 participants was conducted to identify errors and refine the translation process to ensure accuracy and linguistic equivalence. The researchers employed a rigorous translation procedure, first adapting the constructs from English to Spanish and then performing back-translation to English to verify consistency.

An analysis was conducted to assess the credibility of the translation process by examining the differences and similarities between the two English language versions. Data were collected through an online questionnaire survey distributed via blast email to professional networks, organizational mailing lists, social media, and sustainability-focused workplace forums. The sample comprises 560 questionnaires, and after data quality control measures, 340 valid responses, representing 60.7%, were retained for analysis. Data were collected using SurveyMonkey. Participants were provided with clear instructions, and participation was voluntary. To uphold ethical research standards, the participants were informed of confidentiality and anonymity policies before completing the survey, and informed consent was explicitly obtained before participation.

Table 1 displays the demographic analysis, and the sample data reveals a predominantly young to middle-aged adult population, with 38.8% falling within the 25–34 age group. Most respondents fall within the 35–44 and 45–54 age categories, with a smaller percentage belonging to the 18–24 and 55–64 age groups. The 65+ category represents the smallest portion of the sample, suggesting an active working population. Regarding income, 55% of respondents earn between USD 0 and USD 4999, suggesting a large portion of the sample may consist of students, entry-level employees, or part-time roles. The lowest-income category, 12.4%, and highest-income category, 3.2%, represent the extremes of income distribution. The educational background of the respondents demonstrates high academic attainment, with 41.5% holding graduate degrees, 17.4% possessing a bachelor's degree, and 13.5% having an associate degree. A total of 25.0% of respondents have attended college but have not completed a degree, suggesting a high level of education. Only 2.6% have a high school diploma or equivalent, indicating that most participants have pursued or are in the process of obtaining post-secondary education. The gender distribution within the dataset is relatively balanced, with 52.4% male respondents and 47.6% female respondents. This ensures a representative sample and enhances the dataset's reliability in understanding potential gender-related trends in income, education, or occupational outcomes.

Table 1. Demographics.

Variable	Category	Frequency	Percent
Gender	Female	162	47.6
	Male	178	52.4
Age	18–24	41	12.1
	25–34	132	38.8
	35–44	71	20.9
	45–54	54	15.9
	55–64	33	9.7
	65+	9	2.6
Education	High school degree or equivalent (e.g., GED)	9	2.6
	Some college but no degree	85	25
	Associate's degree	46	13.5
	Bachelor's degree	59	17.4
	Graduate degree	141	41.5
Income	USD 0–USD 4999	187	55
	USD 5000–USD 9999	42	12.4
	USD 10,000–USD 14,999	11	3.2
	USD 15,000–USD 19,999	15	4.4
	USD 20,000–USD 24,999	15	4.4
	USD 25,000 and up	70	20.6

4. Analysis and Results

4.1. Data Analysis

A comprehensive statistical analysis was conducted to examine the factors influencing workplace energy-saving intentions. An initial assessment, performed using IBM SPSS (https://www.ibm.com/spss), included descriptive statistics and correlation analysis to summarize key variables and their relationships. Internal consistency was evaluated through Cronbach's alpha ($\geq$0.7) as per [51]. Confirmatory factor analysis (CFA) was conducted in AMOS 28 to validate the measurement model, utilizing multiple fit indices and refining the model based on modification indices where necessary. Reliability and validity were evaluated through composite reliability, average variance extracted (AVE), maximum shared variance (MSV), and maximal reliability. Additionally, discriminant validity was confirmed using a heterotrait-monotrait (HTMT) analysis. The structural model was tested using a regression analysis for direct effects, while mediation analysis examined the indirect roles of organizational culture and environmental knowledge. These methods provided a robust framework for understanding workplace energy-saving behaviors, offering valuable theoretical and practical insights for sustainability initiatives.

Table 2 presents a descriptive analysis of an overview of key study variables, including ATESs, SUBNORMS, PERBCON, ORGCULT, ENVKNOW, and INSER. The analysis examines central tendency (mean), dispersion (standard deviation), and internal consistency (Cronbach's alpha). Results indicate that employees generally hold positive attitudes toward energy conservation (M = 1.46, SD = 0.51), while perceived behavioral control (M = 2.37, SD = 0.91) suggests moderate confidence in adopting energy-saving behaviors. Subjective norms (M = 2.04, SD = 0.89) exhibit slightly lower scores, implying a weaker influence of social expectations in the workplace. Organizational culture (M = 1.45, SD = 0.49) shows low dispersion, reflecting a consistent perception of workplace sustainability values, while environmental knowledge (M = 2.22, SD = 0.78) is moderately high, indicating partial awareness of energy-saving strategies. Energy-saving intentions (M = 1.35, SD = 0.51) are relatively low, suggesting that while employees recognize the importance of sustainability, behavioral intentions may be influenced by external workplace factors. Reliability analysis

confirmed strong internal consistency across all constructs, with Cronbach's alpha values ranging from 0.75 to 0.89. These findings establish a foundation for further statistical testing, particularly examining the direct and indirect effects of attitudes, organizational culture, and environmental knowledge on workplace energy-saving intentions.

