



AMERICAN JOURNAL OF ECONOMICS AND BUSINESS INNOVATION (AJEBI)

ISSN: 2831-5588 (ONLINE), 2832-4862 (PRINT)

VOLUME 2 ISSUE 2 (2023)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

Sustainable Ecopreneurship: Solar Energy Solutions in Commercial Real Estate

Kristina Marie Nalus^{1*}

Article Information

Received: October 07, 2023

Accepted: November 10, 2023

Published: November 16, 2023

Keywords

*Ecopreneurship, Social
Responsibility, Green Business,
Solar Energy, Energy-Efficient
Buildings*

ABSTRACT

This study delves into the rapid trend of integrating solar energy into the realm of business operations, providing valuable insights into the readiness of provincial business establishments and commercial building owners to embrace solar energy as a viable alternative power resource. This study examines the landscape of factors influencing the adoption of solar energy. These pivotal variables, namely, the comfort of tenants, competitive advantage, and cost-effectiveness, are all identified as central drivers within the thriving commercial real estate industry, signifying a promising shift towards solar energy adoption in the province of Pampanga. The result from the study affirms the paramount importance of tenant comfort, a factor inextricably linked with enhanced profitability. Additionally, the study illuminates the strategic significance of maintaining a sustainable environment, serving as a formidable competitive advantage. By embracing sustainability, businesses can unlock an array of economic benefits, rendering solar energy adoption inherently cost-effective. In sum, the interplay of these independent variables signals a robust relationship poised to usher in the widespread adoption of solar energy as a sustainable alternative power resource. As a prudent and forward-looking recommendation, this study underscores the compelling case for provincial commercial real estate entities to actively embrace the integration of solar panels into their operations. By doing so, they can champion both environmental responsibility and economic viability, reaping the rewards of a progressive and eco-conscious approach.

INTRODUCTION

In the contemporary business landscape, the confluence of ecopreneurship and sustainable energy solutions has emerged as a pivotal intersection characterized by innovation, profitability, and environmental stewardship. Defined as the conscientious pursuit of environmentally responsible entrepreneurship (Wagner, 2009), ecopreneurship represents a steadfast commitment to sustainable business practices underpinned by enduring environmental and social values. This research embarks on an academic investigation with the goal of clarifying how entrepreneurs can successfully balance their economic goals with their environmental and social values by employing alternative energy sources. In an era, fraught with acute environmental challenges (Masjud, 2020), it is of high importance to acknowledge and comprehend the seminal role that entrepreneurs play in addressing these issues.

An emerging trend in modern business involves the rapidly increasing adoption of solar energy, making solar-powered companies more and more common. Noteworthy insights are provided by Eddie O'Connor, Chairman of the Global Wind Energy Council and Mainstream Renewable Power, emphasizing that renewable energy, including solar power, not only promises cost reductions but also augments economic competitiveness and elevates living standards (O'Connor, 2018). Moreover, empirical evidence underscores the positive association between the incorporation of solar power and enhanced business valuation, rendering it an appealing prospect for entrepreneurial endeavors.

Against the backdrop of both national and corporate sectors embracing solar energy, entrepreneurs are faced not only with the imperative of diligently scrutinizing this emergent trend but also with the imperative of seamlessly integrating it into their broader social entrepreneurship paradigms.

Nonetheless, the realm of ecopreneurship remains an inadequately explored terrain in relation to alternative energy sources, especially within the purview of developing nations. Although entrepreneurship research has made substantive inroads in comprehending the construct of entrepreneurial opportunity (Shane, 2004), limited few attentions was directed towards the complex juncture of entrepreneurial opportunities and challenges intrinsic to the renewable energy domain. Notably, ecopreneurs grapple with formidable and unpredictable business risks stemming from the complex and evolving environmental landscape (Kirkwood & Walton, 2010). Unfortunately, the existing knowledge base lacks a thorough grasp of the various factors that drive building owners to embrace solar energy as an alternative source of power.

To address this scholarly gap, this study undertakes a systematic endeavor to bridge the schism between entrepreneurship and renewable energy research. It does so through the meticulous conduct of a sector-specific analysis that scrutinizes building owners who hold the potential to metamorphose into green entrepreneurs espousing renewable energy. This investigative approach strategically zooms in on the province of Pampanga, Philippines, allowing for a detailed examination of the

¹ University of Santo Tomas, Philippines

* Corresponding author's e-mail: kmnalus@ust.edu.ph

specific contextual intricacies. It is noteworthy that while the geographic ambit of this research is circumscribed to Pampanga, the insights gleaned therein carry a broader relevance that has the potential to inform future comparative studies across diverse geographic and industrial contexts. Implicit in this academic endeavor is the promotion of the use of a quantitative research methodology, intended to enhance the applicability of research findings beyond the restricted scope of the commercial real estate sector.

The main question driving this study effort pertains to the inclination of businesses and commercial property owners in the province of Pampanga to adopt solar energy as a practical alternative source of power. Central to this inquiry is the meticulous examination of the manifold factors that exert influence upon their decision-making processes. The objectives of this study are:

1. Identification of the variables that drive building owners to opt for solar energy adoption.
2. The significance of these variables within the scope of ecopreneurship and green business practices,
3. The evaluation of the pertinence of ecopreneurship within the commercial real estate sector, and
4. The discernment of the economic sustainability and environmental dividends attendant to the adoption of solar energy.

The significance of this scholarly enterprise transcends the boundaries of academic discourse, holding practical import for the commercial real estate industry. This study provides insights into the approach through which building owners can establish economically successful enterprises while steadfastly adhering to their environmental and social values. Furthermore, it significantly contributes to environmental preservation and efforts to address climate change by promoting the adoption of solar energy, thus reducing electricity consumption and its associated adverse societal impacts. Additionally, this research offers a robust framework that has the potential to inspire social and environmentally conscious entrepreneurship. This, in turn, can offer valuable support to government initiatives, enable corporations to quantitatively evaluate their environmental contributions, and stimulate further scholarly exploration into the complex relationship between entrepreneurs and eco-friendly entrepreneurship. This study is primarily focused on the commercial real estate sector, its findings have implications that reach beyond this specific domain. Notably, even though it is geographically rooted in Pampanga, the study's scope encompasses the limitless potential of solar energy as an endlessly renewable resource, making its insights relevant wherever the sun's radiant influence is felt.

LITERATURE REVIEW

This section introduces pertinent literature that contributes to a comprehensive comprehension of the present study, commencing with an examination of the existing research regarding the adoption of solar energy by building owners. Subsequently, it delves into the

literature detailing various strategies employed by building owners to successfully integrate solar energy solutions.

