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Journal of Risk and Financial Management

Provided in Cooperation with:

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Suggested Citation: Camacho, Luis J. et al. (2023) : Understanding employees' energy saving in the workplace: DR and the Philippines' realities, Journal of Risk and Financial Management, ISSN 1911-8074, MDPI, Basel, Vol. 16, Iss. 1, pp. 1-21, <https://doi.org/10.3390/jrfm16010049>

This Version is available at:

<https://hdl.handle.net/10419/275145>

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Article

Understanding Employees' Energy Saving in the Workplace: DR and the Philippines' Realities

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Abstract: Understanding how employees act at work to save energy and the meaning for sustainability and environmental protection is essential. This research aimed to analyze the influences of Subjective Norms (SN), Descriptive Norms (DN), and Environmental Knowledge (EK) on employees' intention to save energy (ISE) in the Philippines (PH) and the Dominican Republic (DR). The effects of SN, DN, and EK on ISE were evaluated by comparing two developing countries and the mediation effect of EK on the relationship between DN, SN, and ISE. Confirmatory factor analysis (CFA), followed by structural equation modeling and path analysis based on samples collected from employees from DR (340) and PH (339), was performed. Also, construct convergent and discriminant validity were assessed using composite reliability, maximal reliability, average variance extracted, and maximum shared variance. The findings of this study indicate that SN influences ISE positively among employees in PH ($\beta = 0.15, p < 0.05$) but not among employees in DR. Descriptive Norms positively influence ISE among employees in PH ($\beta = 0.47, p < 0.01$) and DR ($\beta = 0.27, p < 0.01$), while EK has a positive and significant influence on the ISE among employees in PH ($\beta = 0.22, p < 0.01$) and not in DR. There is a partial mediation effect between SN and EK on ISE when EK is the mediator in PH, and no mediation effects for RD. The intention to save energy is significant in economic terms because reducing energy consumption can help decrease energy costs and improve business profitability and competitiveness; in social terms, it can reduce energy consumption worldwide and improve social health, reducing gas emissions and pollution.

Keywords: energy saving; intention to save energy; subjective norms; descriptive norms; environmental knowledge



Citation: Camacho, Luis J., Michael Pasco, Moises Banks, Randall Pasco, Marisela Almanzar, Alvin Rodriguez, Akinlawon Amoo, and Nelda Rosima. 2023. Understanding Employees' Energy Saving in the Workplace: DR and the Philippines' Realities. *Journal of Risk and Financial Management* 16: 49. <https://doi.org/10.3390/jrfm16010049>

Academic Editor: Aviral Kumar Tiwari

Received: 19 November 2022

Revised: 10 December 2022

Accepted: 5 January 2023

Published: 12 January 2023



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1. Introduction

Our study contributes to the literature on the understanding of ISE and energy efficiency. The release of carbon dioxide due to people's and businesses' energy consumption is one of the significant causes of climate change (Ritchie and Roser 2020). Most energy generated today comes from nonrenewable sources, and coal mining for energy generation may cause water pollution and solid waste (Liu et al. 2020). Energy conservation is one method for achieving a cleaner, healthier environment and mitigating global warming (Moriarty and Honnery 2019).

We also contribute to the understanding of EK. According to [Hussain et al. \(2021\)](#), a strategy to ensure energy conservation is for people to modify their behavior at home or work. Since human beings primarily created climate change, changing human behavior is vital to achieving a sustainable future ([Lynas et al. 2021](#)). [Soderholm \(2020\)](#) stated that corporations use a great deal of energy and contribute considerably to global environmental problems. The United Nations Framework Convention on Climate Change (COP26) states that a commitment to systemic change must be made, and net zero emissions must be included in company principles and operations ([McKinsey 2021](#)). Increasing energy savings may give companies and the economy internal and external advantages ([Department of Labor 2016](#)). Macroeconomically, increased energy saving may result in decreased energy costs, business profitability, and competitiveness. Reduced energy consumption worldwide may lower fuel costs and volatility, increase energy security, and improve social health, reducing gas emissions and pollution ([Sweeney et al. 2013](#)).

Carbon emissions from energy use comprise a large part of total emissions and have gotten much attention globally ([Yang et al. 2016](#)). Consequently, promoting energy-efficient technologies, enhancing the efficiency of energy usage, and encouraging people to conserve energy in their everyday lives are practical approaches to minimizing energy consumption. Unfortunately, there has been a detrimental impact on the environment due to increased energy usage and the widespread adoption of energy-intensive technologies that generate high levels of carbon emissions. The effect of these emissions on the environment has led to a growing awareness that protecting the environment is in everyone's best interest and that such protection can be accomplished in many ways, including by adopting technologies that increase energy efficiency, reducing the wasteful use of natural resources, and embracing environmentally conscious lifestyle choices. In the same way, [Ryghaug et al. \(2018\)](#) highlight the [Devine-Wright \(2007\)](#) proposed energy citizenship concept built on a perspective of people democratically engaged in sustainable energy transitions. In that concept, people are not only considered as using technologies and influencing innovation paths but also committed politically more comprehensively. Therefore, the concept emphasizes the hybrid relationships between people and energy technologies and the different roles that a person can assume as a user, consumer, protester, supporter, and pro-consumer; consequently, the impact of personal behavior is a determinant of the success of energy-saving policies in companies.

Across the globe, energy consumption is increasing, since it is essential for modernization, economic growth, automation, and social progress. From 1994 to 2014, the growth rates of primary energy consumption and CO₂ emissions were 49 and 43%, respectively, and 2 and 1.8%, respectively, yearly ([Jeon et al. 2013](#)). In 2017, the annual energy consumption growth rate was 3.2% in developing nations, whereas developed countries had a 1.1% rise in the same year ([Akram et al. 2022](#)).

According to the International Energy Outlook report (2022), global energy consumption will increase by 56% between 2010 and 2040. In 2012, buildings accounted for 32% of total energy consumption and 33% of greenhouse gas emissions ([Jeon et al. 2013](#)). For example, in 2010 in the USA, the building sector utilized 38.9% of total energy, whereas 34.8% was spent on cooling, heating, air conditioning, and ventilation systems ([Ma et al. 2017](#)). Globally, energy use in the residential, commercial, industrial, and transportation sectors is 22, 19, 31, and 28% of total energy, respectively ([Berardi 2017](#)). In the developed world, residential and commercial buildings' energy consumption is 30–40% of total energy consumption ([Cao et al. 2016](#)).

[Feng et al. \(2010\)](#) found that in tropical countries such as DR and PH, 44% of all energy is used in residential, commercial, and industrial buildings, and buildings produce 36% of CO₂ emissions. For example, in DR, 40–60% of their total energy consumption is accounted for by the power used for air conditioning to offer thermal comfort for productive office work in commercial and public facilities, similar to countries located in tropical regions ([De Buen 2015](#)). Sadly, the bulk of the existing buildings in the D.R. were built when energy efficiency was not a top concern. Even now, this element still needs to

be considered according to the importance it deserves (Felix Benitez et al. 2022). In PH, electricity consumption climbed to 94,370-gigawatt hours (GWh) in 2017, the Department of Energy (DoE) announced (Lagare 2018, in Rosales Gumar and Banta 2019). Although statistics related to energy consumption in these two developing countries should be analyzed in different areas and topics, it is necessary to evaluate employees' ISE to start cutting down on the high consumption of energy in the workplace.

