Solar Street Lights Adoption of the Native Aeta in the Botolan, Zambales, Philippines: Experience and Performance

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ABSTRACT

The study explores the use of solar street lights (SSLs) and their effects on the indigenous Aeta community of Maguisguis, Botolan, Zambales, Philippines. The study emphasizes the unique cultural heritage of the Aeta and resilience with reference to the 1991 Mount Pinatubo eruption disaster that resulted in the dislocation of many members and adaptation to modern technologies. Its main objective is to evaluate how solar street lights contribute to safety, socio-economic conditions, and environmental sustainability while valuing culture.

In mixed methods surveys, focus group discussions, and field observations, the study found high initial costs to be the main barrier to widespread SSL adoption, with almost no cultural resistance being discovered. Its findings showed significant changes in nighttime visibility, safety, and community activities, with satisfaction levels with SSL performance at 90% of households. Economically, the reduced expenses for households, while socially, this enhanced safety and lengthened hours of work and leisure activities.

Research shows that the acceptance of sustainable energy solutions like SSL within the indigenous communities is enhanced when barriers to finance are dealt with in a community-based support mechanism, along with some facilitation of technical maintenance training. The minor environmental impact and acceptance by the community make SSL a possible model for sustainable development that is culturally sensitive.

Some policy recommendations were the promotion of subsidy schemes, enhancement of community involvement, and exploration of options that can be scaled up in similar indigenous settings. The study concludes that interventions associated with technology can form a bridge between culture and environment and thus give rise to community empowerment, safety, and sustainable development, allowing for a balanced blending of tradition and progress.

Keywords: Aeta; Solar Lights; Indigenous people; Technology; Lyceum of the Philippines University

INTRODUCTION

The Aetas were one of the earliest known migrants or inhabitants of the Philippines. They are regarded for their unique identities and cultures, which are reflections of ingrained ancestral customs. The majority of Aetas live in northern Luzon. According to historical records, people have lived near Mount Pinatubo in Zambales for thousands of years.

However, when Mount Pinatubo erupted in 1991, it destroyed the Aeta people. The vast majority of people lost their houses, while some relocated to cities. This resulted in Aetas being impacted by contemporary Filipino culture and habits [10].

The Aeta people of northeastern Luzon resisted attempts to bring farming into their culture and were forced to leave the land. They were able to adjust to social, economic, cultural, and political obstacles with remarkable resilience, creating mechanisms and institutions within their society to mitigate the impact of change when necessary [9].

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This study sought to examine how certain Aetas lives were adopted technology in the community of Maguisguis, Botolan, Zambales. As they navigate the fine balance between preserving age-old traditions and embracing modern advancements, the adoption of solar streetlights emerges as a pivotal intersection of tradition and technology.

Research Objectives

This study aims to comprehensively investigate the experiences and performance of solar streetlights among the Native Aeta community in Botolan, Zambales, providing a holistic understanding of the impact of solar technology adoption in their context.

Identifying Barriers and Facilitators to Solar Technology Adoption;

Evaluating the Technological Adaptation and User Experience;

Measuring the Environmental and Economic Impact of Solar Street Lights and;

Deploying Solar Street Lights as the adopted technology of the community

Significance of the Study

This study shows how solar street lights have the potential to create safer communities and sustainable development among the Aeta communities, from reducing reliance on fossil fuels to lowering energy costs. The research throws light on culturally sensitive approaches with community participation and ownership in making the technologies fit well into the socio-economic and cultural dynamics for the adoption. To the results, the study aligns any initiative with the policies on indigenous rights, which further encourage the inclusion and empowerment of indigenous voices in decisions involving technology and developmental projects.

Furthermore, the study contributes to the academic discourse through evidence on technology acceptance, environmental consciousness, and sustainable energy solutions, thus serving as a reference for future projects involving indigenous communities. It advocates for community empowerment through education related to the benefits of renewable energy while warning people of possible barriers to such acceptance. Thus, it states that the incorporation of solar energy should help achieve healthy environmental goals and strengthen the rights of indigenous people. Such an effort would also lead to a more inclusive and sustainable approach to development as per community needs and aspirations.

Scope and Delimitations of the Study

This project looks into the adoption of solar street lights in the Aeta community of Maguisguis, Botolan, Zambales, focusing on not least 20 selected households. Among its primary objectives is to identify factors affecting the adoption and implementation of solar street light technologies in the community, offered in different cultural and socio-economic perspectives. The research particularly wants to assess the awareness and perception of solar street lights, which include their perceived advantages in terms of security, environmental impacts, and economic feasibility. Adoption is further driven by socio-economic conditions such as income level, education level, and accessibility to technology. Cultural beliefs and practices of the Aeta that either promote or hinder their willingness to adopt such technologies should also be examined. Other barriers to adoption include those at the technical, financial, and infrastructural levels. And finally, attempts were made to study the perceived benefits of these solar street lights in improved safety, mobility, and quality of life.

