International Journal of Science and Research Archive

eISSN: 2582-8185

Cross Ref DOI: 10.30574/ijsra

Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

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Analytical hierarchal process of environmental ethics decision making for environmental sustainability

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International Journal of Science and Research Archive, 2024, 12(01), 2081–2091

Publication history: Received on 20 April 2024; revised on 29 May 2024; accepted on 31 May 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.12.1.0982

Abstract

The urgency of environmental sustainability is undeniable; global communities face intensifying challenges due to anthropogenic environmental degradation. Addressing resource depletion and pollution needs urgent and effective solutions. This study investigates environmental sustainability practices in Compostela, Cebu. It explores how barangay official representatives perceive environmental challenges and identify potential areas for improvement. The Analytic Hierarchy Process (AHP) was used to analyze the data and prioritize factors influencing environmental sustainability. The findings highlight the importance of energy efficiency and conservation as the primary focus for achieving environmental sustainability in Compostela. Upgrading to energy-efficient equipment emerges as the most impactful alternative within this category. Promoting environmental stewardship through waste reduction is another crucial factor. While renewable energy adaptation and sustainable transportation are also important considerations, they are seen as having a slightly lower overall impact. This research provides valuable insights for barangay officials and policymakers in Compostela, Cebu, to develop effective environmental sustainability strategies. By prioritizing energy efficiency, environmental stewardship, and renewable energy adaptation, the community can move towards a more sustainable future.

Keywords: Energy efficiency; Renewable energy; Waste reduction; Environmental stewardship

1. Introduction

The environment and society are facing a complex and interconnected array of challenges shaped by various factors, including population growth, urbanization, industrialization, globalization, human activities, environmental degradation, and climate change. According to William [1], "sustainability implies living well more equitably within the means of nature. Thus "sustainable lifestyle" implies any pattern of individual consumption and social behaviors that could be shared by everyone while still maintaining ecological integrity; it is facilitated by institutions, social norms and infrastructures that frame individual choices and actions while remaining that the aggregate rates of biophysical resource use and waste generation are within the regenerative and assimilative capacities of ecosystems." Environmental ethics seeks to promote harmonious and responsible relationships between humans and the natural world, recognizing the intrinsic value of all life forms and the interconnectedness of ecosystems.

Environmental ethics serves as a moral compass guiding human behavior towards the environment. It highlights the interconnectedness between humans and the environment, and it calls for ethical behavior that respects the intrinsic value of nature, promotes sustainability, and ensures justice for all beings affected by environmental decisions. It is also our guide for the community towards responsible and sustainable interactions with the environment, ensuring the well-being of both current and future generations.

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According to Alex et al. [2], environmental ethics means that humans are to act as environmental stewards. Knowledge about environmental ethics encompasses all environmental issues. The surrounding society, and notably individuals who are committed to environmental ethics and who can help prevent harmful environmental activities, can influence students' knowledge, and students can learn environmental ethics anywhere. According to Cheng et al. [3], those with high and moderate environmental literacy scores were more interested in ecological science knowledge, whereas those with low scores were more interested in environmental factors and environmental ethics.

Energy efficiency and conservation are essential for environmental sustainability. By using less energy, we rely less on fossil fuels, which are the main culprit behind greenhouse gas emissions that drive global warming. This conserves these finite resources and makes renewable energy sources like solar and wind more practical by reducing the total amount of energy needed. In essence, every bit of energy saved translates to a cleaner and more sustainable future for our planet. According to Zhao et al. [4], the impact of green-bond financing on energy efficiency investments for a green economic recovery is examined in this study. To accomplish the research goal, the fuzzy Analytic Hierarchy Process (AHP) technique was applied. The study's conclusions demonstrated that green bonds, which boost economic growth by 4.9% and have the potential to increase the green economy's recovery by almost 17% annually, are now the main source of funding for energy efficiency initiatives. Additionally, renewable energy sources have minimal environmental impact during operation, reducing air and water pollution. This shift to renewables paves the way for a cleaner, healthier planet and a more secure energy future. As the global community intensifies its efforts to combat climate change, the renewable energy sector has become a focal point for multinational energy companies seeking sustainable and environmentally friendly solutions. (Odunaiya et. al.,) [5]. Environmental stewardship in the energy sector is crucial for achieving environmental sustainability. Our current dependence on fossil fuels harms the planet through greenhouse gas emissions and disrupts ecosystems. In this rapidly evolving landscape, effective leadership and management are crucial for driving innovation, managing growth, and navigating complex challenges. Companies must encourage entrepreneurial thinking, foster collaboration across disciplines, and prioritize environmental stewardship in their operations. (Joel & Oguanobi) [6]. Moreover, since the transportation industry is one of the biggest polluters, energy-sustainable transportation is essential for environmental sustainability. Conventional fossil fuel-powered vehicles emit toxic pollutants into the atmosphere, trapping heat and contaminating the air we breathe. The demand for a reduced carbon footprint and limitations with energy sustenance have brought out alternative energy sources that aspire to sustainable transportation. (Pochont, N. R., & Y, R. S.) [7].