A review of workplace research revealed that pro-environmental actions rely on individual determinants, such as attitudes, and organization-specific impacts, such as management; however, the relationship between individual and organizational variables needs to be better understood (Lo et al. 2012). Energy conservation is one of the most critical policy issues in developed countries, and the commercial sector, which is made up of businesses, is increasingly seen as a crucial part of reaching any important energy conservation goal (Prindle and Finlinson 2011). In general, industries and companies use a lot of energy and contribute to the rise of greenhouse gas emissions. Due to their size, these industries and businesses are well-positioned to explore several chances for reform (US Energy Information Administration 2011) and have significant potential to cut emissions worldwide. Unfortunately, promoting technologies that use less energy and making energy use more efficient are not enough to reduce energy use. Therefore, it is necessary to devise strategies that employees can adopt for energy conservation and continuously promote such strategies so employees can develop energy-saving behaviors that help reduce energy usage. In that sense, Mansor and Sheau-Tingi (2019) support the criterion that efficient energy use will require behavioral modifications to improve the existing practices of energy-saving among users. They argue that various psychological determinants significantly contribute to fostering energy-saving behavior, fluctuating across the local context and culture. Some of these determinants may directly influence an individual's intention to perform pro-environmental behavior, and others may indirectly influence it.

Significant changes must be considered in order to achieve the organizations' energy conservation objectives. For example, changes to the company's structural facilities (Starik and Marcus 2000), using energy-efficient materials in new construction projects (Levine et al. 2007), modifying workflow methods, and implementing new products to increase productivity and efficiency (Starik and Marcus 2000). However, according to Lutzenhiser (1993), individuals' behavior also has a significant role in energy consumption. Therefore, understanding the energy habits of employees is crucial for businesses to decrease energy use (Ehrhardt-Martinez 2008). According to Lülfs and Hahn's (2014) findings, the private sector bears the brunt of the expenses associated with energy-saving habits. The research did not find evidence to support the idea that energy-saving practices between the office and home could be associated because individuals engage in some but not all energy-saving actions at both locations (Littleford et al. 2014). In order to make technological measures and organizational energy-saving initiatives more effective, it is vital to have a deeper understanding of employees' perspectives and actions.

Research in this area needs to be improved (Biggart and Lutzenhiser 2007; Lo et al. 2012; Singh 2008), especially in developing countries. It is essential to comprehend employees' views of energy and the potential predictors of workplace energy conservation (Bin 2012) so that various business organizations can implement effective energy conservation policies. People spend around 60–70% of their weekly time at work, and employees' desire to reduce energy consumption in their jobs is essential for reducing energy consumption and carbon emissions (Janda 2014). Therefore, an individual's energy-saving behavior in the workplace is a crucial theoretical topic that requires more study to identify the elements that influence an individual's motivation to reduce energy consumption in the workplace, closing the research gap.

Past research about factors influencing employee energy conservation behavior in businesses revealed that personal norms, SN, and DN positively promote energy conservation behavior and that the corporate energy conservation climate moderates the effect of personal norms (Zhang et al. 2013; Nolan et al. 2008). Ajzen's Theory of Planned Behavior

(TPB) (Ajzen 1991) says that SN is a behavioral antecedent because it has to do with how people see what others are doing and how they think others (dis)approve of them. However, research has produced various conclusions regarding the effect of SN on behavioral intentions. SN has been shown to significantly affect behavior in many studies, even when the goal is to save energy (Asch 1956; Nolan et al. 2008). However, the process through which an individual's energy-saving behavior develops in the workplace in developing countries still requires further research.

The rationale for selecting DR and PH for this research is due to the historical similarities and differences between these two countries. The Spanish colonized both countries, the first in the American and the second in the Asian continent. Similarly, both countries became independent from Spain and were occupied by the United States at a specific moment in their history. However, their evolution has been different, generating linguistic and cultural differences in addition to significant differences in territory and population.

To the best of our knowledge, little research has been undertaken on how people in developing countries save energy at work. For instance, we do not know if there have been any investigations into this topic in DR or PH. To analyze the elements that influence an individual's energy-saving behavior at the workplace, we develop a model based on some variables of the TPB. Researchers such as Greaves et al. (2013) and Norton et al. (2015) employed TPB to investigate the pro-environmental behavior of individuals in the workplace. Our model integrates two variables from the TPB (SN and ISE) and EK and DN.

Statement of the Problem

The purpose of this study is to analyze the influences of SN, DN, and EK on the employees' intention to save energy (ISE) in PH and DR. Specifically, it aims to answer the following queries, respectively, for PH and DR:

1. What are the influences of the following factors on the ISE?:
 - 1.1. SN;
 - 1.2. DN;
 - 1.3. EK.
2. Is there a mediation effect of EK on the following?:
 - 2.1. relationship between SN and the ISE;
 - 2.2. relationship between DN and the ISE.

This study is significant because it investigates employees' intentions to save energy in the workplace in developing countries and compares results and implications between DR and PH regarding energy savings among the employee populations in the workplace. In addition, this is a pioneer study because it analyzes the reality of these two developing countries located on two continents with different cultural, social, and political contexts.

This paper is divided into six parts. After the Introduction (Section 1), Section 2 concisely assesses the relevant literature. The Section 3 describes the study methodology and data gathering. Next, the findings and data analysis are presented in Section 4. Finally, the discussion is presented in Section 5, and the conclusion and managerial implications are in Section 6.

2. Conceptual Framework and Research Model

2.1. Subjective Norms

SN is widely regarded as a key factor that influences behavioral intention. People believe they should act according to what the majority believes (Ajzen 1991; Chen 2016; Ravis and Sheeran 2003) and refer to the extent to which the opinions of important people influence an individual's performance in a specific activity. Therefore, employees are more likely to behave similarly or conform to the expectations or perspectives of specific key individuals if such influential individuals impose an energy-saving behavior (Ru et al. 2018). Therefore, this circumstance is adequate to promote energy-saving behavior in the workplace if influential individuals can set an energy-saving behavioral trend. The

person tends to conform to the expectations or perspectives of specific key individuals. In other words, the acceptance or disapproval of influential individuals can influence an individual's action intention (Chen 2016). The greater the SN somebody sees, the more likely they are to take action. This is also applicable to energy conservation in the workplace. For example, if a person understands that most coworkers believe it is necessary to save energy at work, the individual will feel pressure and aim to conserve energy.

SN are impacted by ideas and thoughts toward the performance of an act (Nolan et al. 2008). Specifically, they are family, friends, and society's expectations of how individuals must behave. Research conducted by Goldstein et al. (2008) revealed social norms to be observable and salient in affecting behavioral intention. These will encourage energy-efficient behavior and cut energy usage by forty percent (Goldstein et al. 2008). Costanzo et al.'s (1986) energy conservation model is based on socio-psychological ideas. It shows that social influence, diffusion, and reference groups, such as friends, family, and other social networks, play essential roles in getting people to save energy sustainably. Similarly, Stern (1992) argued that personal views and friends' behaviors might have a more powerful impact on family energy decisions than professional advice, even if the latter is more educated. For their part, Dixon et al. (2015) argue that SN, divided into injunctive and DN, has different types of incidences. For example, DN refers to one's perception of what others do; in the same way, research has detected inconsistent findings about the predictive power of SN on behavioral intentions; that is to say, on the one hand, it was found that SN has a powerful effect on behavioral intentions, either from direct observation of others' behavior or by indirect ways, such as directions about a DN. Nevertheless, on the other hand, it is essential to consider that some research indicates that an individual SN has a significant and positive impact on energy-saving behavior in the workplace (Jacobson et al. 2020; Mansor and Sheau-Tingi 2019; Staddon et al. 2016). Therefore, SN has a significant predictive effect on the choices of products, information examination, and pro-environmental behavior, and they positively influence their social support behavior (Fischer et al. 2019).

Consequently, to preserve the social environment, enterprises should assertively encourage employees to commit themselves to energy saving; environmentally aware employees will be willing to cooperate with measures to protect the environment, but employees without environmental consciousness may feel that it is an inconvenience, (Chen and Chen 2021).