There is a geographic limitation because the community in Maguisguis does not represent other Aeta communities in other provinces; second, it is a small sample of about 20 households and may not fully represent the larger community for generalization of findings; third, a time limitation exists because data collection was undertaken within a specific time, which might influence what the research observes in the adoption process and interventions as affected by technological changes. The research would largely embrace qualitative methods like interviews and focus group discussions to provide rich insights, but again, not

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necessarily statistically representative data. Last, this study shall concentrate on the socio-cultural aspects related to adoption rather than on technical specifications or engineering drawings concerning solar street-light technology.

LITERATURE REVIEW

Solar Energy and Sustainable Development

According to a report by Republicans in April 2020, solar would be a viable option within the energy sector; more importantly, solar power generation appears to be a viable option that allows for an increase in the welfare and living standards of rural populations. This viewpoint finds further support in [8] on street lighting systems employing municipal photovoltaic power plants, which shows the implementations of solar technology in the urban context.

The work done by [2] in examining the influences of solar electrification of rural schools also bears practical angles on the use of solar technologies. This was such a huge field of operation that this particular research focused more on the practical findings of solar energy use and its influence in rural areas, particularly in education and other disadvantaged regions.

Technology Adoption and Cultural Dynamics

According to [12], technology has increased disparities in the indigenous population living in the Mentawai Islands. This research highlights the intricate relationships between technological and cultural change and the relevant technological implementation that requires contextual attention to be effective.

Indigenous Communities and Their Practice with Technologies

In the study of [11] give accounts about the Aeta culture who are identified as the first people of the Philippines. Such sources or sites form a valuable context in which the expected technological interventions within the indigenous communities can be understood.

In the work of [3] examining the use of solar energy for streetlights, it is possible to see the prospects for types of technology that can be modified to serve local community requirements, thereby attempting to close the gap between technological advancement and cultural particularism.

MATERIALS AND METHODS

The article by [7] were used by the researcher as their basis for the conceptual framework of the study. This model assembles and incorporates factors from several other theories, including the Technology Acceptance Model (TAM), and has major constructs:

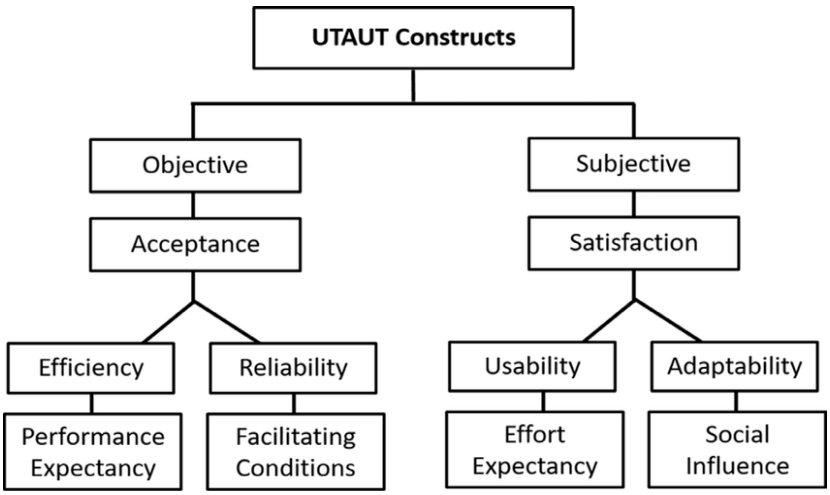

Fig. 1 The framework for Unified Theory of Acceptance and Use of Technology

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Performance Expectancy: Like PU, this is the extent to which the use of technology is perceived to enhance performance on the job.

Effort Expectancy: It relates to PEOU such that it refers to the ease of use associated with the technology.

Social Influence: The extent, or how much it suffices, to be perceived by a person to use the new system based on how others believe he/she should use it.

Facilitating Conditions: The resources and support available to use the technology.

According to the 2020 article by Monami [6], the Unified Theory of Acceptance and Use of Technology (UTAUT) remains central to understanding the processes involved in acceptance and use concerning technology. Rather, it integrates past theories and emphasizes social and contextual factors into a wider, comprehensive study of UTAUT.