Table 2. Descriptive statistics.

	ATESs	**SUBNORMS**	**PERBCON**	**ORGCULT**	**INSER**	**ENVKNOW**
M	1.4612	2.0456	2.3728	1.4500	1.3539	2.2221
SD	0.51206	0.89561	0.90750	0.49094	0.51004	0.78492
CA	0.88600	0.87400	0.88000	0.75000	0.86300	0.85600
			Correlations			
	ATESs	SUBNORMS	PERBCON	ORGCULT	INTSER	ENVKNOW
ATESs	1	0.263 **	0.303 **	0.562 **	0.491 **	0.212 **
SUBNORMS	0.263 **	1	0.469 **	0.277 **	0.217 **	0.259 **
PERBCON	0.303 **	0.469 **	1	0.274 **	0.307 **	0.407 **
ORGCULT	0.562 **	0.277 **	0.274 **	1	0.489 **	0.123 *
INSER	0.491 **	0.217 **	0.307 **	0.489 **	1	0.195 **
ENVKNOW	0.212 **	0.259 **	0.407 **	0.123 *	0.195 **	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix offers valuable insights into the relationships among key study variables, reinforcing the theoretical framework. As anticipated, ATESs demonstrated a positive correlation with INSER (r = 0.49, $p < 0.01$), indicating that employees with stronger pro-environmental attitudes are more likely to intend to conserve energy at work. Similarly, PERBCON was positively correlated with INSER (r = 0.30, $p < 0.01$), suggesting that employees who feel capable of implementing energy-saving behaviors are more likely to develop strong behavioral intentions. Among all predictors, ORGCULT exhibited the strongest correlation with INSER (r = 0.56, $p < 0.01$), highlighting the critical role of workplace sustainability values in motivating employees to engage in energy conservation. While SUBNORMS and ENVKNOW also showed positive correlations with INSER (r = 0.26 and r = 0.21, respectively, $p < 0.05$), their weaker associations suggest that peer influence and environmental awareness contribute to sustainability intentions but are less influential than personal attitudes and organizational support. These findings underscore the significance of workplace-specific factors in behavioral models, demonstrating that organizational culture and perceived control play a more substantial role in shaping workplace energy-saving behaviors than social influence and environmental knowledge.

Although the cross-sectional design limits the ability to make definitive causal claims, this study employs structural equation modeling (SEM) to assess theory-driven causal relationships among latent constructs. SEM is particularly well-suited for evaluating directional hypotheses when they are grounded in established theoretical frameworks and supported by empirical precedent. In this study, the specified causal pathways—from psychological antecedents to organizational and informational mediators, and ultimately to behavioral intention—are not exploratory in nature but reflect a priori assumptions informed by extensions of the Theory of Planned Behavior and the sustainability literature. Within this framework, the model facilitates causal inference in a non-experimental context by testing the plausibility and strength of theoretically posited relationships.

Confirmatory factor analysis (CFA) is a well-established method within structural equation modeling (SEM) for validating measurement models in both exploratory and confirmatory research [52]. Table 3 outlines the reliability assessment of the constructs, with composite and maximum reliability values above 0.7 signifying strong construct dependability. Convergent validity is confirmed when composite reliability exceeds 0.7,

and the average variance extracted (AVE) surpasses 0.5 [53]. Likewise, [52] suggests that a valid measurement model should have an AVE above 0.5 and maximal reliability (MaxR(H)) greater than 0.7. These criteria ensure that the constructs exhibit sufficient reliability and validity, providing a solid foundation for subsequent hypothesis testing.

Table 3. Model fit measures.