Boomsma et al. (2019) and Dixon et al. (2015) determined that the relationship between SN and energy-saving behavior is mixed. It has been suggested that certain conditions need to be in place for SN to have an effect. The authors agree with Bamberg (2003) that SN relates more robustly to intentions if the environmental concern is low when looking at ISE, and with Terry and Hogg (1996) and Terry et al. (1999) in terms of high group compromise. From the perspective of the intervention to promote pro-saving energy environmental behavior in the workplace, Staddon et al. (2016) indicate that persuasive communication and the effective commitment of middle management are needed, not only focused on physical infrastructure. The most impactful interventions involve goal setting, social modeling, and making it easy for employees by justifying the need for action, providing directions, giving advice, offering incentives, and seeking employee compromise (Staddon et al. 2016). Interventions that create social and physical opportunities for employees to save energy are the most successful and fundamentally constitute enablement, environmental restructuring, and modeling (Staddon et al. 2016). Furthermore, given the evident importance of governance and culture and the potential for process changes, they point out that energy savings in the workplace depend not only on the individual and collective efforts of employees but also significantly on the attitudes and engagement of management, on broader organizational change, and investment in energy-efficient technology (Boomsma et al. 2019).

Nonetheless, SN has also been identified as a poor predictor of intentions owing to the diversity in norm measurement (Armitage and Conner 2001). Abrahamse and Steg (2011)

also found that SN is not a good predictor of environmental goals, and Bamberg (2003) found that SN is a strong predictor of an individual's intentions only when EK is low.

The approval of others or SN has also been observed as a factor positively associated with vaccination intentions (Winter et al. 2021). Jung et al. (2020) found that SN predicted specific intentions using wearable augmented reality. This literature agrees on the importance of SN in predicting intention. This implies that what others think, and the approval of others, are considerations in promoting environmentally friendly behaviors such as energy saving. Therefore, we hypothesized:

H1a: SN have a positive and significant influence on ISE in the workplace among employees in PH.

H1b: SN have a positive and significant influence on ISE in the workplace among employees in DR.

2.2. Descriptive Norms

Gao et al. (2017) expanded the TPB model to study an employee's desire to save energy at work. Their expansion covered both individual moral standards and DN. DN relate to how an individual decides to conduct a particular behavior based on what most people do in a given scenario. Their research showed that people are more likely to save energy at work if they have specific and robust personal moral standards. Gao et al. (2017) also said that DN is the most accurate predictor of a person's desire to save energy. Tang et al. (2019) found that DN had a significant direct and positive effect on how workers saw their energy-saving responsibilities. Also, Xu et al. (2020) found that DN is a better predictor of energy-saving goals for shared offices than for offices with just one person. In the same way, Akhound et al. (2021) found that DN positively affects the intention to save energy at work.

Ru et al. (2018) and Gao et al. (2017) looked into how people save energy at work and what makes them want to save energy. The results regarding DN and their effect on ISE were contradictory; in Ru et al. (2018), the findings were negative, while for Gao et al. (2017), they were highly positive. In the same way, Azar and Ansari (2017) examined campus building users' energy-saving motives and behaviors, and Lin and Azar (2019) studied crucial behavioral connections and patterns.

Normative elements represent the prevailing social influences in the working environment. Therefore, social influence is a situational circumstance that is beyond an individual's ability to control. According to Camacho et al. (2022a), corporations need to exhibit an image among all stakeholders, especially the employees, in this case, related to energy saving. When employees perceive corporations follow and maintain norms and exhibit proactive behavior that benefits all stakeholders, they become good citizens. In the same vein, Camacho et al. (2022b) and Saxunova et al. (2021) stated that corporations should appear to society as good citizens and show they can operate socially responsibly.

According to Nolan et al. (2008), DN is the strongest predictor of energy conservation. On the other hand, Dixon et al. (2015) found that DN produced the most remarkable change in energy conservation behaviors relative to informational campaigns where other reasons to conserve were preeminent. However, the authors indicated it was crucial to consider that survey participants could rate DN as the lower influential factor in decision-making behavior. On the other side, Nolan et al. (2008) stated that this situation is due to individuals' particular perception of their behavior and mental processes, in which individuals place greater weight on introspective thoughts and beliefs related to their decision to conform than to behavioral evidence of their conformity; therefore, it is necessary to ponder issues that arise when individuals are conscious of normative effects on their behavior; consequently, they may react by decreasing such behavior and correct for any biasing effect. Hence, campaigns that try to increase people's awareness of what their referent groups do should be cautious that participants do not detect deliberate normative manipulation.

Fischer et al. (2019) explain that DN needs to be better understood and may backfire to produce unwanted effects. Furthermore, given that DN has a more substantial impact on behavior than injunctive norms, if the process through which they influence consumers'

decisions are understood, it allows for identifying even more significant consequences for companies, public policymakers, or other organizations that promote an environmentally friendly way of doing their tasks.

In their research, [Tverskoi et al. \(2021\)](#) indicate that DN describes an individual's perceptions of how others are behaving. Furthermore, normative factors are critical predictors of energy-saving behaviors in the workplace ([Tverskoi et al. 2021](#)). From another point of view, [Jacobson et al. \(2020\)](#) understand that occasionally evidence indicates that individuals can embrace DN as "personal norms", and once internalized, personal norms can drive behavior independently from the current DN in the social environment. Thus, focusing on DN is strongly connected with intrapersonal goals related to accuracy and efficiency in decision-making.

DN collects impressions of people's thoughts about others' actions, such as how their coworkers use or save power. DN are also affected by social factors. For example, most coworkers expect an employee to turn off the lights before leaving the office. Therefore, there is a link between descriptive and subjective standards, which is very important for figuring out how people will act ([Hogg and Terry 2000](#)). Therefore, we hypothesized:

H2a: *DN have a positive and significant influence on ISE among employees in PH.*

H2b: *DN have a positive and significant influence on ISE among employees in DR.*

2.3. Environmental Knowledge

Knowledge generally refers to an individual's comprehension and interpretation of a topic, in this instance, environmentalism. EK is the capacity to comprehend and assess the influence of civilization on the ecosystem ([Haron et al. 2005](#)). Knowledge is essential in consumers' decision-making ([Chiou et al. 2002](#)) since it directly influences current knowledge and the acquisition of new information ([Park et al. 1994](#)).

The absence of EK may lead to intimidation and the avoidance of pro-environmental tasks and responsibilities ([Chan et al. 2014](#); [Fawehinmi et al. 2020](#)). Hence, when action related to EK is absent, no environmentally friendly behavior will be exhibited, which could obstruct the efforts of environmental management initiatives. Some scholars indicate that green human resource management has a significant incidence in the development of EK because it increases environmental consciousness and knowledge among employees ([Daily et al. 2009](#); [Ramus and Steger 2000](#)). Also, these human resources practices and strategies empower employees to develop capabilities and confidence to effectively lessen ecological issues, supporting employees to embrace and accomplish environment-friendly behavior in the workplace ([Daily et al. 2009](#)). In addition, employees execute organizational green policies and practices, so organizations must foster and support employee behaviors and align them with organizational green goals and objectives ([Ramus and Steger 2000](#)).

A friendly individual's behavior towards the environment is called "green behavior" ([Ones and Dilchert 2012](#)). In this sense, [Blok et al. \(2014\)](#) understand employees' green behavior as when they deliberately minimize adverse effects on the environment by optimizing resources and inducing environmentally friendly behavior, generating awareness, training, and opportunities to inspire a more thoughtful behavior.