Compostela, Cebu, with its 17 barangays, offers a good area for research on environmental ethics to achieve environmental sustainability. This community presents a unique opportunity to explore the integration of sustainable practices. From analyzing energy consumption patterns and exploring renewable energy sources like solar or wind power to investigating waste management strategies and promoting alternative transportation options like cycling and improved public transportation, Compostela is a model for sustainable development.

The purpose of this study was to promote ethical behavior, environmental sustainability, and public health, ultimately contributing to the well-being of people within Compostela, Cebu City. It specifically investigates individual behaviors and habits related to environmental sustainability, such as recycling, energy conservation, and community engagement. The research also examines factors that influence people's environmental decision-making, including pleasure (recreational activities), money, and attitude. Additionally, the study assesses public awareness regarding the sustainability of the environment.

2. Materials and Methods

In order to achieve the goals of the study, quantitative research was conducted. The researchers used direct interviews and questionnaires for each representative of the barangay officials in Compostela holding the committee on the environment in order to collect relevant data.

Table 1 The following respondents are from different barangays within Compostela, Cebu

Respondent #	Barangay Official Representative
1	Bagalnga
2	Basak
3	Buluang
4	Cabadiangan

5	Cambayog
6	Canamucan
7	Cogon
8	Dapdap
9	Estaca
10	Lupa
11	Magay
12	Mulao
13	Panangban
14	Poblacion
15	Tag-ube
16	Tamiao
17	Tubigan

2.1. Materials

The researchers used materials such as printed questionnaires, which helped them to obtain accurate answers during data gathering. Moreover, the researchers used Google Forms as well, which is an online tool for conducting surveys that provides a digital substitute for paper questionnaires if the officials are likely to answer in that way, and a camera to have proof that the researchers were conducting and were used to record the respondents answering survey questions. By using this technique, researchers may better preserve the information they gather from interviews with respondents while gathering them, which improves the quality of the data they collect.

2.2. Methods

The researchers requested permission from the barangay officials to conduct the study before beginning. The researchers will only utilize the data from the study for research purposes and will keep it totally private and confidential. In this study, a quantitative research design was used. To gather data, anyone working in the barangay office was interviewed based on the guide questions made.

The researchers' quantitative data from interviews and surveys will be interpreted and analyzed with the use of the Analytic Hierarchy Process (AHP). According to Saaty [8], AHP is a mathematical method that can be used to determine the criterion weights via pairwise comparisons of the relative importance of two criteria. To do this, the stakeholders and decision-makers are asked to compare the relative importance of each pair of criteria, one after the other. These judgements are then summarized in the pairwise comparison matrix A, given by Saaty, which recommended the use of a nine-point scale for assessing the relative importance or 'intensity' of each pair of criteria, where '1' implies equal importance between two criteria and '9' indicates the absolute importance of one criterion over another. According to the website 1000mind [9], the Analytic Hierarchy Process involves a five-step process, which are: Structuring the hierarchy, pairwise comparing the criteria, Calculate Criterion Weights, Evaluate Alternatives, and Combine Weights and Scores to rank alternatives

The first step of AHP is to organize the main components of your decision-making problem into a hierarchy comprising of at least three levels: Goal, Criterions and Alternatives.