Factor/Item	FL	CR	AVE	MSV	MaxR(H)
SUBNORMS		0.876	0.64	0.28	0.88
SN1	0.78				
SN2	0.84				
SN3	0.76				
SN4	0.81				
PERBCON		0.88	0.65	0.28	0.89
PBC1	0.76				
PBC2	0.83				
PBC3	0.87				
PBC4	0.77				
ATES		0.89	0.62	0.48	0.9
ATES1	0.68				
ATES2	0.72				
ATES3	0.85				
ATES4	0.84				
ATES5	0.83				
ORGCULT		0.77	0.53	0.47	0.78
OCUL2	0.61				
OCUL4	0.78				
OCUL5	0.77				
INSER		0.87	0.69	0.37	0.87
ISE1	0.83				
ISE2	0.82				
ISE3	0.85				
ENVKNOW		0.84	0.57	0.22	0.85
EK2	0.79				
EK3	0.84				
EK4	0.70				
EK5	0.68				

Notes: FL: Factor Loading; CR: Composite reliability; AVE: Average Variance extracted; MSV: Maximum shared variance; MaxR(H): Maximal Reliability.

Table 3 assesses the validity and reliability of the measurement model by examining key fit indices and construct validity metrics, including factor loadings (FL), composite reliability (CR), average variance extracted (AVE), maximum shared variance (MSV), and maximal reliability (MaxR(H)). All factor loadings exceeded the recommended minimum of 0.60, demonstrating that each indicator effectively represented its respective construct. Composite reliability (CR) values ranged from 0.77 to 0.89, surpassing the 0.70 benchmark, thereby confirming strong internal consistency across all constructs. Convergent validity was established as all AVE values exceeded 0.50, demonstrating that latent constructs accounted for a significant proportion of variance in their observed indicators. Discriminant validity was supported by MSV values being lower than AVE for all constructs, confirming their distinctiveness within the model. Additionally, MaxR(H) values ranged between 0.78 and 0.90, further reinforcing the measurement model's robustness. These findings validate the structural integrity of the proposed framework and confirm that the extended Theory of Planned Behavior (TPB) model, incorporating organizational culture and environmental

knowledge, provides a reliable and theoretically sound explanation of workplace energy-saving behaviors.

Table 4 evaluates the heterotrait-monotrait (HTMT) ratio of correlations employed to assess discriminant validity, ensuring that each construct in the model remains conceptually distinct. Results indicated that all HTMT values were below the strict threshold of 0.85, confirming that the constructs were not highly correlated and measured separate theoretical concepts. The strongest relationships emerged between organizational culture (ORGCULT) and attitudes toward energy saving (ATESs), as well as between perceived behavioral control (PERBCON) and energy-saving intentions (INSER), aligning with established theoretical expectations. Conversely, the HTMT values for subjective norms (SUBNORMS) and environmental knowledge (ENVKNOW) were comparatively lower, suggesting that while these factors contribute to energy-saving behaviors, their influence is more secondary. Since all values remained within acceptable limits, the findings confirm that discriminant validity is upheld, reinforcing the integrity and distinctiveness of the constructs within the extended Theory of Planned Behavior (TPB) model.

Table 4. HTMT Analysis.

	SUBNORMS	PERBCON	INSER	ORGCULT	ATESs	ENVKNOW
SUBNORMS						
PERBCON	0.468					
INSER	0.217	0.306				
ORGCULT	0.271	0.272	0.496			
ATESs	0.263	0.301	0.493	0.57		
ENVKNOW	0.259	0.408	0.19	0.12	0.209	

4.2. Structural Model Assessment

To address potential endogeneity within the structural equation model, control variables such as age, gender, education, and income were incorporated into the analysis. The structural model, constructed using AMOS, was utilized to assess the relationships among the key constructs. A well-fitting model is characterized by a CMIN/DF value below 5, along with goodness-of-fit indices (GFI), the Tucker–Lewis Index (TLI), and the Comparative Fit Index (CFI) exceeding 0.90 [53–55]. The evaluation of model fit confirms that the extended TPB framework effectively captures ISER. The Chi-square test (CMIN = 341.731, DF = 217) suggests an adequate model fit, though this statistic is known to be sensitive to sample size. The relative Chi-square (CMIN/DF = 1.575) falls within the recommended range of 1 to 3, indicating a strong fit. Additionally, the CFI of 0.971 exceeds the 0.95 threshold, reinforcing the model's explanatory power. The Standardized Root Mean Square Residual (SRMR) of 0.049 remains below the 0.08 cutoff, suggesting minimal residual discrepancies. Moreover, the Root Mean Square Error of Approximation (RMSEA) of 0.041 and a PClose value of 0.963 further support the model's strong fit by demonstrating minimal error in representing the data structure. Overall, these fit indices confirm the theoretical and statistical robustness of the structural model, validating the inclusion of organizational culture and environmental knowledge as essential mediators of workplace energy-saving intentions.