According to [Camacho and Salazar-Concha \(2020\)](#), the availability of education in developing nations has enabled the population to analyze and respond to the negative actions of companies. Environmental knowledge consists of the information a person uses to assess and validate environmental challenges, enabling that person to transfer this knowledge into impactful behavior. Environmental knowledge affects how people think and act ([Kollmuss and Agyeman 2010](#)), and it can also be thought of as knowing how people and the environment depend on each other. This information exposes how individuals feel about their obligation to the environment, which directly or indirectly influences their environmental behavior. Therefore, individuals with EK are also aware of their contribution to sustainability ([Fan et al. 2012](#)). Consequently, we hypothesized:

H3a: *EK has a positive and significant influence on ISE among employees in PH.*

H3b: *EK has a positive and significant influence on ISE among employees in DR.*

On the other hand, a study conducted by [Pothitou et al. \(2016\)](#) about knowledge's influence on environmental and energy issues on pro-environmental behavior found that individuals with strong environmental values and sensitivity are more likely to engage in energy-saving activities, attitudes, and routines at home. Similarly, [Liobikienė and Poškus \(2019\)](#) discovered that actions related to EK were associated with an ecological worldview and directly affected private sector conduct; thus, EK influences environmentally responsible behavior. Consequently, educating people about local and global environmental issues is crucial to foster energy savings and environmental citizenship.

[Li et al. \(2019\)](#) asserted that individuals with some EK have constructive attitudes concerning environmental behavior and are willing to act. To them, environmental concern and knowledge will make people more conscious of the consequences of energy conservation and emissions reduction, so encouragement and education are essential to increasing EK.

Thus, [Żywiołek et al. \(2021\)](#) confirmed that educated societies are interested in learning about resource management in order to improve energy-saving measures, reinforce knowledge and behavior, and stimulate pro-environmental trends. They also point out that these societies take care of the sustainable development of the city, the country, and the individual. In the same vein, [Lin and Niu \(2018\)](#) say that educated people with a stronger sense of duty and care have better environmental attitudes because they are aware of environmental problems and take steps to fix them. Therefore, we hypothesized:

H4a: *EK mediates the relationship between SN and ISE among employees in PH.*

H4b: *EK mediates the relationship between DN and ISE among employees in PH.*

The existing research on environmental behavior in the workplace demonstrates that workers may be motivated to adopt energy-saving practices ([Lo et al. 2012](#)). [Greaves et al. \(2013\)](#) discovered that workers who wish to conserve energy turn off their equipment, mainly if they believe doing so is desirable and if social norms in the workplace support this conduct. Similarly, [Law et al. \(2017\)](#) stated that comprehensive EK helps a person select environmentally responsible behavior. Goal setting, individual feedback, group discussions, group feedback, peer education, and leveraging an ethical orientation create efficiencies and help build knowledge in a firm ([Singh 2008](#)), which have been demonstrated to be essential to improving environmental responsiveness ([Carrico and Riemer 2011](#)). Therefore, we hypothesized:

H5a: *EK mediates the relationship between SN and ISE among employees in DR.*

H5b: *EK mediates the relationship between DN and ISE among employees in DR.*

2.4. Intention to Save Energy

Moving towards environmentally friendly behavior, such as a shift to sustainable consumption, is necessitated by environmental deterioration. This applies to environmentally friendly behaviors, such as energy saving in the workplace; thus, the behavioral intention gap becomes an exploration interest. Past research has found a strong and positive effect of attitude on the purchase intention of sustainable apparel products ([Jung et al. 2020](#)), while performance expectancy and effort expectancy have been observed as factors for the intention to use e-government ([Afrizal and Wallan 2021](#)). Both constructs, environmentally friendly behavior and energy saving in the workplace, were determining factors in measuring attitude. Indeed, attitude has a strong positive influence on intention ([Winter et al. 2021](#)). Therefore, looking into attitude as a source of insight to increase intention can help promote environmentally friendly behaviors such as energy saving.

The theory of planned behavior (TPB) is widely used in applied social psychology. It shows how intention, antecedents, and actual behavior are connected. Attitude, norms, and perceived control were used to predict the ISE ([Ru et al. 2018](#); [Xu et al. 2020](#)). According to [Xu et al. \(2020\)](#), measuring the energy-saving behavior of participants had the limitation

of self-reported surveys. However, answers were anonymous, limiting the motivation to boost answers provided by the participants. The attitude was found to be one of the positive predictors of energy saving, and the extended variable ascribed responsibility was the strongest predictor (Xu et al. 2020).

Figure 1 depicts all relevant studies that support our literature review. Citations that have been included represent a positive influence on ISE (+) and a negative or no proven influence on ISE (-).

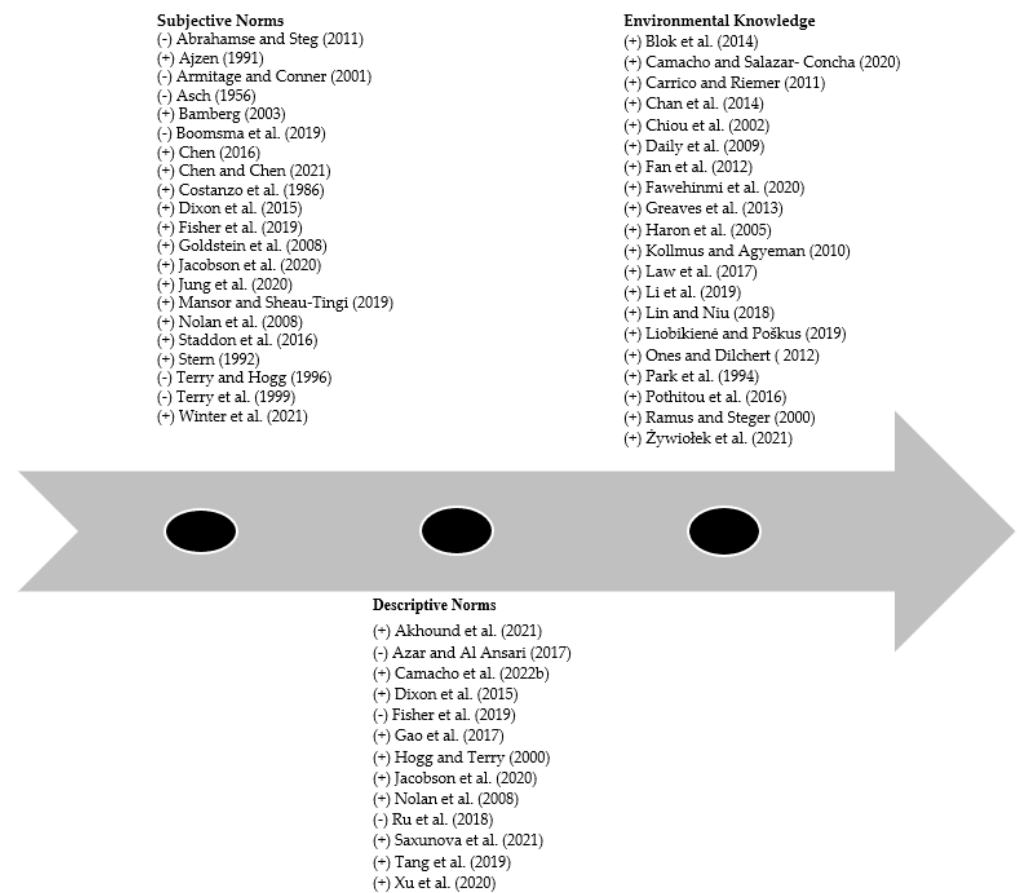


Figure 1. Review of The Related Literature about the Factors on Intention to Save Energy.

Based on the above discussion and arguments, the framework of this research is presented in Figure 2.