Social Responsibility by Building Owners

The reviewed literature provides valuable insights into the realm of Corporate Social Responsibility (CSR) and its multifaceted implications. Schremph-Stirling, Palazzo, and Phillips (2016) explore the concept of social responsibility, examining its effects on a business's reputation and legacy, emphasizing the importance of businesses addressing historical decisions made by previous generations of owners. Mikolajek-Gocejna's (2016) study delves into the relationship between CSR and financial performance, highlighting positive correlations between social responsibility and financial performance, while underscoring the need for more empirical research to validate CSR practices' impact on organizational economics. Wang, Tang, Takeuchi, and George's work sheds light on the evolving landscape of CSR research, emphasizing its growing importance for businesses, stakeholders, and society. A. Jain, P. Jain, and Rezaee (2016) investigate whether informed investors consider social responsibility performance when making investment decisions, finding a positive association between CSR performance and investment decisions. Kang, Germann, and Grewal's (2016) study explores the relationship between CSR and firm performance, identifying mechanisms that influence this relationship and finding support for good management and penance mechanisms. Collectively, these studies underscore the significance of social responsibility in business, highlighting its potential for positive feedback within the industry and financial effectiveness. They emphasize that an effective social responsibility strategy can contribute to a business's long-term success, while acknowledging the need for further investigation into specific CSR categories and their correlation with corporate financial performance in future research.

Energy-Efficient Buildings

The reviewed literature provides valuable insights into energy-efficient building strategies and their implications. Pape-Salmon, Muncaster, and Kaye (2011) evaluated the effectiveness of energy-efficient buildings, emphasizing their promotion through widespread adoption and eventual regulation, leading to new codes and standards. Passe and Nelson (2013) identified the relationship between form, proportions, and thermal performance in building construction, proposing joint demonstration projects to prevent thermal bridges. Horsley, France, and Quatermass (2003) examined the economic and environmental benefits of reducing energy consumption through design, highlighting the importance of life cycle costing. Iwaro and Mwashia (2010) assessed the implementation of building energy standards in developing countries, emphasizing the need for effective standards to achieve energy efficiency. Roulet, Flourentzou, Foradini, Bluysen, Cox, and

Aizlewood (2006) evaluated the attainment of sustainable development goals, including energy performance and occupant comfort. These studies collectively emphasize the importance of energy-efficient building strategies for sustainability, reduced energy consumption, and improved economic outcomes. This supports the statement of the study in the paper of (Pasaoa *et al.*, 2023), that focuses on innovation being able to improve business performance and sustain economic growth. They suggest that environmentally friendly design concepts, such as solar panels and green materials, can yield long-term benefits, including reduced energy consumption and increased tenant satisfaction, outweighing initial construction costs. However, consistent data and further research are needed to comprehensively understand the implications of energy-efficient buildings. These articles provide valuable insights for the development and construction of energy-efficient buildings and their openness to alternative energy sources, such as solar panels, contributing to a more sustainable and efficient future.

Green Business

The reviewed literature provides insights into various aspects of green business practices and their implications (Parry, 2012; Mishra & Sharma, 2014; Agrawal, Ferguson, Tokta, Thomas, 2012; Isaak, 2002). This study (Majeed *et al.*, 2022) explored a company perceptions' impact on its green business implementation of eco-friendly strategies and business performance. Parry (2012) identified distinct stages that businesses go through during the "greening" process, highlighting exploration, substantiation, and integration as key phases. In the study of Vilkaite-Vaitone & Skackauskiene (2019), discussed the trends and challenges of green marketing, emphasizing the need for businesses to target environmentally conscious consumers and promote the benefits of green products and services. As the study of (Qin & Li, 2023), Green business exhibits qualities such as minimal resource utilization, negligible environmental impact, the creation of high-value products, robust technological advancements, and the employment of highly concentrated production techniques. Agrawal, Ferguson, Tokta, and Thomas (2012) assessed the environmental impact of leasing compared to selling, concluding that leasing can have a lower environmental impact under certain conditions. The definition of ecopreneurship as a means to transform economic sectors toward sustainability, providing practical strategies for individuals interested in pursuing ecopreneurial ventures was studied by Rodríguez-García, Guijarro-Garcia and Carilero-Castillo (2019).

Collectively, these studies underscore the significance of green business practices in promoting sustainability and attracting environmentally conscious consumers. They highlight the potential benefits of green initiatives, including long-term growth, cost savings, and improved market positioning. Data analysis methods were employed in these studies to support their findings and conclusions. These articles pave the way for further research into the

environmental and economic aspects of green business practices, offering valuable insights for businesses seeking to integrate sustainability into their strategies. Additionally, they emphasize the relevance of energy efficiency as a key component of green business practices, aligning with the focus of my research study.

Solar Energy

The reviewed literature emphasizes the significance of solar energy as an alternative and sustainable power resource, addressing both environmental and economic considerations (Jayaraman, Ling, 2014; Bucking, 2017; Kononov, Pogornitskaya, Rostovshchikova, Matveenko, 2015). In the study of (Liu *et al.*, 2022), they evaluated the cost, energy, and environmental aspects of solar power, highlighting its potential to reduce greenhouse gas emissions and emphasizing the need for government support and incentives. Yüksek & Karadağ (2021) examined strategies to maximize solar energy utilization in buildings, emphasizing the importance of cost-effective technologies for solar energy capture and utilization. Makki & Mosly (2020) identified obstacles in the adoption of solar energy, including high subsidies for conventional electricity and the need for public awareness. Focusing on the effects of solar variability on energy and economics, emphasizing the importance of energy conservation, net metering laws, fuel price escalation, and upfront financing for cost-effectiveness for southeast Asian countries was conducted in the study (Govindarajan *et al.*, 2023). Kumar (2020) highlighted the growing demand for renewable and alternative energy sources to address environmental concerns and energy supply needs.

These studies collectively underscore the potential benefits of solar energy in reducing environmental impacts, improving energy efficiency, and contributing to sustainable business practices. They emphasize the need for government support, public awareness, and cost-effective technologies to facilitate the adoption of solar energy. Additionally, they highlight the relevance of energy-efficient building practices in achieving economic and environmental sustainability.

Overall, the literature review provides valuable insights into the role of solar energy in ecopreneurship and green business practices. It underscores the importance of continued research and innovation in solar energy technologies to promote its widespread adoption and maximize its benefits for businesses and the environment.