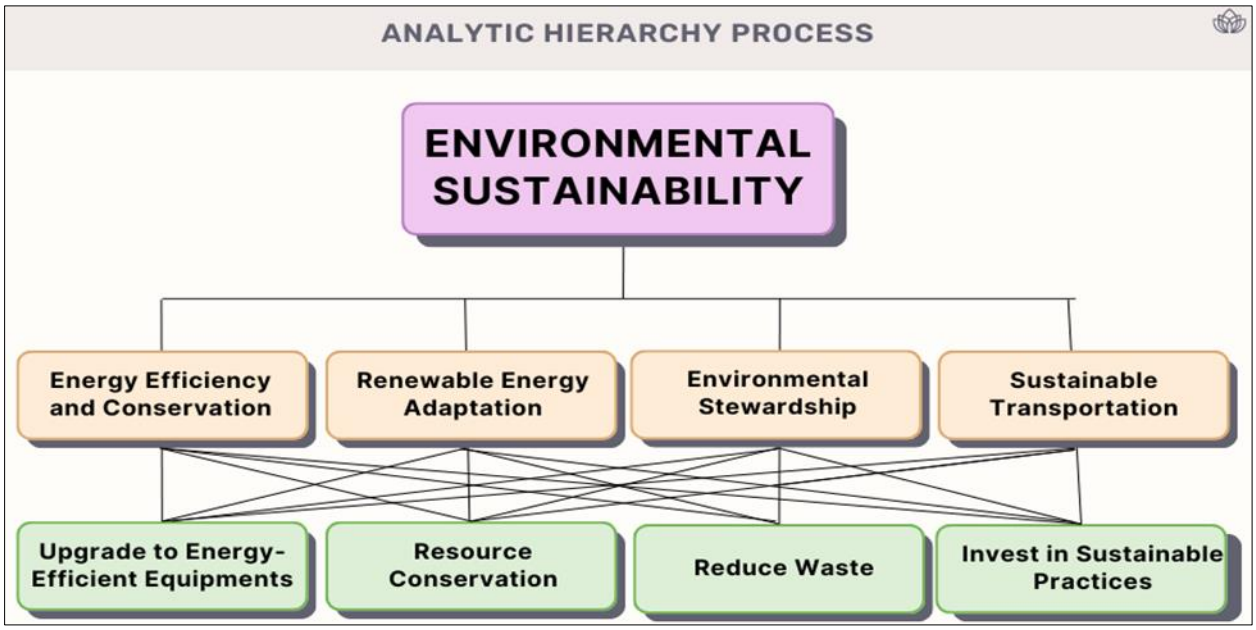

Figure 1 Analytic Hierarchy Process (AHP) Structure for Environmental Sustainability

Figure (1) depicts a hierarchical framework for achieving environmental sustainability which is the goal at the top. This structure prioritizes actions, moving from the different criterions such as Energy Efficiency and Conservation, Renewable Energy Adaptation, Environmental Stewardship and Sustainable Transportation. Furthermore, various alternatives will be the factors for achieving the goal. By following this hierarchy, we can identify which of the factors are the most important down to the least important.

The second step is to assess the corresponding importance of the various factors in which it is fundamental to an AHP that there is a following ratio scale value and its corresponding descriptions.

Table 2 Pairwise Comparison Scale

Preference Level	**Numerical Value**	**Description**
Equally preferred	1	Both factors have equal importance
Equally to moderately preferred	2	One factor is found to have a weaker importance than the other
Moderately preferred	3	One of the factors is slightly more important than the other one
Moderately to strongly preferred	4	One of the factors is moderately more important than the other one.
Strongly preferred	5	One of the factors is strongly more important than the other one
Strongly to very strongly preferred	6	One of the factors is found to be stronger in importance than the other one
Very strongly preferred	7	One of the factors is very strongly important compared to the other one
Very to extremely preferred	8	One of the factors is slightly stronger in importance compared to the latter
Extremely preferred	9	One of the factors is strictly superior to the other one

Table (2) shows the Pairwise Comparison Scale, and it uses a scale of 1 to 9, where 1 means two options are equally important and 9 signifies one option is extremely much more important than the other. 3 is for moderate importance, 5 for strong importance and 7 for very strong importance while the numbers 2, 4, 6, and 8 represent intermediate values on a scale used to denote the relative importance of two elements being compared.