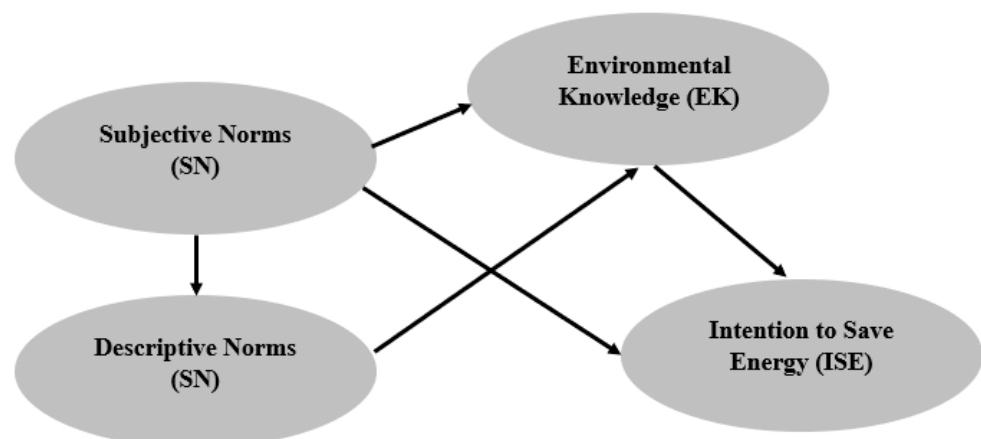


Figure 2. Research model.

3. Materials and Methods

Figure 3 exhibits the methodology that has been implemented to conduct this research. A combination of different scales has been adopted to design the questionnaire (Appendix A exhibits questions and definitions of variables). Five sections were used to structure the survey, SN, DN, EK, ISE, and demographics. First, 5-point Likert-type scales were used to evaluate the measurement indicators. Subjective norms, DN, and ISE measurement items were adopted from prior research conducted by Gao et al. (2017) and EK (EN) from Haron et al. (2005). A pilot test with 50 respondents was carried out to remove mistakes and validate the translation from English to Spanish for DR. No translation was necessary for PH.

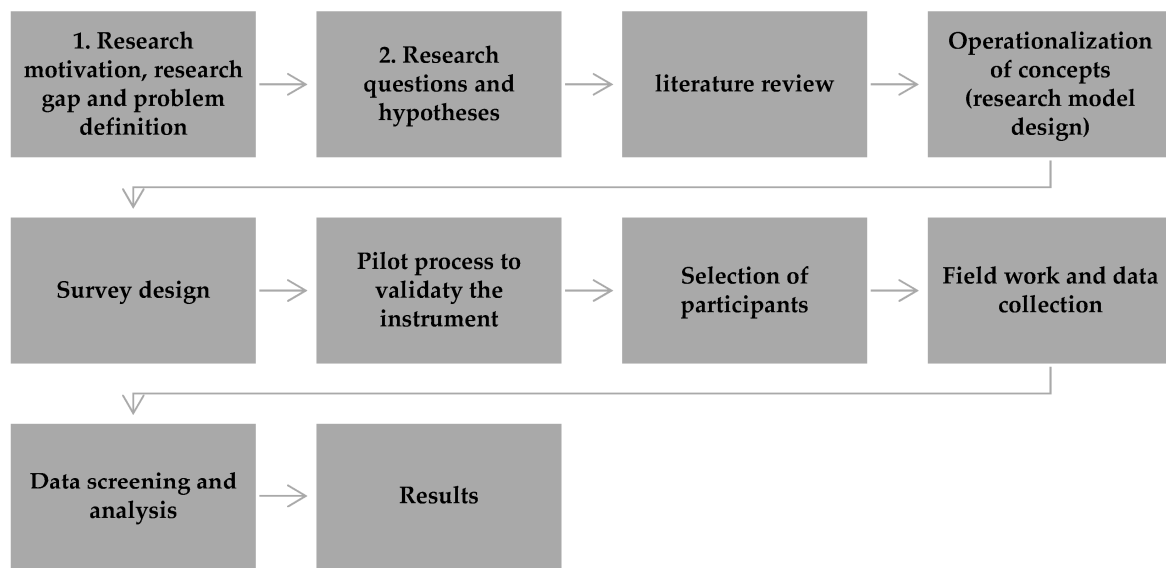


Figure 3. Graphical representation of the research methodology.

Employees from DR and PH were invited to participate in collecting the data. Through email blasting and some social media platforms, the instrument was distributed among the population of both countries, considering only its capitals: Santo Domingo and Manila. The survey was designed using Survey Monkey services. The research team repeated the survey distribution every other week in order to attract more participants, and the data collection process lasted for 20 weeks.

The researchers received 440 questionnaires from DR and 532 from PH; 60 and 193 were eliminated, respectively, due to a lack of essential information. Finally, 340 responses from DR and 339 from PH were accepted, meaning a response rate of 81.82% and 63.72%, respectively. Table 1 exhibits the participants’ demographics.

As shown in Table 1, 47.6% (DR) and 63.7% (PH) of the participants were female, while 52.5% (DR) and 36.3% (PH) of the participants were male. Concerning age, 12.1% (DR) and 33% (Philippines) of participants were under 25 years; from 25 to 44 years old, 59.7% and 56.6%, respectively. Furthermore, education results exhibit a close approximation between participants from both countries; 17.4% (DR) and 52.2% (PH) had completed a bachelor’s degree, and 41.4% and 18.9% had obtained graduate degrees, respectively. Furthermore, regarding the type of employment, 86.2% (DR) and 76.1% (PH) were full-time employees. Lastly, income shows that most people in both countries, 70.6% in DR and 87.3% in PH, made less than USD 15,000.

Table 1. Demographics.

Characteristic	n (%) DR	n (%) PH	Characteristic	n (%) DR	n (%) PH
Gender			Education		
Female	162 (47.6)	216 (63.7)	>than high school degree	-	10 (2.9)
Male	178 (52.5)	123 (36.3)	High school degree	9 (2.6)	41 (12.1)
Age			Some college but no degree	85 (25.0)	40 (11.8)
18–24	41 (12.1)	112 (33.0)	Associate degree	46 (13.5)	7 (2.1)
25–34	132 (38.8)	137 (40.4)	Bachelor’s degree	59 (17.4)	177 (52.2)
35–44	71 (20.9)	55 (16.2)	Graduate degree	141 (41.5)	64 (18.9)
45–54	54 (15.9)	26 (7.7)	Income		
55–64	33 (9.7)	7 (2.1)	USD 0–4999	187 (55.0)	217 (64.0)
65+	9 (2.6)	2 (0.6)	USD 5000–9999	42 (12.4)	57 (16.8)
Employment type			USD 10,000–14,999	11 (3.2)	22 (6.5)
Part-time	47 (13.8)	81 (23.9)	USD 15,000–19,999	15 (4.4)	169 (4.7)
Full-time	293 (86.2)	258 (76.1)	USD 20,000–24,999	15 (4.4)	8 (2.4)
			USD 25,000 and up	70 (20.6)	19 (5.6)

4. Analysis and Results

In order to answer the research questions, a preliminary analysis, including descriptive statistics and correlation analysis (via IBM’s SPSS), was performed using all the variables in the study. Next, the internal consistency of the measures used was computed based on Cronbach’s alpha coefficients. Cronbach’s alpha greater than 0.7 was used as the criterion for good internal consistency of the items (Field 2009; Kline 2015). Confirmatory factor analysis (CFA) was performed using AMOS version 23 to validate the measurement instruments. Several model fit indices were used to evaluate the fit of the measurement model. The model was then revised using modification indices suggested by AMOS. Construct convergent validity and discriminant validity were assessed using composite reliability, maximal reliability, average variance extracted, and maximum shared variance.