The excellent model fit further strengthens the reliability of hypothesis testing results, ensuring that the proposed relationships are well-supported by empirical data. In Table 5, the results of the hypotheses validation are presented.

Table 5. Hypotheses validation.

			S.E.	C.R.	*p*-Value	Decision
ORGCULT	<---	ATESs	0.078	8.261	***	Supported
ENVKNOW	<---	SUBNORMS	0.067	0.625	0.532	Not Supported
ENVKNOW	<---	PERBCON	0.076	5.435	***	Supported
ENVKNOW	<---	ATESs	0.106	1.281	0.2	Not supported
INSER	<---	ENVKNOW	0.032	0.886	0.376	Not supported
INSER	<---	SUBNORMS	0.031	−0.552	0.581	Not supported
INSER	<---	PERBCON	0.036	2.151	0.031	Supported
INSER	<---	ATESs	0.075	2.621	0.009	Supported
INSER	<---	ORGCULT	0.089	4.49	***	Supported

Note: *** significant at level $p < 0.001$.

The hypothesis validation results strongly support the extended TPB framework, particularly highlighting the roles of ATESs, PERBCON, and ORGCULT in shaping INSER. Findings indicate a significant positive relationship between ATESs and ORGCULT ($\beta = 0.641$, $p < 0.001$), suggesting that employees with pro-environmental attitudes are more likely to perceive their workplace as supportive of sustainability. Similarly, PERBCON significantly predicts ENVKNOW ($\beta = 0.412$, $p < 0.001$), reinforcing the idea that employees who feel capable of saving energy tend to have higher environmental awareness. However, SUBNORMS did not significantly predict ENVKNOW ($\beta = 0.042$, $p = 0.532$), and ATESs had no significant influence on ENVKNOW ($\beta = 0.136$, $p = 0.200$), indicating that knowledge acquisition is more likely influenced by structural or organizational factors rather than peer influence or individual attitudes. Regarding direct predictors of INSER, PERBCON ($\beta = 0.078$, $p = 0.031$) and ATESs ($\beta = 0.198$, $p = 0.009$) both had significant positive effects, confirming that employees who feel in control of their energy-saving actions and hold pro-environmental attitudes are more likely to develop conservation intentions. Most notably, ORGCULT exhibited the strongest effect on INSER ($\beta = 0.401$, $p < 0.001$), underscoring the central role of workplace culture in fostering sustainability behaviors. This finding highlights the importance of corporate policies, leadership commitment, and a sustainability-oriented work environment in encouraging energy-saving practices. Conversely, ENVKNOW ($\beta = 0.028$, $p = 0.376$) and SUBNORMS ($\beta = -0.017$, $p = 0.581$) did not significantly predict INSER, suggesting that environmental knowledge alone does not directly translate into conservation intentions, and peer influence is less impactful compared to structural and organizational factors. These results validate the importance of attitudes, perceived control, and organizational culture in driving workplace energy-saving behaviors while challenging the assumed direct influence of subjective norms and environmental knowledge. These insights have significant implications for corporate sustainability strategies, emphasizing the need for workplace culture reinforcement, leadership-driven initiatives, and structural interventions rather than relying solely on awareness campaigns or peer influence.

4.3. Mediation Analysis

Figure 2 and Table 6 depict the mediation analysis. The mediation analysis offers key insights into the indirect effects of ORGCULT and ENVKNOW on INSER. The results confirm that ORGCULT significantly mediates the relationship between ATESs and INSER, with a standardized estimate of 0.286 ($p < 0.001$) and a fully positive confidence interval (0.156–0.399). Conversely, ENVKNOW did not exhibit significant mediation effects. The ATESs → ENVKNOW → INSER pathway ($p = 0.251$) yielded a confidence interval crossing zero (−0.002 to 0.025), indicating no significant indirect effect. Similarly, SUBNORMS → ENVKNOW → INSER ($p = 0.409$) and PERBCON → ENVKNOW → INSER ($p = 0.337$) also

failed to reach significance. These results suggest that while ENVKNOW may enhance awareness, it does not independently drive energy-saving intentions unless reinforced by workplace structures and policies. This mediation analysis underscores the pivotal role of organizational culture in shaping workplace energy-saving behaviors while challenging the assumption that environmental knowledge directly influences behavioral intentions. These findings emphasize the need for corporate sustainability strategies that extend beyond awareness campaigns to cultivate a workplace environment that actively supports and reinforces energy conservation efforts.