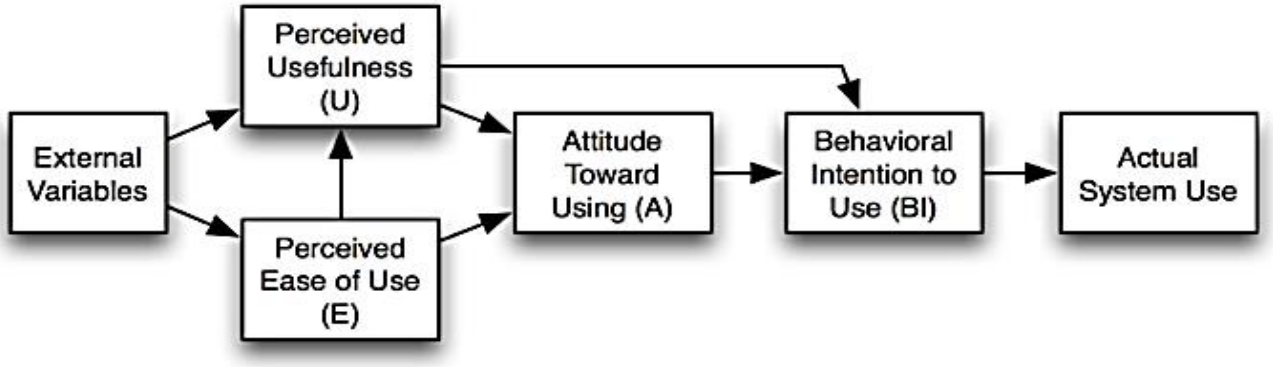

Fig. 2 Conceptual Diagram for Technology Acceptance Model (TAM)

Research under these concepts followed the Technology Acceptance Model, which began with an identification of external parameters for using the Solar Street Lights, followed by perceived usefulness and ease of use of the technology in the community. The researchers then solicited feedback from the community, with respect to their attitude toward the use of Solar Street Light as well as behavioral intention to use and accept the system in their community, after the installation of SSL in an area that necessitated lighting.

RESEARCH METHODOLOGY

The study has used qualitative and quantitative approaches to comprehensively address the multifaceted nature of the study. The researchers have used a survey and questionnaire alongside focused group discussion, interviews, and field interviews.

Data Collection Technique

The researchers have travelled from Manila to Maguisguis, Botolan, Zambales, where they met the Aeta Community. The questionnaires used for surveys and interviews were composed based on the research objectives. Focus group discussions were also used to get meaningful insights and knowledge from the target community. The researchers also did field observation and carefully laid out where the Solar Street Lights should be installed with the help of the local teacher in the community.

Research Procedures

To gather necessary information and facts, the researchers have visited the Aeta community to conduct a survey and focus group discussion among the selected families. They have also secured permission from the community leader, who is also the principal of the local elementary and high school in Maguisguis, Botolan,

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Zambales. The researchers have also prepared to install Solar Street Lights within the community area, as well as eat together with them to build rapport and to deliver their good intentions in visiting them. Only a few Aetas know how to speak in Filipino language, which leads them to ask questions to talk to the one who could represent the community and deliver it to them in their native language. Nevertheless, the language barrier does not hinder the researcher from obtaining truthful content and information regarding their willingness to adopt solar technology. The interview and focused group discussion were finalized by taking a group photo with the community's consent, by IPRA law.

Data Analysis Technique

The researchers have used three descriptive measures that provided a set of numerical data: frequencies, measures of central tendency, and measures of variability. A frequency statistic counts the number of times a variable appears, for example, counting the number of males and females in the sample. Specifically, such measures include the mean, which represents the average of the values in the data. The measure of variability helps to understand how far from the average the values in the data set are [1].

Research validity and reliability

Validity and reliability are the two basic concepts in research methodology that ensure the accuracy and dependability of the findings. Understanding these concepts is important for the assessment of the effectiveness of research instruments and the credibility of the research conclusions. Criterion-related validity checks whether one measure predicts an outcome well based on another measure. This validity consists of concurrent validity, which refers to the extent to which the test scores are correlated with a validated measure obtained at the same point of time. All such modes of validity play vital functions in deciding the reliability and truthfulness of the assessment instrument in question [5].

RESULTS

Challenges in SSL Adoption

The main barrier identified to adopt Solar Street Lights was the high initial costs, since 8 of the 10 respondents pointed it out as a significant barrier. Technical complexity and lack of information were low barriers, with each mentioned by only one respondent. There have been no cultural concerns reported to date, so the technology shares good values with the community.