Theoretical Framework

In accordance with the findings presented in the scholarly article by Horsley, France, and Quatermass (2003) titled "Delivering Energy Efficient Buildings: A Design Procedure to Demonstrate Environmental and Economic Benefits," the concept of building energy performance can be comprehensively delineated as a multifaceted construct contingent upon three intricately linked factors. These factors encompass building design,

services design, and occupant behavior. Building design, in this context, pertains to the fundamental parameters encompassing the architectural plan, form, orientation, and structural components of the building. Services design encompasses the detailed specifications related to heating, lighting, and cooling systems within the building's framework. Furthermore, occupant behavior is considered a crucial determinant of energy performance and pertains to patterns of occupancy and utilization within the building.

These three interrelated factors governing building energy performance are intricately woven into the fabric of the building's development process, evolving and taking shape throughout various stages of design and construction. Notably, the article places its primary focus on facets that are less susceptible to change during the building's operational lifespan, namely building and

services design. The dynamic and iterative nature of the design process underscores the notion that the requisites for achieving energy-efficient building design are subject to evolution and adjustment as the project progresses through its developmental phases.

In summary, Horsley, France, and Quatermass (2003) assert that the multifaceted construct of building energy performance pivots on the interconnected dynamics of building design, services design, and occupant behavior, with these factors evolving throughout the developmental trajectory of the project. The study underscores the persistent need for meticulous attention to building and services design in the pursuit of energy-efficient buildings, recognizing their enduring significance in the face of evolving design requirements during the development process.

Within the scholarly work titled "Multi Criteria Analysis

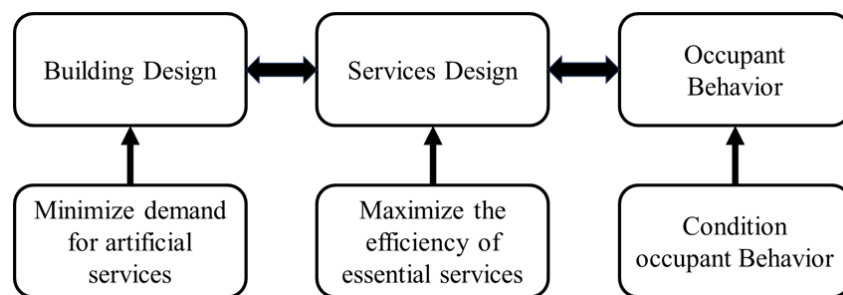


Figure 1: Theoretical Framework

of Health, Comfort and Energy Efficiency in Buildings,” a pivotal aspect under scrutiny is the perception of comfort among building occupants. In order to systematically assess this crucial variable, the researchers employed a self-administered questionnaire as their data collection instrument (Roulet *et al.*, 2006). The primary inquiry posed to the occupants was directed at elucidating their appraisal of the prevailing working conditions within the building, a query that solicited subjective feedback. In response to this inquiry, occupants were instructed to select a single rating from a spectrum spanning from 1 to 7, with each integer representing a distinct level on the comfort continuum. This evaluative process was conducted separately for both the winter and summer seasons to capture potential variations in comfort perception across different climatic conditions (Roulet *et al.*, 2006).

In essence, the study by Roulet *et al.* (2006) underscores the salient role assigned to the variable of perceived comfort, elucidating its evaluation through a structured questionnaire. Occupants were tasked with assessing typical working conditions within the building by assigning numerical values to distinct levels of comfort, thus facilitating a comprehensive understanding of comfort dynamics in both winter and summer seasons.

In summary, the research conducted by Roulet *et al.* (2006) delves into the realm of occupant comfort within buildings, employing a self-administered questionnaire to gauge occupants’ subjective evaluations. This approach allowed for the nuanced assessment of comfort perception under varying seasonal conditions, contributing to a holistic comprehension of the comfort-related aspects in building performance.

Table 1: Questions related to comfort

Thermal Comfort	Temperature	Comfortable	Uncomfortable
		Too hot	Too Cold
		Stable	Varies
	Air Movement	Too Still	Too Draughty
Air Quality	Air Quality	Dry	Humid
		Fresh	Stuffy
Light		Odorless	Smelly
Noise	Light Overall	Satisfactory	Unsatisfactory
	Noise from Outside	Satisfactory	Unsatisfactory

	Noise from Bldg. Systems		
	Other Noise from Bldg.		
	Noise Overall		
Comfort	Comfort Overall	Satisfactory	Unsatisfactory

The findings presented in this study draw upon an extensive dataset comprising over 5800 questionnaires collected from office buildings, with an average of approximately 90 questionnaires per building. Additionally, data were collected from 2700 questionnaires sourced from apartment buildings, averaging 27 questionnaires per building. For the purposes of the current analysis, the dataset has been aggregated to compute the mean scores for each question based on responses from all participants within a particular building. Detailed statistical summaries of these aggregated scores are provided in Table 2.

Table 2: Result of comfort marks given by occupants

Item	Mean	Median
Air Quality	2.95	2.90
Thermal Comfort	2.87	2.87
Lighting	3.37	3.41
Acoustics	2.67	2.60
Comfort Overall	3.09	2.94

The findings underscore the significance of the overall comfort levels experienced by building occupants, a factor that holds substantial importance not only for building owners but also for tenants. This aspect plays a pivotal role in the selection of an appropriate and conducive atmosphere for the building's inhabitants.

Operational Framework

Drawing upon the conceptual framework presented earlier, the researcher has developed an operational framework designed to effectively investigate the hypothesis and specific research objectives, thereby providing insights into the main research inquiries. Within this study, the dependent variables encompass aspects such as comfort, competitive advantage, and cost-effectiveness. Meanwhile, the focal independent variable revolves around the adoption of solar energy as an alternative power resource. The primary objective of this investigation is to examine the relationships among these factors and their respective significance.

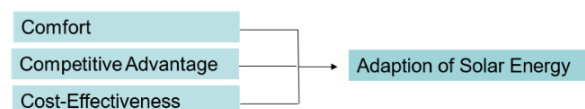


Figure 2: Operational Framework

METHODOLOGY

Research Design

This study is primarily characterized by a descriptive

research design, focusing on elucidating the characteristics of a specific demographic segment. The utilization of a purposive sampling technique was deemed appropriate due to the relatively small size of the target sample. Purposive sampling is not employed for the purpose of random selection from a population with the intent of generalization. Rather, it serves the objective of deliberately selecting units from a population with shared characteristics and common interests, aligning with the research's aim to address specific research questions.