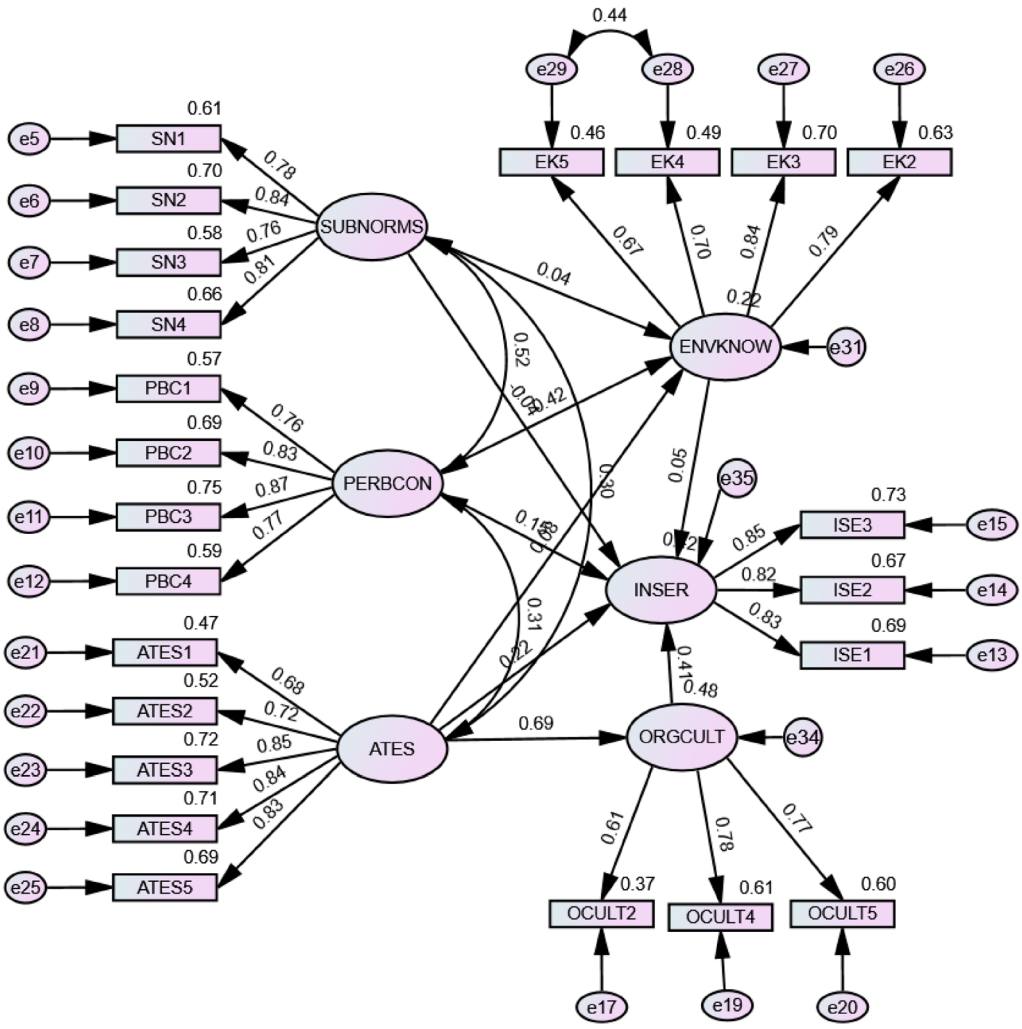


Figure 2. Structural equation model.

Table 6. Mediation analysis.

Indirect Path	Direct Effect	Indirect Effect	Lower	Upper	*p*-Value	Standardized Estimate	Decision
ATESs --> ORGCULT --> INSER	0.257	0.012	0.156	0.399	0.001	0.286 ***	Supported
ATESs --> ENVKNOW --> INSER	0.004	0.012	−0.002	0.025	0.251	0.004	Not supported
SUBNORMS --> ENVKNOW --> INSER	0.001	0.001	−0.002	0.012	0.409	0.002	Not supported
PERBCON --> ENVKNOW --> INSER	0.012	0.261	−0.008	0.039	0.337	0.023	Not supported

Notes: *** significant at level $p < 0.001$.

5. Discussion

This study examined the determinants of workplace energy-saving intentions by extending the TPB to include ORGCULT and ENVKNOW as mediators. The findings provide strong empirical support for the role of ATESs, PERBCON, and ORGCULT in shaping INSER while challenging the assumed significance of SUBNORMS and ENVKNOW. These results reinforce previous research on workplace sustainability while expanding the understanding of organizational influences in predicting pro-environmental behaviors. Specifically, the evidence suggests that workplace culture and employees' perceived control over their environment are more influential drivers of energy-saving behaviors than external social pressures or environmental knowledge alone.