Table 2 and Figure 4 show the computation of means (M), standard deviations (SD), reliability coefficient (indicated by Cronbach’s alpha (CA), and correlations among the study variables. SN and DN have the highest reliability in the data collected from PH, while EK has the lowest reliability value (0.86). DN has the highest reliability value (0.88) in the data collected from DR, while EK has the lowest reliability value (0.84). In addition, EK has the highest mean value in the data from PH, while ISE has the lowest mean value. The data collected from DR show that DN has the highest mean value, while ISE has the lowest mean value.

Table 2. Descriptive Statistics.

	SN(P)	DN(P)	EK(P)	ISE(P)	SN(DR)	DN(DR)	EK(DR)	ISE(DR)
M	1.72	1.88	1.97	1.51	2.05	2.37	2.25	1.35
SD	0.65	0.64	0.59	0.54	0.90	0.91	0.74	0.51
CA	0.91	0.91	0.86	0.88	0.87	0.88	0.84	0.86
Correlations								
SN	1	0.511 **	0.398 **	0.461 **	1	0.469 **	0.285 **	0.217 **
DN	0.511 **	1	0.540 **	0.613 **	0.469 **	1	0.417 **	0.304 **
EK	0.398 **	0.540 **	1	0.495 **	0.285 **	0.417 **	1	0.205 **
ISE	0.461 **	0.613 **	0.495 **	1	0.217 **	0.307 **	0.205 **	1

Notes: ** $p < 0.01$.

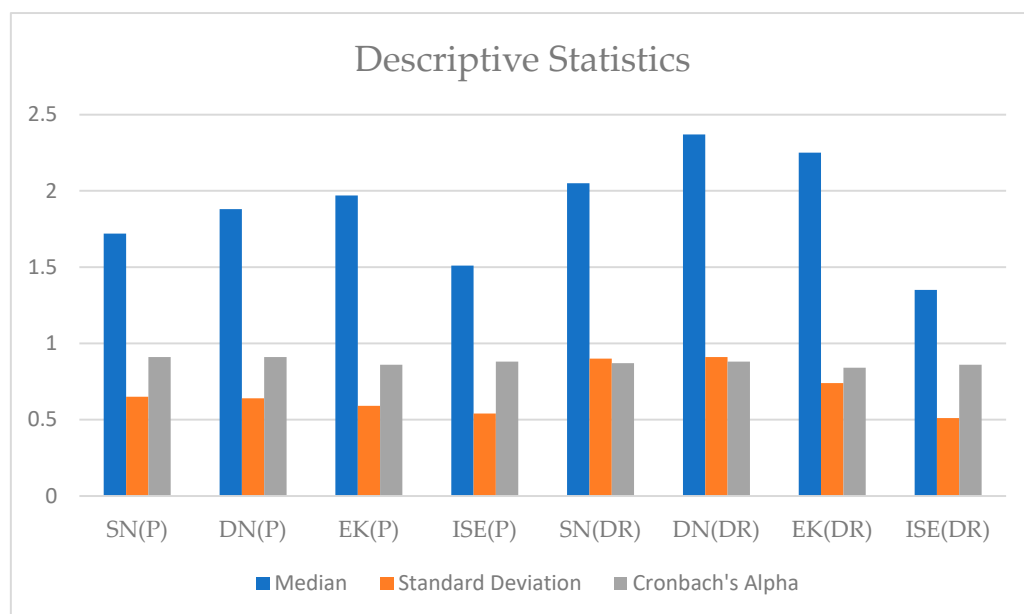


Figure 4. Graphical presentation of findings.

Regarding the standard deviation, ISE has the lowest value in both countries. This means that participants' answers to the questions on the measuring instrument were very similar. Most participants agree with the items on the scale based on the mean value. Table 2 shows that the highest positive correlation in the data from PH was between DN and ISE ($r = 0.61, p < 0.01$), while the highest positive correlation in the data from DR was between SN and DN ($r = 0.47, p < 0.01$). The correlations served as a preliminary method of testing the strength and direction of the relationships hypothesized previously and were not interpreted as evidence of causation.

Values greater than 0.7 for composite reliability and maximal reliability indicate good construct reliability. Composite reliability above 0.7 and average variance extracted above 0.5 shows proof of convergent validity (Malhotra and Dash 2011; Kline 2015). Finally, the average variance extracted should be greater than the maximum shared variance to establish discriminant validity for each construct.

CFA is an effective statistical method for evaluating the existence and interrelationships of latent components (e.g., attitudes, intention, etc.). According to Jackson et al. (2009), CFA evaluates a priori hypotheses on the relationships between observable and latent variables or factors, in contrast to exploratory factor analysis. CFA is often used to build and refine assessment instruments, evaluate concept validity, uncover method effects, and examine factor invariance across time and groups (Brown 2006). Since the late 1990s, there has been an upward trend in the usage of CFA for examining themes relevant to most business and psycho-sociological researchers, with most applications occurring in scale development and build validation (Brown 2006; Russell 2002). CFA is a member of the more popular family of techniques known as structural equation modeling (SEM), and plays a crucial role in validating measurement models in route or structural investigations (Brown 2006; MacCallum and Austin 2000). Before analyzing the structural model, researchers often study the measurement model while performing SEM. According to Brown (2006), difficulties with SEM models are attributable to measurement model errors that may be addressed using CFA (Brown 2006).

CFA (Table 3) was performed in order to confirm and validate the factor structure of the measurement instruments. Then, the measurement model with four factors was developed. The results for PH indicated that the initial measurement model fit was good, goodness of fit index (GFI) = 0.92, comparative fit index (CFI) = 0.96, Tucker Lewis index (TLI) = 0.95, incremental fit index (IFI) = 0.96, standardized root mean square residual (SRMR) = 0.04,

and root mean square error of approximation (RMSEA) = 0.07. The model was revised by deleting the first item of “EK” which loaded weakly on its respective construct, and allowing two items each on “DN”, “SN” and “EK” constructs to covary freely.

Table 3. CFA results.

Factor/Item	FL-PH	FL-DR	CR-PH	CR-DR	AVE-PH	AVE-DR	MSV-PH	MSV-DR
Descriptive norms			0.91	0.88	0.71	0.65	0.46	0.27
DN1	0.84	0.76						
DN2	0.85	0.83						
DN3	0.83	0.87						
DN4	0.85	0.77						
Subjective norms			0.91	0.88	0.71	0.64	0.32	0.27
SN1	0.79	0.78						
SN2	0.87	0.84						
SN3	0.86	0.76						
SN4	0.87	0.81						
Environmental Knowledge			0.86	0.85	0.56	0.53	0.34	0.22
EK1	0.63	0.50						
EK2	0.70	0.74						
EK3	0.76	0.77						
EK4	0.77	0.79						
EK5	0.84	0.79						
Intention to save energy			0.89	0.87	0.72	0.69	0.46	0.12
ISE1	0.80	0.84						
ISE2	0.91	0.83						
ISE3	0.84	0.84						

Notes: FL: Factor Loading; CR: Composite reliability; AVE: Average Variance extracted; MSV: Maximum shared variance; PH: PH; DR: DR.

The results for DR indicated that the initial measurement model fit was good, goodness of fit index (GFI) = 0.92, comparative fit index (CFI) = 0.95, Tucker Lewis index (TLI) = 0.94, incremental fit index (IFI) = 0.95, standardized root mean square residual (SRMR) = 0.04, and root mean square error of approximation (RMSEA) = 0.06.

As shown in Table 2, the constructs’ composite reliability and maximum reliability were greater than 0.7, indicating good construct reliability. In addition, the average variance extracted for the constructs was greater than 0.5. The high composite reliability of the constructs fulfilled the convergent validity requirement (Sharif et al. 2018). Moreover, the average variance extracted from each construct was greater than its respective maximum shared variance, thus establishing the discriminant validity of the constructs.