The third step of AHP is to calculate criterion weights in which the weights on the criteria, representing their relative importance, are derived from your preference ratios in the pairwise comparison chart via some intricate calculations usually performed using Excel or specialized software. The following formula would be used in steps 3 and 4.

$$\frac{I}{\sum \text{Column}} = AS$$

Where: I correspond to the importance of this certain comparison (e.g. 1 is "equal importance") and AS stands for Arithmetic Score.

In continuation, to calculate the Arithmetic Mean of the Row, the formula is;

$$\sum AS/N = AM_R$$

Where N is equal to the number of factors and AM_R stands for Arithmetic Mean of the Row. In this case, the Arithmetic Mean of the Row is the Criterion Weights.

Table 3 Pairwise Comparison Chart

GOAL:	**Criteria 1**	**Criteria 2**	**Criteria 3**	**Criteria 4**	**Weight**
Criteria 1	1				
Criteria 2		1			
Criteria 3			1		
Criteria 4				1	

Table (3) is a blank pairwise comparison chart commonly used in the Analytic Hierarchy Process (AHP) for decision-making. Each cell except for the diagonal is empty and would be filled in with a number representing a comparison between two criteria.

The fourth step is evaluating alternatives, assessing the relative importance of your criteria at the previous step. This assessment is also done via a series of pairwise comparisons, again in the form of a pairwise comparison chart but this time with a chart for each criterion. Apply the formula from step 3 since it has the same process. The only difference is that the AM_R (Arithmetic Mean of the Row) in this step is equal to the attributed score instead of criterion weights.

Table 4 Pairwise Comparison for each criterion with regards to the alternatives

Criterion	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Attributed Score**
Alternative 1	1				
Alternative 2		1			
Alternative 3			1		
Alternative 4				1	

Table (4) showcases a pairwise comparison chart, a key component of the Analytic Hierarchy Process (AHP). This chart systematically compares each pair of alternatives (options) for every established criterion (factor influencing the decision). By assigning values (typically between 1 and 9) in each cell except for the diagonal, the chart reflects the relative importance of one alternative over another with respect to that specific criterion.

The final step of AHP involves combining the criterion weights from step 3 with the alternatives' scores by multiplying and summing them to get a total score for each alternative, by which they can be ranked and the researchers would be able to decide based on the ranking. The formula is;

$$\sum (X * Y_c) = \text{Value of the Alternative}$$

Where: X is the Criterion Weights, and Y_c is the Alternative Score of each criterion.

3. Results and Discussion

This study focused on the environmental issues faced by barangay officials, a pivotal component of any local government unit. Environmental issues are problems that might be a hindrance to the overall success of a community, so it must be assessed on what are the insights of the barangay officials regarding these challenges. The study aimed to shed light on the unique experiences and perceptions of barangay officials working on environmental issues and seek to identify key drivers for potential areas for improvement and the overall well-being of the community in tackling this critical issue. As we delve into the results, we anticipate uncovering insights that can inform environmental strategies and foster a positive community that will contribute to the individuals' overall engagement in addressing environmental concerns in their barangays.

3.1. Pairwise Comparison

Table 5 Pairwise Comparison of the Criterion Weights

GOAL: Environmental Sustainability	**Energy Efficiency and Conservation**	**Renewable Energy Adaptation**	**Environmental Stewardship**	**Sustainable Transportation**	**Weight**
Energy Efficiency and Conservation	1	6	7	6	0.620
Renewable Energy Adaptation	1/6	1	1/3	3	0.112
Environmental Stewardship	1/7	3	1	5	0.209
Sustainable Transportation	1/6	1/3	1/5	1	0.059

Table (5) indicates that the focus should be on reducing overall energy consumption and energy efficiency within the community, with a weight of 0.489, followed by promoting environmental stewardship, having a weight of 0.209. Renewable Energy and Sustainable transportation, while still important, are seen as having a slightly lower overall impact on achieving environmental sustainability, with a weight of 0.112 and 0.059, respectively. According to Paramati, S. R., Shahzad, U., & Doğan, B. [10], environment-related technological progress can lead to meaningful decreases in energy consumption and increase in energy efficiency. The efficient use of resources through recycling and eliminating waste can reduce the consumption of energy.