Motivation and Performance Satisfaction

Improved nighttime visibility and safety was the rationale for SSL, with 9 of 10 citing this as the reason for its adoption. None mentioned cost savings as a motivation for adopting SSL, while environmental reasons were not rated as a prime motivator, nor were government incentives.

Satisfaction ratings with the SSL implementation were surprisingly high. In the Ease of Use, 7 out of 10 participants said that they are very satisfied with the Solar Street Lights. In terms of Performance Satisfaction, 9 out of 10 participants also answered very satisfied. Lastly, for Technical Problems, only 60% of the respondents said that they have not experienced any technical problems in operating the solar street lights, and 40% experienced some technical problems that occurred in the first few days.

Community Impact Assessment

SSL deployment has introduced a number of positive impacts on everyday life within the community. In terms of Increased Safety, all 10 respondents reported that safety had risen at night. 9 out of 10 respondents said that they had increased hours for work or study. Lastly, 8 out of the respondents claimed that their social activities were enhanced, and socialization among people in the community improved.

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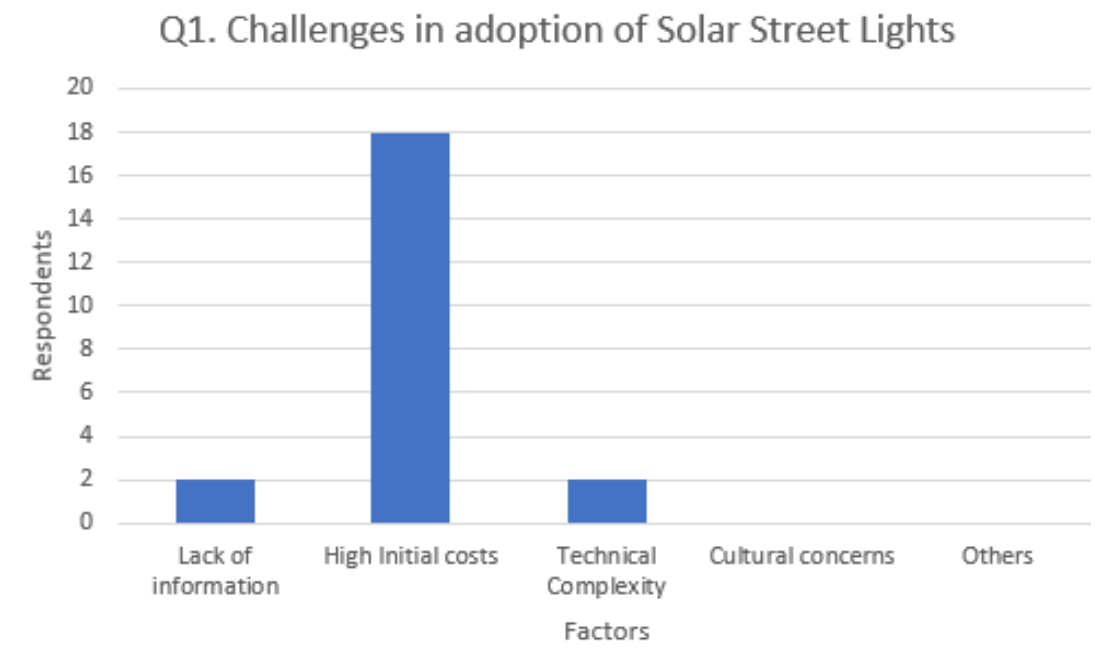

Fig. 3 Challenges encountered in adoption of Solar Street Lights

The SSL installation was highly positive about the economic aspect since 70% of participants reported that the expense was highly diminished, and 30% reported that the expense slightly decreased. No participant reported an increase or that it had no impact on expenses. The installation had the least interruption on the society environment, as 8 of the respondents gave the answer "Absolutely no disruption" and 2 respondents reported giving "No disruption" while none were reported for environmental negative impacts.