In order to keep the structural equation model away of the possibility of potential endogeneity, we introduced all the control variables to our analyses. The control variables are age, gender, education, employment type, industry, and income.

Table 4 and Figures 5 and 6 depict the mediation analysis of EK between DN and ISE and SN and ISE. The results reveal that EK partially mediates the relationship between SN and the ISE among employees in PH and partially mediates the relationship between DN and the ISE. This implies that EK, as the mediating variable, is only responsible for a part of the relationship between SN and the ISE among employees in PH and is also partly

responsible for the relationship between DN and the ISE. On the other hand, no mediation effect was observed in the relationship between SN and the ISE among employees in DR and the relationship between DN and the ISE among employees in DR.

Table 4. Path Analysis and Hypotheses Test.

	Hypothesis	Standardized Estimate	p-Value	Decision
H1a	ISE ← SN	0.11	0.014	Accepted
H1b	ISE ← SN	0.03	0.403	Rejected
H2a	ISE ← DN	0.37	<0.001	Accepted
H2b	ISE ← DN	0.13	0.001	Accepted
H3a	ISE ← EK	0.20	<0.001	Accepted
H3b	ISE ← EK	0.02	0.641	Rejected
Mediation	Total Effect/p-value	Indirect Effect/p-value	Direct Effect/p-value	Results
H4a	0.14 (0.011)	0.03 (0.019)	0.12 (0.052)	Partial mediation
H4b	0.46 (0.001)	0.09 (0.004)	0.37 (0.001)	Partial mediation
H5a	0.03 (0.399)	0.00 (0.581)	0.08 (0.394)	No mediation
H5b	0.14 (0.001)	0.02 (0.628)	0.27 (0.005)	No mediation

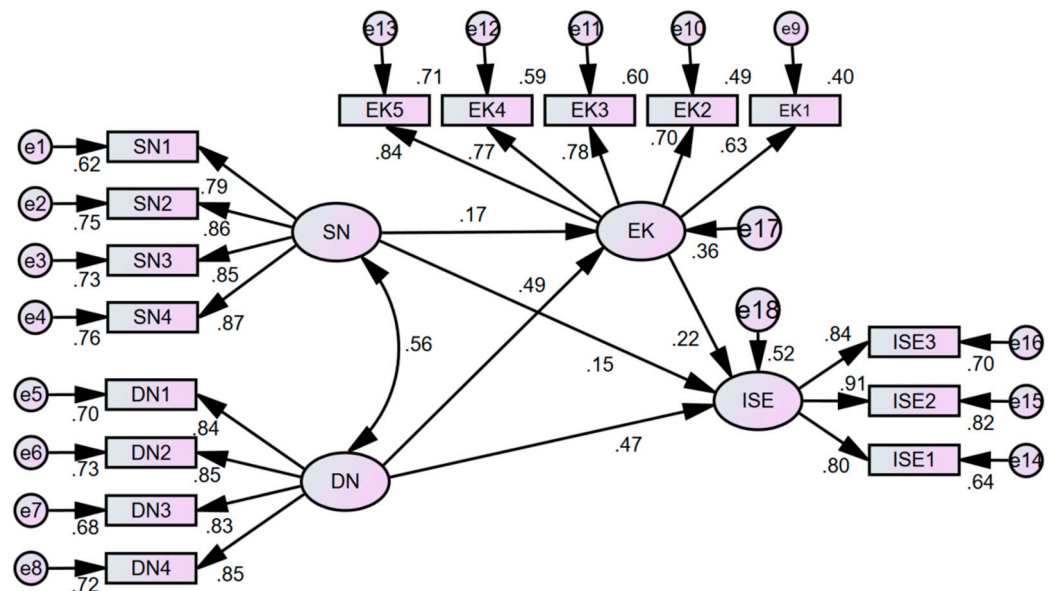


Figure 5. Mediation analysis for PH.

This study aimed to analyze the influences of SN, DN, and EK on ISE among the employee population in PH and DR to compare the actual situation for both countries. This research contributes to the extent of the literature about one of the most prominent factors that affects global warming and sustainability: energy consumption waste in the workplace, reflected on the ISE behavior of employees. Also, this study contributes to understanding how vital EK is to improve positive behavior and favor ISE. The results are aligned, as stated by some authors when they confirm in order to guarantee energy conservation it is necessary to modify employees’ behavior towards energy conservation (Hussain et al. 2021; McKinsey 2021; Soderholm 2020).

The research measured the direct effect of the independent variables, SN, DN, and EK, on ISE, and the mediation between SN and DN, when EK acts as a mediator. The results from both countries were different and, at some points, contradictory. For instance, in PH, all the variables (SN, DN, and EK) positively impact ISE. There is a partial mediation effect between SN and EK on ISE when EK is the mediator. The results in DR are different because the only variable that positively affects ISE is DN, and the other two (SN and EK) and the hypotheses were rejected. The same result occurred with the mediation effect of SN and DN on ISE when EK is the mediator; in both cases, no mediation effect was found.

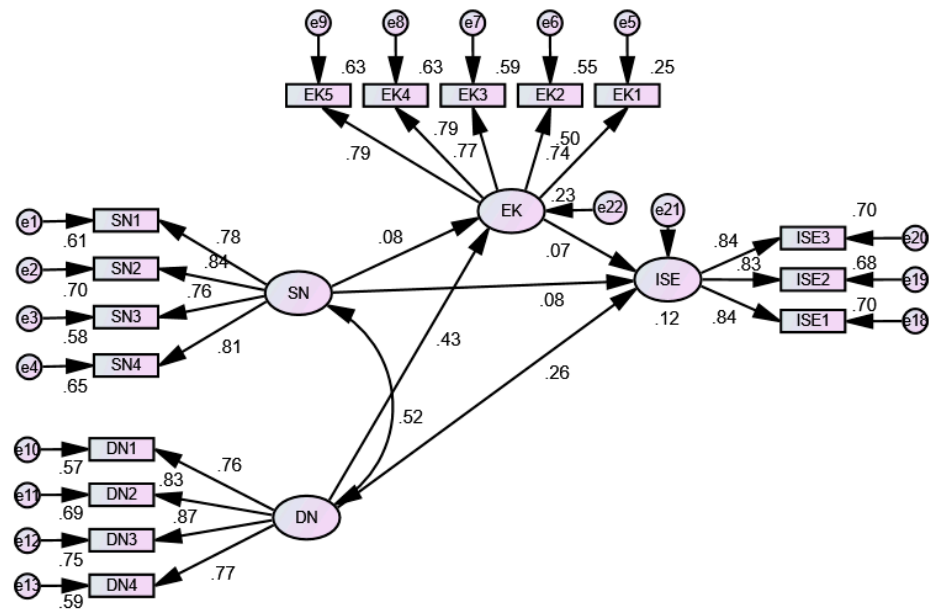


Figure 6. Mediation analysis for DR.

According to these results, there are significant differences between the countries evaluated. On the one hand, PH’s employee population is bonded to follow socially structured behavior toward ISE, and also, EK increases their willingness to save energy. On the other hand, in DR, the only variable that influences ISE positively is DN; therefore, employees neither follow social behavior in favor of sustainability nor exhibit a general knowledge of environmental protection.

These results can be interpreted in several ways. First, it would be necessary to improve EK among both countries’ employee populations, particularly in DR, not only for ISE but for sustainability in general. Second, corporations should stimulate employees to save energy based on programs, incentives, and organizational practices. Finally, the public sector (which demands more energy power in both countries) should get involved and implement programs and energy-saving techniques.