The central aim of this research is to ascertain the relationships among variables that influence owners' decisions to adopt solar energy as an alternative energy source. Consequently, the ideal respondents for completing the questionnaires are the property owners themselves.

To ensure the representativeness of the sample, a selection process was undertaken. Among the 19 municipalities situated in Pampanga, five were strategically chosen for inclusion in the study-Floridablanca, Guagua, Lubao, Santa Rita, and Porac. These municipalities were selected due to their proximity, all falling within a 20-kilometer

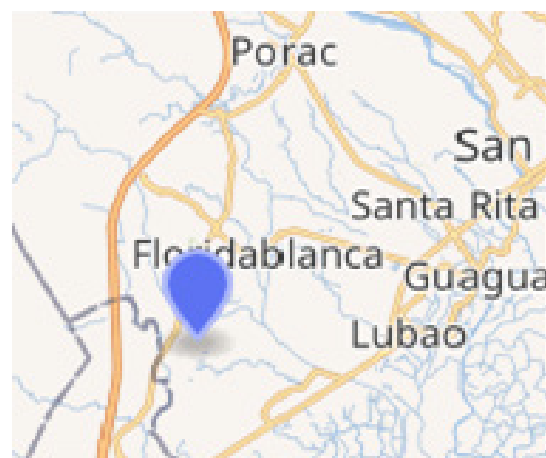


Figure 3: Map of Pampanga highlighting the municipalities of interest

radius of Floridablanca, one of the largest municipalities in the province, ranking third in size following Porac and Candaba.

Within these five municipalities, a total of 50 establishment and commercial building owners were selected as the target population for this study, serving as a representative sample reflective of a province of typical size. This sample was chosen to facilitate an in-depth analysis of their perspectives regarding the adoption of solar energy.

Table 3: Population of Respondents

Municipality	1-2 Story	2-4 Story	5 story and above	Total
Apalit	4	6	2	12
Arayat	5	5	1	11
Bacolor	5	6	2	13
Candaba	4	5	1	10
Floridablanca	6	3	0	9
Guagua	6	4	2	12
Lubao	4	4	3	11
Macabebe	5	3	0	8
Magalang	5	4	0	9
Masantol	5	2	0	7
Mexico	6	6	3	15
Minalin	4	3	2	9
Porac	3	3	2	8
San Luis	4	2	0	6
San Simon	4	3	0	7
Santa Ana	5	2	1	8
Santa Rita	4	3	3	10
Santo Tomas	6	3	0	9
Sasmuan	5	3	0	3

Research Procedures and Data Collections

Distribution and Administration of Questionnaires

Questionnaires are prepared in printed form and disseminated among the selected respondents. Respondents were guided through the questionnaire completion process by the researcher to ensure accuracy and candor in their responses. Furthermore, respondents were given explicit assurances that any information they provided concerning themselves and their business endeavors would be treated with strict confidentiality and solely employed for academic research purposes.

Questionnaire Structure

The questionnaire was thoughtfully structured to align with the relevant variables of the study. The initial section of the questionnaire was dedicated to gathering demographic information about business/building owners and assessing the extent of their involvement in their respective enterprises. Queries encompassed aspects such as the duration of their tenure in the industry, their experience in building maintenance, and the number of years their business operations have spanned.

Subsequently, the second part of the questionnaire was formulated to gauge the respondents' level of contentment with their financial performance, utilizing the Likert scale for measurement. The Likert scale, calibrated with '5' designating "Strongly Agree" and '1' signifying "Strongly Disagree," was employed for this purpose. The questions in this section were categorized into three distinct dimensions: Comfort of the Tenants, Competitive Advantage, and Cost-Effectiveness. Each

dimension comprised five questions, a deliberate choice to bolster the reliability and consistency of the obtained results. Moreover, an overarching measure of overall business satisfaction was incorporated into this segment of the questionnaire.

Questionnaire Validation

To validate the questionnaire, a pre-testing phase was carried out, and the Cronbach's alpha coefficient was implemented. Cronbach's alpha, developed by Lee Cronbach in 1951, serves as a metric for evaluating the internal consistency and reliability of tests. Its values range from 0 to 1, with a threshold of 0.7 or higher signifying the desirable or acceptable internal consistency

Table 4: Cronbach's alpha with raw variables for comfort of tenants/occupant's questionnaire

Cronbach's alpha	0.9461
95% lower confidence limit	0.8922

Table 5: Results of Cronbach's alpha for comfort of tenants' questionnaire

Variable dropped	Alpha	Change
Q1	0.9557	0.009612
Q2	0.9336	-0.01250
Q3	0.9445	-0.001552
Q4	0.9336	-0.01250
Q5	0.9360	-0.01001
Q6	0.9375	-0.008560
Q7	0.9470	0.0009012
Q8	0.9336	-0.01250
Q9	0.9476	0.001585
Q10	0.9336	-0.01250

Table 6: Cronbach's alpha with raw variables for competitive advantage questionnaire

Cronbach's alpha	0.8238
95% lower confidence limit	0.6480

Table 7: Results of Cronbach's alpha for competitive advantage questionnaire

Variable dropped	Alpha	Change
Q1	0.7756	-0.04823
Q2	0.8015	-0.02230
Q3	0.8877	0.06387
Q4	0.7667	-0.05715
Q5	0.8058	-0.01800
Q6	0.8048	-0.01902
Q7	0.8134	-0.01036
Q8	0.7975	-0.02632
Q9	0.8136	-0.01016
Q10	0.7808	-0.04296

Table 8: Cronbach's alpha with raw variables cost-effectiveness questionnaire

Cronbach's alpha	0.9613
95% lower confidence limit	0.9227

Table 9: Results of Cronbach's alpha for cost-effectiveness questionnaire

Variable dropped	Alpha	Change
Q1	0.9574	-0.003922
Q2	0.9530	-0.008319
Q3	0.9564	-0.004933
Q4	0.9590	-0.002363
Q5	0.9593	-0.002024
Q6	0.9552	-0.006081
Q7	0.9632	0.001856
Q8	0.9629	0.001549
Q9	0.9510	-0.01037
Q10	0.9530	-0.008319

of test items (Andrew, Pedersen, & McEvoy, 2011). The Cronbach's alpha coefficient calculated for questions pertaining to the comfort of tenants/occupants revealed an "Excellent Level of Reliability"

Cronbach's alpha for questions regarding competitive advantage resulted to "Good Level of Reliability"

Cronbach's alpha for questions regarding cost-effectiveness resulted to "Excellent Level of Reliability"

Research Ethics Approaches

The survey questionnaire commenced with an introductory section elucidating the study's provenance, its overarching objectives, and the thematic facets it encompassed. The questionnaire provided a comprehensive breakdown of its constituent segments, each serving a distinct purpose in the research inquiry. Additionally, the survey questionnaire explicitly delineated its intended respondents. Importantly, participation in the survey was entirely voluntary, and respondents were under no compulsion to partake. A paramount ethical consideration was the commitment to employ the gathered data exclusively for educational and research purposes, as explicitly communicated to the respondents in the questionnaire's introductory preamble. Furthermore, stringent measures were taken to ensure academic integrity, with all utilized resources being meticulously cited and referenced in accordance with established scholarly conventions.