3.2. Pairwise comparison of the alternatives under energy efficiency and conservation factor

Table 6 Pairwise Comparison of the Criteria, Energy Efficiency, and Conservation with regards to the alternatives

Energy Efficiency and Conservation (0.620)	**Upgrade to Energy Efficient Equipment**	**Resource Conservation**	**Reduce Waste**	**Invest in Sustainable Practice**	**Attributed Score**
Upgrade to Energy Efficient Equipment	1	3	2	3	0.448
Resource Conservation	1/3	1	2	1/2	0.165

Reduce Waste	1/2	1/2	1	1/3	0.125
Invest in Sustainable Practice	1/3	2	3	1	0.262

Table (6) focuses on the "Energy Efficiency and Conservation" criterion, which holds the highest weight of 0.620 based on pairwise comparisons in Table 5. The subsequent pairwise comparisons within table 3 reveal that "Upgrade to Energy Efficient Equipment" emerges as the most impactful alternative with a weight of 0.448 for addressing this specific criterion. This suggests that, in the context of this AHP analysis, directly reducing energy consumption through equipment upgrades is considered the most effective strategy for promoting environmental sustainability. Interestingly, "Invest in Sustainable Practice," while a crucial long-term environmental goal, appears to have a less direct impact on energy efficiency, specifically with a weight of 0.262. Furthermore, "Resource Conservation" has a weight of 0.165, which is considerably lower than that of sustainable practice. This might be because it focuses on replacing energy sources rather than directly reducing overall consumption. Finally, "Reduce Waste" has the lowest weight (0.125) within this criterion, suggesting a less direct connection to energy efficiency in this specific context. Energy efficiency is a crucial component of system evaluation, and certain energy efficiency indicators can assess alternative competition at a macro level, particularly in high-energy industries (Si et al.) [11]. It could be seen that the importance of energy efficiency in achieving environmental sustainability and upgrading equipment that would contribute to energy efficiency consumption is the most impactful alternative.

3.3. Pairwise comparison of the alternatives under renewable energy adaptation factor

Table 7 Pairwise Comparison of the Criteria, Renewable Energy Adaptation with regards to the alternatives

Renewable Energy Adaptation (0.112)	**Upgrade to Energy Efficient Equipment**	**Resource Conservation**	**Reduce Waste**	**Invest in Sustainable Practice**	**Attributed Score**
Upgrade to Energy Efficient Equipment	1	1/2	2	1/2	0.187
Resource Conservation	2	1	3	2	0.412
Reduce Waste	1/2	1/3	1	1/3	0.108
Invest in Sustainable Practice	2	1/2	3	1	0.293

Table (7) analyzes the effectiveness of various alternatives in promoting "Renewable Energy Adoption," another key criterion for achieving environmental sustainability. This finding aligns with the overall emphasis on environmental sustainability, where transitioning to renewable energy sources is a crucial objective. The table further explores how the alternatives might contribute to "Renewable Energy Adoption." For instance, "Resource Conservation" has a relatively high weight of 0.412 compared to the other alternatives, such as "Upgrade to Energy Efficient Equipment" and "Reduce Waste," having weight of 0.187 and 0.108. This suggests that a strategy that reduces overall energy consumption is resource conservation, which might create a greater opportunity for renewable energy sources to meet remaining energy needs.

Similarly, "Invest in Sustainable Practices," with a weight of 0.293, might have a lesser impact than “Resource Conservation” but still have considerable influence on renewable energy adaptation. According to Nguyen et al. [12], renewable energy is critical for combatting climate change and the global sustainability crisis. Rooftop solar panels offer one of the cleanest forms of renewable energy, with residential installations particularly effective in reducing household carbon dioxide emissions. Renewable energy is a trend in today's society, but we still need to find solutions to lessen the cost of renewable energy so that it would be accessible to all.