5. Discussion

Our study aimed to measure whether the contributing factors –SN, DN, and EK—significantly impact the ISE at the workplace in two developing countries, DR and PH. Integrating some components of the TPB theory, the research created a model in which the dependent variable is ISE.

The measurement model confirms that SN positively and significantly influences the ISE among employees in PH but not among employees in DR. Subjective norms pertain to people’s views of what others are doing and perceptions of (dis)approval of others. This outcome demonstrates several conclusions regarding the effect of SN on behavioral intentions. According to [Armitage and Conner \(2001\)](#), and supporting the results from PH, SN impacts positively ISE behavior. On the other hand, according to [Abrahamse and Steg \(2011\)](#) and the result from DR, SN is a poor indicator of environmental goals.

The results of the model indicate that DN positively and significantly influences ISE among employees in PH and DR. These results confirmed the statement by [Tang et al. \(2019\)](#) that DN is a determinant of an individual’s ISE. These results are significant because, according to [Gao et al. \(2017\)](#), DN is how an individual decides to conduct a particular behavior based on what most people do in a given scenario and is also the most accurate predictor of an individual’s desire to save energy. Therefore, managers must create the conditions and share the correct information about plans and actions to save energy in their businesses to improve engagement and positive behavior toward energy savings.

Furthermore, the study reveals that EK positively and significantly influences ISE among employees in PH but not in DR. These outcomes align with several authors that understand EK is crucial for energy conservation because it is the people that must modify their behavior and create the path for change and a sustainable future (Hussain et al. 2021); moreover, it is the capacity to comprehend and assess the influence of civilization on the ecosystem (Haron et al. 2005), and it is also an instrument that enables the population to analyze and respond to the wrong actions of companies (Camacho and Salazar-Concha 2020) regarding sustainability and environmental protection. On the other hand, the lack of EK negatively affects ISE. In economic terms, reducing energy consumption can help decrease energy costs and improve business profitability and competitiveness. In social terms, ISE can reduce energy consumption worldwide and improve social health, reducing gas emissions and pollution (Sweeney et al. 2013). Therefore, it is necessary to create educational programs that promote and improve the knowledge of energy saving in the workplace in DR. Also, these results go along with what was stated by Kollmuss and Agyeman (2010): that the awareness acquired through education influences attitudes and behaviors and energy savings.

The study evaluated the mediation effects between SN and DN on ISE, with EK acting as a mediator. For PH, the results show a partial mediation on both. This is significant because ISE increases when employees have acquired education about sustainability and environmental protection. On the contrary, the results showed no mediation effects of SN and DN on ISE for DR employee population. These results are aligned with the findings about the direct relationship between EK and ISE in DR.

6. Conclusions and Managerial Implications

It is impossible to exaggerate the value of energy conservation at work today. In order to lessen carbon emissions, it is crucial to motivate people to conserve energy and reduce their usage. However, given that most individual-level studies concentrate on families, only some studies have examined how people conserve energy at work. Employees frequently leave the office without turning off the electricity and air conditioners, for instance. This study aims to learn employees' intentions to save in the workplace. In addition, it improves the understanding of some theoretical concepts, such as SN, DN, and EK, related to ISE.

It is crucial to emphasize that although DR and PH are both developing nations, they differ significantly from one another concerning energy savings in the workplace. Therefore, businesses, government agencies, and nonprofits must develop nationwide campaigns to raise awareness and knowledge in those two nations, particularly in DR, where the greatest ignorance about energy conservation and environmental protection was discovered.

Additionally, these findings have significant implications for businesses hoping to motivate employees to use energy-saving techniques at work. This research investigated how a person performs specific energy conservation behaviors and found a lack of understanding and knowledge based on the ISE. These findings are helpful for the public and private sectors to implement initiatives that lower energy use. These results show that employees with solid SN, DN, and EK are more likely to decide to conserve energy in their jobs.

In order to design and implement a saving energy culture in the workplace, managers need to consider the country's energy-saving culture; local behavior in terms of energy saving can affect the implementation of educational programs that promote saving energy and sustainability. The findings of this research, when contrasting results among employees in PH and DR related to the influence of SN on the ISE, are insightful to managers locally and internationally. It is evident that local culture influences attitude and intention, and it is crucial to recognize cultural differences between these two countries and any others.

The development of an organizational culture of energy saving in the workplace cannot be undermined, as DN significantly influences the ISE in PH and DR. On the contrary, leaders leading by example and even company values that shape the practices of people in the organization are great advocates for promoting energy-saving behavior in the workplace.

Investing in organizational training, educational extension projects, and campaigns to increase EK are advised. It is evidenced by the partial mediation effect of EK on the ISE among the employees in PH and no mediation effect in DR. In addition, operational cost reduction and the benefits to company branding and image are a few benefits when energy-saving behavior is promoted. Moreover, the values of sustainability and social responsibility are upheld.

According to these results, understanding and education about environmental protection and concern in DR are very low. Therefore, it is imperative that actions are taken to close the knowledge gap among this employee population. Furthermore, the lack of understanding presented in these findings can put several aspects of sustainability at risk, not only energy savings but many others.

Finally, employee energy-saving behavior is the key to achieving energy-saving goals. Therefore, organizations should offer training and education to encourage their employees to adopt energy-saving habits to save energy. Also, organizations should create sustainability teams to monitor and take action to emphasize the importance of energy savings in the workplace.

Although we conducted comprehensive research, the limitations of this research do exist. Firstly, this research only investigates participants’ ISE in their workplaces in DR and PH. Neither country has data about energy-saving behavior that could be compared with our findings. Second, the survey was applied in the capitals of both countries, Santo Domingo and Manila; undoubtedly, this restricts the generalization of results. Finally, these are developing countries with some similarities and differences; therefore, the findings cannot be generalized, especially in developed countries in which environmental concerns and knowledge are more advanced.

Author Contributions: Conceptualization, L.J.C.; methodology, L.J.C.; software, L.J.C. and A.A.; validation, L.J.C. and A.A.; formal analysis, L.J.C. and A.A.; investigation, L.J.C., M.P., M.B., R.P., M.A., A.R. and N.R.; resources, L.J.C., M.P., R.P., M.A., A.R. and N.R.; data curation, L.J.C. and A.A.; writing—original draft, L.J.C. and A.A.; writing—review and editing, L.J.C., M.P., M.B., R.P., M.A., A.R. and A.A.; visualization, L.J.C. and A.A.; supervision, L.J.C., M.B. and R.P.; project administration, L.J.C.; All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Questionnaire and Variable Definitions.

Question	Variable Definition
Subjective norms	
My colleagues think that I should save energy in my company.	SN1
My managers think that I should save energy in my company.	SN2
The high-level management team would want me to save energy in my company.	SN3
Others who are important to me think I should save energy in my company.	SN4
Descriptive norm	
My colleagues have taken actions to save energy in my company.	DN1
A number of employees in my company I know have participated in energy-saving behavior.	DN2
My manager and the high-level management team have participated in energy-saving behavior.	DN3
Others who are important to me have participated in energy-saving behavior.	DN4

Table A1. Cont.

Question	Variable Definition
Environmental Knowledge	
I know that I buy products and packages that are environmentally safe and manufactured based on energy-saving processes	EK1
I know more about recycling and energy saving than the average person.	EK2
I am very knowledgeable about environmental issues and energy saving.	EK3
I understand the various phrases and symbols related to the environment and energy saving on product packages.	EK4
I know how to select products and packages that reduce the amount of waste dumping and energy.	EK5
Intention to save energy	
I am willing to save energy in my company.	ISE1
I intend to engage in energy-saving activities in my company.	ISE2
I will make an effort to save energy in my company.	ISE3

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