Data Analysis

The obtained results underwent a rigorous analytical process involving both quantitative and descriptive methods. These analytical techniques were instrumental in computing key statistical parameters, particularly the mean and standard deviation, for each of the research variables.

The Population Mean, denoted by the symbol μ , was

ascertained using the formula: $\mu = (\sum X_i) / N$, where $\sum X_i$ signifies the summation of all scores within the population, and 'N' represents the total count of individuals or cases constituting the population.

Concurrently, the Population Standard Deviation, symbolized as σ , was determined to assess the degree of variability or spread exhibited by the scores pertaining to a given variable. The formula employed for this purpose is: $\sigma = \sqrt{[\sum (X_i - \mu)^2 / N]}$, with 'sqrt' signifying the square root operation and ' $\sum (X_i - \mu)^2$ ' denoting the summation of squared deviations of individual scores from the population mean.

It is imperative to note that the mean serves as a pivotal measure of central tendency, while the standard deviation functions as a critical gauge of dispersion. These statistics are especially pertinent when dealing with data sets adhering to a normal distribution and employing ratio or interval scaling. Furthermore, the mean and standard deviation play integral roles in the computation of various correlation coefficients and effect sizes, as elucidated in the subsequent chapter.

In the research context, the independent variable pertains to the adoption or implementation of solar energy as an alternative energy source. The dependent variable encompasses financial performance indicators, specifically comfort, competitive advantage, and cost-effectiveness. These parameters serve as the empirical foundations for investigating the research hypotheses and objectives outlined in the study.

Demographic Profile

A complete enumeration of the study's participant pool comprised 50 respondents who actively completed the questionnaire.

The educational attainment of the respondents reveals

Table 10: Profile of Respondents – Demographics

	Frequency	%
Age		
Below 30	3	6.0
30 to 35	18	36.0
36 to 40	4	8.0
41 to 45	10	20.0
46 and above	15	30.0
Gender		
Male	34	68.0
Female	16	32.0
Civil Status		
Single	23	46.0
Married	27	54.0
Highest Level of Educational Attainment		
High School	1	2.0
College	35	70.0
Post Grad	14	28.0

that 70% hold a college degree, 28% possess a post-graduate degree, and a solitary respondent did not complete a college degree, holding only a high school diploma. In terms of age distribution, the majority of respondents fall within the 30-35 age bracket (36%), followed by 30% aged 46 and above, 20% aged 41-45, 8% aged 36-40, and 6% below 30 years old. Gender-wise, the majority of participants are male (68%), with females constituting the remaining 32%. Marital status among respondents indicates that 54% are married, while 46% are single.

Table 11: Involvement in Business of Respondents

	Frequency	%
Full-time and hands on	26	52.0
Visits weekly	17	34.0
Visits whenever needed/necessary	7	14.0

Twenty-six respondents are actively engaged in full-time business management, wherein they personally oversee day-to-day operations and are responsible for making decisions that impact their businesses. Among these, seventeen respondents visit their businesses on a weekly basis and often employ area managers to handle operational matters. On the other hand, seven respondents, typically owners of two or more buildings, visit their businesses as needed. Despite their periodic presence, they have established systems and protocols to ensure the smooth operation of their commercial buildings during their absence. Consequently, their businesses can function with minimal direct supervision from the owners due to well-defined operational procedures.

Approximately 44% of the respondents, equivalent to 22

Table 12: Duration in Commercial Real Estate of the Respondents

	Frequency	%
4 years or less	8	16.0
5 to 10 years	22	44.0
11 years or more	20	40.0

Table 14: Descriptive statistics of the importance of comfort of the tenants and occupants

A. Comfort (Tenants/Occupants)	Mean	SD	Interpretation
Utilizing solar energy for your premises can greatly reduce the property's carbon footprint, which improves your tenant's green credentials and reduce health hazards	4.22	0.62	Strongly Agree
Tenants will have a peace of mind knowing that there will be no fire scare that is electricity related	4.64	0.56	Strongly Agree
With solar energy, tenants are immune from a fluctuating energy market or sporadic power outages	4.56	0.54	Strongly Agree
Reduction in utility bills will increase the life comfort of tenants	4.72	0.50	Strongly Agree
Convenience, safety, and health of the tenants is a priority	4.80	0.45	Strongly Agree
Owner of a rental unit is responsible for providing a "habitable" unit for a tenant. Rental unit must be free from hazards or defects, and be compliant with all local building and health codes	4.46	0.58	Strongly Agree

individuals, possess 5 to 10 years of experience within the commercial real estate industry. Moreover, 40% of the respondents, comprising 8 individuals, boast over 11 years of experience, concurrently managing two or more operational buildings. A total of 16% of the respondents, or 8 individuals, are relatively new to the industry, having accrued 4 years or less in the field. It is noteworthy that this group often includes the children of recent building owners. It should be emphasized that these well-defined business operations allow for the effective operation of commercial properties with minimal direct owner supervision.

Table 13: Amount Spent in Building Establishment's Maintenance of the Respondents

	Frequency	%
Php499,000 or less	35	70.0
Php500,000-999,000	14	28.0
Php1,000,000 or more	1	2.0

A significant proportion of the respondents, accounting for 70% or 35 individuals, allocate an annual budget of Php 499,000 or less for their building maintenance expenses. Additionally, 14% of the respondents, specifically 28 individuals, allocate an annual budget ranging from Php 500,000 to Php 999,000 for their building maintenance. Notably, only one respondent, constituting 2% of the population, incurs building maintenance expenses exceeding Php 1,000,000 annually.

RESULTS AND DISCUSSION

The building proprietors hold the comfort of their lessees in high esteem, deeming it a paramount consideration in each operational choice. The cultivation of comfort is instrumental in fostering productivity, ultimately culminating in enhanced financial viability. Given that numerous tenants employ personnel within their establishments, the provision of a comfortable milieu not only engenders contentment but also streamlines job performance. Furthermore, the preservation of a well-maintained in-store ambiance holds significant importance, particularly in cultivating patron loyalty.