3.4. Pairwise comparison of the alternatives under the environmental stewardship factor

Table 8 Pairwise Comparison of the Criteria, Environmental Stewardship with regards to the alternatives

Environmental Stewardship (0.209)	**Upgrade to Energy Efficient Equipment**	**Resource Conservation**	**Reduce Waste**	**Invest in Sustainable Practice**	**Attributed Score**
Upgrade to Energy Efficient Equipment	1	1	1/2	1/3	0.144
Resource Conservation	1	1	1/2	1/3	0.144
Reduce Waste	2	2	1	2	0.380
Invest in Sustainable Practice	3	3	1/2	1	0.332

Table (8) focuses on the "Environmental Stewardship" criterion, which emphasizes responsible practices for protecting the natural environment. Here, the pairwise comparisons reveal interesting connections between environmental stewardship and other sustainability initiatives. "Reduce Waste" has the highest weight of 0.380 compared to all other alternatives. This suggests that waste reduction efforts are seen as having a strong positive impact on environmental stewardship. Similarly, "Invest in Sustainable Practice," having a weight of 0.332, also appears to be significantly linked to environmental stewardship. This alignment makes sense, as both practices aim to minimize negative environmental impact. "Upgrade to Energy Efficient Equipment" and "Invest in Sustainable Practices" each have the same weight of 0.144. While these weights are lower than those for waste reduction and resource conservation, they still suggest that promoting energy efficiency and broader sustainable practices can contribute positively to environmental stewardship. These mounting factors lead to higher consumption and subsequent generation of abnormal waste, which continuously puts pressure on natural resources and environmental sustainability. Also, the adverse effect of waste on living creatures, socio-economic dynamics, and climate change further complicates its remedial process (Razzaq, A.,) [13]. These factors that lead to higher consumption and subsequent generation of abnormal waste are evident in today's society, and that is why we need to promote environmental stewardship, specifically reducing waste within our community to achieve environmental sustainability.

3.5. Pairwise comparison of the alternatives under the sustainable transportation factor

Table 9 Pairwise Comparison of the Criteria, Sustainable Transportation with regards to the alternatives

Sustainable Transportation (0.059)	**Upgrade to Energy Efficient Equipment**	**Resource Conservation**	**Reduce Waste**	**Invest in Sustainable Practice**	**Attributed Score**
Upgrade to Energy Efficient Equipment	1	1	2	1/3	0.193
Resource Conservation	1	1	3	1/3	0.225
Reduce Waste	1/2	1/3	1	1/2	0.127
Invest in Sustainable Practice	3	3	2	1	0.455

Table (9) examines the impact of various sustainability initiatives on "Sustainable Transportation," which has the lowest overall weight (0.059) based on the previous analysis in Table 2. Despite this lower weight, the table offers insights into how other strategies might indirectly contribute to promoting sustainable transportation. The pairwise comparisons reveal that both "Upgrade to Energy Efficient Equipment" and "Resource Conservation," with a corresponding weight of 0.193 and 0.225, have a moderate positive influence on sustainable transportation. This suggests that reducing overall energy consumption, even though non-transportation-specific means might create a greater need for opportunity to adopt sustainable transportation options. Interestingly, "Reduce Waste" has the lowest weight of 0.127 within this specific criterion. While waste reduction is a valuable environmental goal, it might have a small impact on promoting sustainable transportation in the context of this AHP analysis. Finally, "Invest in Sustainable Practices"

weights 0.455, suggesting that broader sustainability efforts might hold the most potential for influencing the adaptation of sustainable transportation. This could encompass a wider range of initiatives that promote alternative transportation options or discourage reliance on personal vehicles. According to Shah et al. [14], the sustainability of a transportation system is a major concern for urbanization, as evidenced by the ever-growing problems of air pollution issues in major cities. Urbanization raises serious concerns about a transportation system's sustainability, as demonstrated by the main cities' increasing air pollution problems. It could be seen that urbanization is a major concern, and that is why we need to invest in sustainable practices regarding transportation to at least lessen the effect of this on our environment.