A key finding of this study is the comparatively limited influence of subjective norms and environmental knowledge on the employees' intention to save energy, relative to the more substantial impact of organizational culture. This outcome suggests that within structured professional environments, institutional and cultural dynamics exert a stronger influence on sustainable behavior than interpersonal or informational factors. While theoretical frameworks such as the Theory of Planned Behavior (TPB) traditionally emphasize individual cognition and social influence, the present findings align with a growing body of empirical research indicating that organizational culture functions as a critical mechanism in converting pro-environmental attitudes into behavioral intentions, particularly in workplace settings. From a practical standpoint, this highlights the potential efficacy of organizational leadership, policy development, and internal culture-building initiatives over normative appeals or informational campaigns in promoting energy-saving behavior. Furthermore, the results underscore the need for theoretical refinements that integrate institutional logics and structural enablers into behavioral models, especially when applied in organizational contexts.

5.1. Theoretical Contributions

The significant direct effects of ATESs and PERBCON on INSER support the fundamental tenets of the TPB [8], indicating that employees who exhibit pro-environmental attitudes and perceive more significant control over their actions are more inclined to adopt INSER in the workplace. These results are consistent with previous studies highlighting the pivotal role of ATESs in shaping sustainability-related behaviors across diverse settings, including households, organizations, and consumer decision-making [2,10,56]. However, the non-significance of SUBNORM challenges conventional TPB assumptions, which typically position social influence as a key determinant of behavioral intentions [5,7]. While SUBNORMS play a substantial role in household energy conservation [14], INSER appears to be more influenced by organizational structures and policies. This supports prior research suggesting that formal sustainability initiatives and leadership-driven strategies may be more effective than peer influence in professional settings [1,3]. Since workplace behaviors are shaped by formal expectations rather than informal peer pressure, this study contributes to the growing literature emphasizing the importance of organizational infrastructure over social persuasion in workplace sustainability.

A key theoretical contribution of this study is the identification of ORGCULT as a strong mediator between ATESs and INSER, with a highly significant indirect effect ($\beta = 0.257$, $p < 0.001$). This finding underscores the role of ORGCULT in translating the employees' pro-environmental attitudes into behavioral intentions. Even employees with strong sustainability values are unlikely to act on their beliefs unless their workplace actively promotes environmental responsibility. This aligns with [1], who argued that ORGCULT bridges individual attitudes and pro-environmental behavior. Similarly, [3,12] emphasized that leadership commitment, corporate policies, and workplace incentives sig-

nificantly enhance employees' INSER. By providing quantitative evidence that ORGCULT plays a more influential role than SUBNORMS in workplace energy-saving behaviors, this study reinforces the need for companies to prioritize cultural transformation over peer influence or awareness campaigns.

Contrary to expectations, ENVKNOW did not emerge as a significant mediator of INSER, as none of the tested indirect effects reached statistical significance. This suggests that while ENVKNOW positively correlates with PERBCON, it does not independently drive INSER. These findings challenge the assumption that increasing the employees' environmental awareness automatically translates into behavioral change [14,15]. This aligns with the "knowledge-action gap" observed in environmental psychology, where individuals may be aware of sustainability issues but fail to act due to contextual barriers, lack of motivation, or perceived inconvenience [57]. Additionally, research suggests that structural interventions, such as automated lighting and energy-efficient office infrastructure, may be more effective in reducing energy consumption than knowledge-based interventions alone [1,2]. Another possible explanation is that employees may already possess a baseline level of ENVKNOW, making additional awareness initiatives redundant in influencing behavioral change.

PERBCON emerged as a significant predictor of INSER and ENVKNOW, reinforcing that employees who feel in control of their energy-saving actions are more likely to develop strong behavioral intentions and acquire relevant knowledge. This finding aligns with Ajzen's [8] TPB model, which posits that self-efficacy and perceived ease of performing a behavior strongly influence intention formation. However, while PERBCON positively influences ENVKNOW, the latter does not significantly mediate workplace energy-saving intentions. This distinction is critical for policymakers, as it suggests that enhancing employees' control over energy use—through innovative office technologies or flexible energy-saving policies—may be more effective than solely focusing on educational programs.