Tenants have a compelling reason to consider Environment Quality measures when selecting a space where their employees will be most productive	4.20	0.61	Agree
Turnovers and dissatisfaction are expensive, therefore, achieving a high degree of tenant comfort and satisfaction is important	4.66	0.56	Strongly Agree
Energy efficient buildings tend to be more comfortable and have higher air quality	4.16	0.62	Agree
Building owners must provide and maintain rental properties in a reasonable state of repair. This means making sure they're safe and healthy to dwell in.	4.44	0.58	Strongly Agree
Overall Mean	4.49		Very Satisfied

The findings demonstrate that building owners universally accord substantial importance to the concept of competitive advantage. The study has unveiled that ecopreneurship, owing to its dedication to environmental sustainability, has garnered a commendable reputation. This commendation imparts a significant competitive edge to ecopreneur enterprises, enabling them to amass a substantial client base, inclusive of both existing and prospective customers. The sizable clientele within

the realm of ecopreneurship enterprises, in turn, contributes to heightened gross revenue volumes, thereby underpinning the profitability of these business endeavors (Isaak, 2002).

The outcomes of the study substantiate that integrating sustainability principles into business operations can indeed yield economic advantages. In addition to these benefits, ecopreneurship also exemplifies notable energy and resource efficiency.

Table 15: Descriptive Statistics of the importance of competitive advantage to the owners

B. Competitive Advantage	Mean	SD	Interpretation
Tenants or clients prefer establishments or businesses that are eco-friendly	3.90	0.74	Agree
Reduction of greenhouse gas emissions using solar power is a good Corporate Social Responsibility	4.22	0.62	Strongly Agree
There is no building in my area that uses solar panels	4.36	0.69	Strongly Agree
Adaption of solar energy will be a competitive edge; it provides a differentiation when putting the property back on the market for tenancies	4.18	0.60	Agree
Innovation and change are needed to stay in the market, and a competitive edge is needed in any type of businesses.	4.48	0.54	Strongly Agree
An understanding of the current environment of a building enables managers to improve and promote operational performance	4.30	0.54	Strongly Agree
Innovative building owners and operators recognize that satisfied tenants mean renewals, referrals and reduced operating costs	4.36	0.53	Strongly Agree
Solar energy is one of the most visible ways for a building to pledge their allegiance to the green movement.	4.12	0.56	Agree
Installation of solar panels can differentiate a building's brand in the market and irrefutably demonstrate stellar smart building leadership.	4.12	0.52	Agree
A top priority for building owners is delivering best-in-class service to retain tenants	4.36	0.63	Strongly Agree
Overall Mean	4.24		Very Satisfied

Table 16: Descriptive Statistics of the importance of cost-effectiveness to the owners

C. Cost-Effectiveness	Mean	SD	Interpretation
Using solar energy can lead to reduced operating costs by reducing or even eliminating utility expenditures	4.14	0.57	Agree
An investment in solar panels will help the business in the long run (future increase in electricity prices, etc.), and proves to tenants that they're investing in the future of the property	4.08	0.63	Agree
Long life span of a solar power system with a low maintenance process can make the rent expense low and will benefit both the owner and tenants/occupants since it requires little to no maintenance at all.	4.08	0.60	Agree
The number of years it takes for the investment to pay back might be high, but potential savings over time are higher, as it increases the property's value	3.96	0.60	Agree
Without the electricity bills, it will be easier for all businesses to stay in the market	4.42	0.88	Strongly Agree

Solar panels immediately help a commercial building become more recognizable, if not by the general public, then at least by future tenants.	4.04	0.57	Agree
To lower vacancy loss and maintenance expenses, building owners must deliver a superior tenant experience	4.64	0.48	Strongly Agree
Solar energy implementation can also increase tenant comfort levels and attract new tenants.	4.06	0.71	Agree
Solar energy ensures a high-build quality and a comfortable building with low-energy costs. The added value to tenants may justify the cost of construction	4.00	0.67	Agree
The cost of investments in energy efficient buildings can also be justified by the enhanced reputation of building owners	4.02	0.65	Agree
Overall Mean	4.14		Satisfied

To align with principles of sustainable development, buildings must meet certain minimum criteria, including providing a healthy, comfortable, and energy-efficient environment (Roulet, 2006). These criteria involve assessing factors such as occupants' perceived health, indoor air quality, and energy efficiency. With the emergence of solar energy panels, it is now possible to design and construct buildings that simultaneously fulfill these criteria, being energy-efficient, healthy, and comfortable.

Tenant comfort in commercial buildings also translates to higher profitability. Reduced electricity expenses result in lower operational costs, contributing to increased income. Safety considerations are also pivotal for tenants when selecting buildings or rental spaces for their businesses. Consequently, respondents in this study strongly concur that tenant comfort holds paramount importance in their business operations, particularly in achieving long-term goals such as minimizing turnover rates and tenant dissatisfaction.

Buildings significantly impact the environment through energy consumption during their operational lifetimes (Horsley, 2003). Solar energy, as a sustainable and renewable energy source, contributes to lower air pollution levels. This sustainability and reduced environmental impact can enhance the image of building owners, attracting more clients and consequently bolstering business volume (Wagner, 2009). John Elkington, in his influential work "Cannibals with Forks: The Triple Bottom Line of 21st Century Business" (Elkington, 2002), argues that organizations must meet ecological, social, and economic criteria to achieve success. A socially responsible business should take into consideration the interests of all stakeholders - the community, suppliers, consumers, customers employees, and innovators, as these stakeholders can influence financial performance (Pfajfar *et al.*, 2022).

These results align with a study by Pape-Salmon, where quantitative analysis of energy efficiency measures indicated that a targeted 20% reduction in energy use per area could be achieved if all measures were implemented. Additionally, it was found that the reduction in commercial and institutional energy use per square meter could exceed the target, resulting in a reduction in energy intensity. The distribution of savings across measures was well-balanced. However, other studies have concluded

that the additional costs associated with sustainability measures are potentially offset by benefits both direct and indirect, illustrating a very positive correlation between financial performance and social responsibility.