3.6. Summary of results

Table 10 Summary of the results from previous tables (Table 5 – 9)

Environmental Sustainability	**Energy Efficiency and Conservation (0.620)**	**Renewable Energy Adaptation (0.112)**	**Environmental Stewardship (0.209)**	**Sustainable Transportation (0.059)**
Upgrade to Energy Efficient Equipment	0.448	0.165	0.125	0.261
Resource Conservation	0.187	0.412	0.108	0.293
Reduce Waste	0.144	0.144	0.380	0.332
Invest in Sustainable Practice	0.271	0.115	0.117	0.387

Table (10) explored the effectiveness of various alternatives in achieving the overall goal of environmental sustainability within a community. It provides a consolidated view of the AHP analysis. It emphasizes prioritizing actions that directly reduce energy consumption within the community. Additionally, promoting environmental stewardship and adopting renewable energy sources are crucial strategies. While sustainable transportation remains an important facet of environmental sustainability. Achieving sustainable energy integration is critical amid rising energy consumption and environmental concerns (Alharasees et al.) [15].

3.7. Overall priorities

Table 11 Overall Priorities with regard to the value of the alternatives in achieving the goal of environmental **sustainability**

Environmental Sustainability	**Energy Efficiency and Conservation (0.620)**	**Renewable Energy Adaptation (0.112)**	**Environmental Stewardship (0.209)**	**Sustainable Transportation (0.059)**	**Value of the Alternatives**
Upgrade to Energy Efficient Equipment	0.448	0.165	0.125	0.261	0.338
Resource Conservation	0.187	0.412	0.108	0.293	0.202
Reduce Waste	0.144	0.144	0.380	0.332	0.204
Invest in Sustainable Practice	0.271	0.115	0.117	0.387	0.228

Table (11) shows that the AHP analysis prioritizes sustainability initiatives, with "Upgrade to Energy Efficient Equipment" with a weight of 0.338 taking the lead. Further breakdown reveals the focus on energy efficiency within that initiative itself. "Resource Conservation," with a weight of 0.204, prioritizes "Renewable Energy Adaptation," which

weights 0.412 within its category, while "Reduce Waste" has a weight of 0.204, emphasizing the waste reduction itself which contributes to Environmental Stewardship has, a weight of 0.380 on this category. Finally, "Invest in Sustainable Practice," with a weight of 0.228, focuses on implementing "Sustainable Transportation," which has a weight of 0.387. Overall, this analysis suggests that energy efficiency, renewable energy adoption, and sustainable transportation are the key areas for achieving sustainability goals. According to Candan, G., & Toklu, M. C. [16], fossil resource consumption, which is scarce for the solution of the increasing energy demand problem as the population increases, is replaced by the consumption of renewable energy resources. The maximization of the efficiency of solar energy is possible with the correct location selection. It could be seen that the two alternatives, Energy Efficiency and Conservation as well as Renewable Energy Adaptation, were connected based on this study; by applying renewable energy resources such as solar energy then, with the right location, you would be able to maximize the efficiency of energy usage.

4. Conclusion

The analysis highlights two key areas for prioritizing environmental sustainability in Compostela, Cebu. Upgrading to energy-efficient equipment is identified as the most crucial initiative. Implementing sustainable practices that reduce waste generation is also a significant contributor. While resource conservation and further waste reduction efforts received slightly lower weights, they remain important and should be incorporated into a comprehensive sustainability plan. This two-pronged approach, combined with ongoing efforts to conserve resources and minimize waste, will have the greatest impact on achieving environmental sustainability in Compostela.

Recommendations

The recommended actions are upgrading to energy-efficient equipment such as solar-powered energy equipment as the top priority, alongside implementing sustainable practices that minimize waste generation. While additional resource conservation and waste reduction efforts are equally important, these initial actions will have the least but considerable impact. By combining these efforts with ongoing community engagement, Compostela Cebu can create a comprehensive and impactful plan for a more sustainable future.

Compliance with ethical standards

Acknowledgement

The researchers would like to acknowledge and thank all individuals whose contributions were instrumental in the successful completion of this study and the partial fulfillment of this research.

First, we are deeply thankful to the Almighty God for his unwavering guidance and blessings that illuminated our path throughout this academic endeavor.

Second, to the esteemed barangay official representatives from each of the barangays in Compostela, Cebu, we thank you with the utmost sincerity for your unwavering support. Your full cooperation and enthusiastic participation in this research project have been invaluable.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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