5.2. Practical Implications

The findings of this study suggest several strategies for improving INSER. First, organizations should prioritize cultivating a sustainability-oriented corporate culture, as ORGCULT was the strongest predictor of behavioral intentions. Leadership engagement, policy enforcement, and financial incentives for sustainability efforts should precede peer influence or generic awareness campaigns. Second, organizations should focus on empowering employees by enhancing their PERBCON over energy-saving actions. This can be achieved through technological interventions (e.g., automated energy-saving systems, innovative office configurations), targeted sustainability training, and removing structural barriers that hinder conservation behaviors. Finally, while ENVKNOW remains important, the findings indicate that it cannot drive behavioral change independently. Instead of relying solely on informational campaigns, companies should integrate knowledge-building efforts with hands-on experiences and tangible workplace incentives. Interactive sustainability challenges, real-time energy consumption tracking, and team-based conservation initiatives could help make energy-saving a shared organizational goal.

This study provides empirical support for the extended TPB framework, demonstrating that INSER is primarily driven by ORGCULT, ATESs, and PERBCON rather than SUBNORMS or ENVKNOW. By highlighting the mediating role of ORGCULT, these findings underscore the importance of workplace policies and leadership in translating sustainability values into action. For organizations aiming to enhance energy conservation efforts, fostering a strong sustainability culture and empowering employees with control over their actions may prove more effective than traditional awareness campaigns. Future

research should explore industry-specific differences and additional contextual factors influencing workplace energy-saving behaviors.

5.3. Managerial Implications

This study provides key insights for business leaders, sustainability managers, and policymakers seeking to enhance energy conservation in organizations. It challenges the conventional assumption that increasing environmental awareness drives behavioral change, highlighting instead the pivotal roles of organizational culture and perceived behavioral control in shaping workplace energy-saving behaviors. The findings suggest that structural and cultural interventions are more effective than traditional awareness campaigns in fostering sustainable workplace practices.

A significant finding of the study is that ORGCULT significantly influences the employees' INSER. When sustainability is embedded in workplace norms, values, and daily operations, employees are more likely to adopt energy-saving intentions. Leadership is crucial in this process, as managerial commitment to sustainability fosters a shared sense of responsibility. Organizations can institutionalize sustainability by integrating energy-saving metrics into performance evaluations, obtaining green office certifications, and implementing clear policies that mandate energy-efficient practices [58]. When sustainability becomes a core component of corporate identity, employees perceive energy conservation as an essential professional responsibility rather than an optional initiative.

While educating employees on energy conservation is beneficial but insufficient to drive substantial behavioral change. Instead, organizations should implement structural modifications and targeted behavioral interventions. Real-time energy-use dashboards provide instant feedback, encouraging self-regulation. Behavioral nudges—such as automated power-saving modes, strategically placed reminders, and energy-efficient lighting—can reinforce conservation habits with minimal effort. Gamification, incentives, and "Green Teams" also foster engagement, friendly competition, and peer-driven sustainability initiatives.

PERBCON emerges as another key determinant of energy-saving behaviors. Employees are more likely to engage in conservation efforts when they feel empowered to take action. Organizations can enhance this perception by eliminating structural barriers—installing motion-sensor lighting, smart thermostats, and energy-efficient office equipment reduces reliance on manual efforts. Flexible work arrangements, including remote work options and energy-efficient office spaces, further empower employees. Training programs should focus on actionable strategies, equipping employees with practical skills such as optimizing heating and cooling systems, minimizing standby power usage, and utilizing innovative office technologies.

Leadership commitment is essential for fostering an energy-conscious workplace culture. Executives should model energy-efficient behaviors, integrate sustainability into corporate strategy, and establish policies reinforcing responsible energy consumption. Sustainability metrics can be embedded into human resources and operational policies, incentivizing departments to achieve energy reduction targets.

The study also underscores the importance of tailoring energy-saving strategies to different workplace environments. Manufacturing facilities, corporate offices, and retail settings have distinct energy consumption patterns and require customized approaches. Large corporations may benefit from centralized policies, whereas smaller firms may rely more on employee-led initiatives. Cultural differences should also be considered, as sustainability strategies may require stronger enforcement mechanisms or incentive-based programs in regions with lower environmental awareness.

Technological advancements like AI and IoT-enabled systems present opportunities for automated energy-saving solutions with minimal employee intervention. Hybrid work models also necessitate adaptive strategies, including remote work and paperless workflows. Finally, workplace energy conservation should be integrated into a broader corporate sustainability framework, aligning efforts with international commitments such as the United Nations Sustainable Development Goals. By embedding energy conservation into the organization's operational structure and corporate identity, businesses can maximize their environmental impact while enhancing employee engagement and corporate reputation.