Efficient energy usage by ecopreneurs often involves the use of solar power, a sustainable and renewable energy source that reduces carbon emissions. This clean energy source can lead to lower energy costs for ecopreneurs, reinforcing their commitment to sustainability (Isaak, 2002, p.16). Numerous studies have affirmed that integrating sustainability into business operations can yield economic benefits (Wagner, 2010). Energy and resource efficiency are among the advantages of ecopreneurship. Ecopreneurs typically prioritize sustainable energy use to minimize energy losses during the production of goods and services. This conserved energy can then be directed toward other energy needs within their ventures.

In summary, the results from the questionnaires demonstrate a strong connection between entrepreneurship and environmentalism. Factors such as tenant comfort, competitive advantage, and cost-effectiveness are driving the adoption of solar energy as an alternative power source in commercial establishments across the province of Pampanga. Building owners are increasingly interested in the benefits of solar energy, particularly the reduction in electricity expenses, which outweighs the potential drawbacks associated with renewable energy adoption.

CONCLUSION

The study successfully discerned the primary independent variables crucial in motivating building owners to embrace solar energy as a viable alternative power source. These variables encompass tenant comfort, competitive advantage, and cost-effectiveness, collectively influencing the propensity of building owners to adopt solar energy solutions.

The study's findings highlight the potential of ecopreneurship and green business initiatives to not only achieve cost-effectiveness but also confer a significant competitive advantage while enhancing tenant comfort. Ecological entrepreneurship manifests in diverse forms and conditions, occasionally emerging unexpectedly within sustainable development contexts. However, it's crucial to acknowledge that ecopreneurship remains relatively

Table 17: Summary of Findings, Conclusion, and Recommendation

Results/Findings	Conclusions	Recommendations
1. Comfort of the tenants are highly regarded by the building owners.	1. Comfort of the tenants also means high profitability rate.	1. Design and build buildings that are simultaneously energy efficient, healthy, and comfortable.
2. Keeping a sustainable environment is a great competitive advantage.	2. Increased gross revenues volume which translates into profitable concern ventures are attainable for ecopreneurship ventures.	2. Renewable power resource as a competitive advantage should be considered in any business industry.
3. Incorporating sustainability in business can yield economic benefits, making it cost-effective.	3. There is a good correlation between financial performance and social responsibility.	3. A business must consider stakeholders' interests that have impacts on financial stability and its objectives.
4. The independent variables are the top factors to consider in the decision-making process of the business owners.	4. The independent variables have significant relationship that will lead to adaption of solar energy as an alternative power resource.	4. It is highly recommended that the provincial commercial real estate industry adapts the usage of solar panels.

nascent and has lacked empirical research in recent years, emphasizing the need for contemporary researchers to contribute to its growth. This paper addresses this research gap by illuminating how entrepreneurs can effectively pursue innovative, eco-friendly strategies for sustainable development. Amid challenges facing the commercial real estate industry, especially in regions like Pampanga, the paper asserts that ecopreneurship and green business initiatives, particularly in solar energy adoption, should be central to sustainable development agendas. Ecopreneurship urges entrepreneurs to blend environmental and financial objectives. While entrepreneurship historically drove economic growth, mounting evidence in the natural environment reveals a disconnection between economic growth and environmental preservation, underlining the importance of environmental responsibility in entrepreneurship, or ecopreneurship. Sustainable businesses tend to attract a substantial customer following, and solar investments offer opportunities for community engagement. In today's job market, employees increasingly favor sustainability-focused companies, with solar energy showcasing a business's dedication to eco-friendly practices and reducing operational costs. The adoption of solar energy among building owners in Pampanga hinges on tenant comfort, competitive advantage, and cost-effectiveness, with the study emphasizing their pivotal roles in business decision-making, underscoring the tangible benefits that outweigh potential drawbacks.

RECOMMENDATION

The study's findings emphasize the potential of ecopreneurship and green business initiatives to provide cost-effectiveness, competitive advantages, and improved tenant comfort. Ecological entrepreneurship takes various forms and thrives under diverse conditions, often emerging unexpectedly within sustainable development contexts. Despite its promise, ecopreneurship remains relatively under-researched, highlighting the need for

contemporary researchers to contribute to its growth. This paper addresses this research gap by illuminating how entrepreneurs can effectively pursue innovative, eco-friendly strategies for sustainable development, particularly in the commercial real estate sector. It asserts that ecopreneurship and green business initiatives, including solar energy adoption, should be central to sustainable development agendas in regions like Pampanga and beyond, encouraging entrepreneurs to integrate environmental and financial goals.

While entrepreneurship has traditionally been seen as a driver of economic growth, mounting evidence suggests a disconnection between economic growth and environmental preservation. Ecopreneurship can bridge this gap, as businesses demonstrating a commitment to sustainability tend to attract a substantial following among customers. Investing in solar installations offers organizations opportunities to raise awareness, promote their offerings within the community, and attract employees who increasingly seek sustainability-minded companies. Solar energy, as a prominent alternative power source, not only aligns businesses with eco-friendly practices but also reduces operational and maintenance expenses, particularly electricity costs. The study underscores the pivotal role of tenant and occupant comfort, competitive advantage, and cost-effectiveness in driving the adoption of solar energy among building owners in Pampanga, highlighting their tangible benefits that outweigh potential drawbacks.

Acknowledgements

I extend my heartfelt gratitude to my research adviser, Prof. Alfredo Velez, for his unwavering support, invaluable guidance, and mentorship throughout this research endeavor. I would also like to thank my family, particularly my dad, for the unwavering encouragement and belief in my abilities. To my dear friends, Mr. Justin Ong and Mr. Jullian Ducut, your support and camaraderie have been a source of inspiration. Lastly, I humbly

acknowledge the divine guidance of the Lord Jesus Christ, which has provided strength and clarity throughout this journey.

REFERENCES

- Agrawal, V., Ferguson, M., Toktay, B., & Thomas, V. (2011). Is leasing greener than selling? *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1857535>
- Andrew, D. P., Pedersen, P. M., & McEvoy, C. D. (2011). *Research Methods and Design in Sport Management*. <https://doi.org/10.5040/9781492596417>
- Elkington, J. (2002). Cannibals with forks: The triple bottom line of 21st century business. Capstone.
- Govindarajan, L., Bin Mohideen Batcha, M. F., & Bin Abdullah, M. K. (2023). Solar energy policies in Southeast Asia towards low carbon emission: A Review. *Heliyon*, 9(3). <https://doi.org/10.1016/j.heliyon.2023.e14294>
- Horsley, A., France, C., & Quatermass, B. (2003). Delivering energy efficient buildings: A design procedure to demonstrate environmental and economic benefits. *Construction Management and Economics*, 21(4), 345–356. <https://doi.org/10.1080/0144619032000073505>
- Isaak, R. (2009, November 24). The making of the ECOPRENEUR. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1512317
- Iwano, J., & Mwashia, A. (2010). A review of Building Energy Regulation and policy for energy conservation in developing countries. *Energy Policy*, 38(12), 7744–7755. <https://doi.org/10.1016/j.enpol.2010.08.027>
- Jain, A., Jain, P. K., & Rezaee, Z. (2016). Value-relevance of Corporate Social Responsibility: Evidence from short selling. *Journal of Management Accounting Research*, 28(2), 29–52. <https://doi.org/10.2308/jmar-51439>
- Kang, C., Germann, F., & Grewal, R. (2016). Washing away your sins? corporate social responsibility, corporate social irresponsibility, and firm performance. *Journal of Marketing*, 80(2), 59–79. <https://doi.org/10.1509/jm.15.0324>
- Kirkwood, J., & Walton, S. (2010). How ecopreneurs' green values affect their international engagement in Supply Chain Management. *Journal of International Entrepreneurship*, 8(2), 200–217. <https://doi.org/10.1007/s10843-010-0056-8>
- Kumar, M. (2020). Social, economic, and environmental impacts of renewable energy resources. *Wind solar hybrid renewable energy system*, 1. <https://doi.org/10.5772/intechopen.89494>
- Liu, T., Chen, L., Yang, M., Sandanayake, M., Miao, P., Shi, Y., & Yap, P.-S. (2022). Sustainability considerations of Green Buildings: A detailed overview on current advancements and future considerations. *Sustainability*, 14(21), 14393. <https://doi.org/10.3390/su142114393>
- Majeed, M. U., Aslam, S., Murtaza, S. A., Attila, S., & Molnár, E. (2022). Green marketing approaches and their impact on Green Purchase Intentions: Mediating Role of Green Brand Image and consumer beliefs towards the environment. *Sustainability*, 14(18), 11703. <https://doi.org/10.3390/su141811703>
- Makki, A. A., & Mosly, I. (2020). Factors affecting public willingness to adopt renewable energy technologies: An exploratory analysis. *Sustainability*, 12(3), 845. <https://doi.org/10.3390/su12030845>
- Masjud, Y. I. (2020). Ecopreneurship as a solution to environmental problems: Implications for university entrepreneurship education. *Journal of Environmental Science and Sustainable Development*, 3(1), 97–113. <https://doi.org/10.7454/jessd.v3i1.1041>
- McEwen, T. (2013, May). Ecopreneurship as a solution to environmental problems ... - HRMARS. https://hrmars.com/papers_submitted/9566/fraydanbranch-islamic-azad-university-isfahan-iran.pdf
- Mikolajek-Gocejna, M. (2016). The relationship between Corporate Social Responsibility and corporate financial performance – evidence from empirical studies. *Comparative Economic Research. Central and Eastern Europe*, 19(4), 67–84. <https://doi.org/10.1515/ceer-2016-0030>
- O'Connor, E. (2018, February 21). How wind and solar energy can help ph. INQUIRER.net. <https://opinion.inquirer.net/111197/wind-solar-energy-can-help-ph>
- Pape-Salmon, A., & Berkhout, T. (2020). British Columbia. Canadian Energy Efficiency Outlook, 31–50. <https://doi.org/10.1201/9781003151326-4>
- Parry, S. (2012). Going green: The evolution of micro-business environmental practices. *Business Ethics: A European Review*, 21(2), 220–237. <https://doi.org/10.1111/j.1467-8608.2011.01651.x>
- Pasaoa, K. A., Tan, J., Ong, J. I., & Trinidad, F. (2023). The Effects of Covid-19 on the Strategies of Social Enterprises in Metro Manila. *American Journal of Economics and Business Innovation*, 2(2), 1–16. <https://doi.org/10.54536/ajebe.v2i2.1512>
- Passe, U., & Nelson, R. (2013). Constructing energy efficiency: Rethinking and redesigning the architectural detail. *Journal of Architectural Engineering*, 19(3), 193–203. [https://doi.org/10.1061/\(asce\)ae.1943-5568.0000108](https://doi.org/10.1061/(asce)ae.1943-5568.0000108)
- Pfajfar, G., Shoham, A., Malecka, A., & Zalaznik, M. (2022). Value of corporate social responsibility for multiple stakeholders and social impact – relationship marketing perspective. *Journal of Business Research*, 143, 46–61. <https://doi.org/10.1016/j.jbusres.2022.01.051>
- Phillips, R., Schrempf-Stirling, J., & Stutz, C. (2019). The past, history, and Corporate Social Responsibility. *Journal of Business Ethics*, 166(2), 203–213. <https://doi.org/10.1007/s10551-019-04319-0>
- Qin, Y., & Li, J. (2023). Research on sustainable development of China's Green Enterprise Economy. *American Journal of Economics and Business Innovation*, 2(2), 86–92. <https://doi.org/10.54536/ajebe.v2i2.1891>
- Rodríguez-García, M., Guijarro-García, M., & Carrilero-Castillo, A. (2019). An overview of Ecopreneurship, eco-innovation, and the Ecological Sector.

- Sustainability*, 11(10), 2909. <https://doi.org/10.3390/su11102909>
- Roulet, C.-A., Flourentzou, F., Foradini, F., Bluysen, P., Cox, C., & Aizlewood, C. (2006). Multicriteria analysis of health, comfort and energy efficiency in buildings. *Building Research & Information*, 34(5), 475–482. <https://doi.org/10.1080/09613210600822402>
- Davidsson, P. (2004). Scott Shane, A General Theory of Entrepreneurship: The Individual-Opportunity Nexus. *International Small Business Journal*, 22(2), 206–210. <https://doi.org/10.1177/0266242604043697>
- Vilkaite-Vaitone, N., & Skackauskiene, I. (2019). Green marketing orientation: Evolution, conceptualization and potential benefits. *Open Economics*, 2(1), 53–62. <https://doi.org/10.1515/openec-2019-0006>
- Wagner, M. (2009). Eco-entrepreneurship: An empirical perspective based on survey data. *Frontiers in Eco-Entrepreneurship Research*, 127–152. [https://doi.org/10.1108/s1048-4736\(2009\)0000020009](https://doi.org/10.1108/s1048-4736(2009)0000020009)
- Yukse, I., & Karadag, I. (2021). Use of renewable energy in buildings. *Renew. Energy—Technol. Appl.* <https://doi.org/10.5772/intechopen.93571>