5.4. Limitations and Future Research

5.4.1. Limitations

This study identifies key limitations in understanding workplace energy conservation behaviors. A significant constraint is its cross-sectional design, which prevents establishing causal relationships. The reliance on self-reported data also introduces social desirability bias, potentially leading to overestimating energy-saving behaviors. Future research should incorporate objective measures, such as energy consumption tracking and intelligent monitoring systems, to ensure accuracy. Another limitation is the study's focus on a developing country, which may affect its generalizability. Economic conditions, regulatory frameworks, and cultural norms influence workplace sustainability behaviors differently across regions. Comparative studies between developed and developing economies would provide deeper insights into these variations. The study's industry scope is also limited, as workplace sustainability behaviors differ by sector. Future research should explore sectoral differences to develop targeted conservation strategies. The study also omits key moderating factors such as leadership engagement, financial incentives, and environmental policies, which may significantly impact energy conservation efforts. Future research should integrate these variables for a more comprehensive understanding. Lastly, the findings suggest that subjective norms and ENVKNOW may not directly influence INSER, indicating the need for further research into indirect influences, such as workplace motivation and leadership dynamics. Addressing these limitations will enhance the understanding of workplace energy conservation, leading to more effective and context-specific sustainability strategies.

An additional limitation of this study lies in its focus on a single geographical and cultural context, which may constrain the generalizability of the findings. Variations in cultural norms, organizational structures, and levels of environmental awareness across regions may influence the operation of key constructs—such as subjective norms, perceived behavioral control, and organizational culture—in shaping energy-saving intentions. Consequently, the applicability of these results to other national or cultural settings should be approached with caution. Future research could enhance the model's external validity by conducting cross-cultural comparative studies or replicating the analysis in diverse organizational and regional contexts. Such efforts would facilitate the assessment of the extended TPB framework's cultural robustness and contribute to the refinement of its theoretical propositions for broader application.

Another important limitation of this study is its exclusive reliance on self-reported measures, which may introduce response bias and social desirability effects. Although perceptual data are essential for capturing individual intentions and psychological constructs, the lack of objective measures of actual energy consumption constrains the empirical evaluation of behavioral outcomes. This intention–behavior gap is well-documented in the environmental psychology literature and underscores the need for future research to incorporate objective indicators—such as electricity usage records or sensor-based monitoring systems—to validate self-reported intentions. Triangulating perceptual data with

behavioral or organizational performance metrics would provide a more robust and comprehensive assessment of the effectiveness and real-world impact of energy-saving initiatives.

5.4.2. Future Research Directions

Future research should adopt longitudinal designs to track how workplace energy-saving behaviors evolve and assess the long-term impact of interventions such as behavioral nudges, sustainability training, and leadership-driven initiatives. Studies should incorporate objective energy consumption data from smart sensors and automated monitoring systems to improve accuracy, reducing reliance on self-reported responses. Given the influence of ORGCULT, future studies should explore how workplace sustainability norms vary across different cultural, economic, and industry contexts. Comparative research between developed and developing economies and across sectors (e.g., public vs. private, technology vs. manufacturing) would provide insights into the contextual factors shaping energy conservation. Additionally, further research should examine how leadership styles—such as transformational or servant leadership—impact employee engagement in sustainability efforts and evaluate the effectiveness of financial incentives and performance-based rewards.

A valuable direction for future research involves exploring additional structural, cultural, and leadership-related variables that were not included in the present model. While organizational culture emerged as a significant determinant of energy-saving intentions, it is likely influenced by, or interacts with, broader organizational factors such as leadership style, managerial commitment, organizational climate, formal sustainability policies, and structural incentives. These elements are frequently identified in the literature on workplace environmental behavior as key antecedents to sustainable engagement. Expanding the model to incorporate such variables would provide a more holistic understanding of the multifaceted nature of organizational influence. Furthermore, it would enable researchers to distinguish between cultural values enacted in everyday practices and those embedded through formal structures or leadership behaviors. Integrating these dimensions could enhance both the explanatory depth and contextual sensitivity of behavioral models within organizational sustainability research.

Future research should investigate the potential influence of SUBNORMS and PERBCON as antecedents of organizational culture (ORGCULT). While the present study conceptualized ORGCULT as a mediating construct to assess how individual-level factors influence energy-saving intentions, emerging theoretical perspectives highlight the possibility of bottom-up processes in shaping organizational culture. Specifically, normative pressures and the employees' perceived agency may play a formative role in cultivating a shared organizational ethos that supports environmental responsibility. Examining these pathways could offer a more dynamic understanding of the interplay between individual and collective forces in the development of sustainability-oriented cultures. Longitudinal or multi-level research designs would be especially valuable for capturing the temporal and structural complexities of these interactions, thereby enhancing the explanatory capacity of existing behavioral models.

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