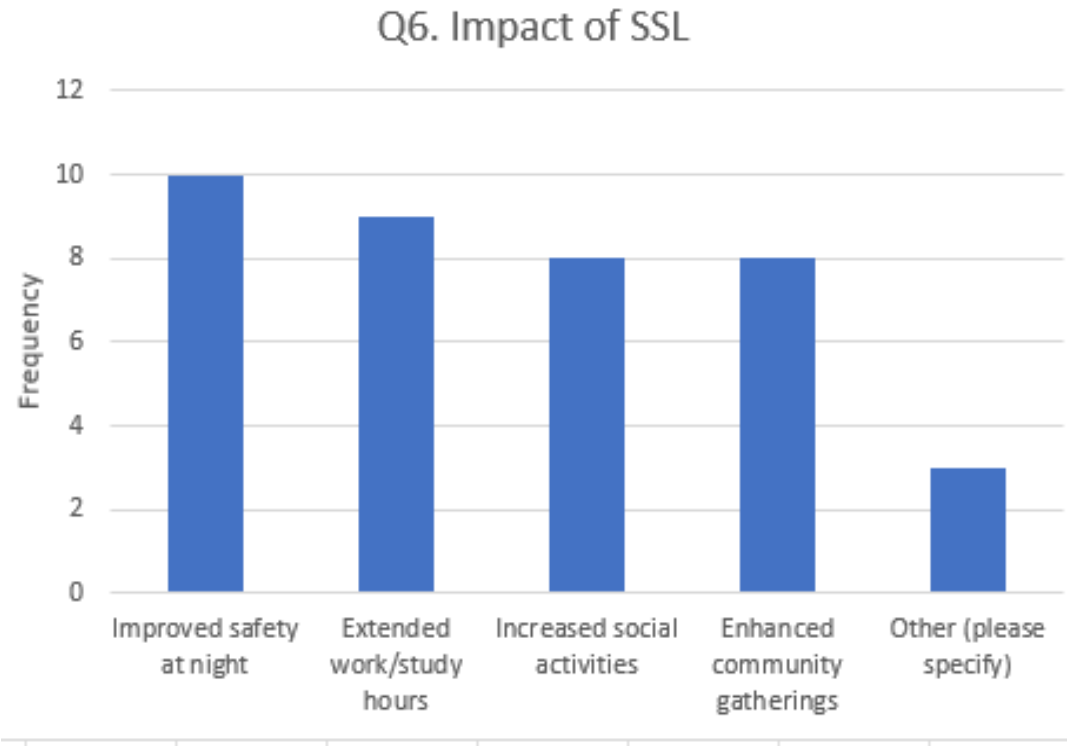

Fig. 4 Impact of Solar Street Lights in the community

There are a few major indicators showing that SSL was implemented successfully in the Aeta community. In terms of Quality-of-Life improvement, 80% of the respondents said their daily life had improved considerably, while 20% said it had improved a little, and no negative impacts were reported. For acceptance by the community, 100% of the respondents would recommend adopting SSL.

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The study revealed several key findings regarding the implementation of Solar Street Lights in the Aeta Tribe community:

Adoption Challenges

The High initial cost was identified as the biggest adoption barrier for SSLs since 8 out of 10 cited that it formed the highest problem to them, technical complexity, information deficiency, and also cultural issues. No respondent mentioned any cultural concerns relating to adopting SSLs; hence, they indicated good compatibility with community values

Success in Implementation

As per the survey and interview results, 90% cited improved nighttime visibility and safety as their top motivator for adoption. There are high levels of satisfaction, with 70% highly satisfied with the usability, 90% were highly satisfied overall, and 60% had no technical problems after installation.

Community Impact

The social impact of the solar street light in the community has reported 100% improved safety at night, there is a 90% reported increase in hours for work/study, and 80% reported increased social activities and acquaintance with the community.

In terms of Economic Impact, 70% of respondents reported significantly reduced expenses, while only 30% reported slightly reduced expenses. There are no adverse economic impacts that have been reported.

In terms of Environmental and Cultural Impact, 80% reported absolutely no disruption to the community environment, 20% reported minimal disruption, and no negative environmental impacts were noticed.

DISCUSSION

Financial Support Mechanisms

Develop subsidization programs or flexible payment schemes to eliminate the high initial cost barrier. Explore partnerships with government agencies and NGOs for funding support.

Technical Support

Set up a regular maintenance program to address the technical problems listed to be reported by 40% of the respondents. Provide comprehensive training on general maintenance and troubleshooting to the members of the community.

Community Involvement

Implement programs that are designed for the enlightenment of the community concerning the benefits and proper maintenance of SSLs. Publish and promote best practices that emerge from a successful application. Develop local capacity as a way to ensure that the practice is supported in the long term.

The successful implementation of Solar Street Lights in the Aeta community can be a model for indigenous communities to adopt sustainable technology. Appropriate support mechanisms, coupled with careful attention to community needs, can really make a difference and allow SSL technology to improve quality of life while respecting cultural and environmental values.

CONCLUSIONS

The demonstration of Solar Street Lights in the Aeta community is a model for sustainable technology adoption in indigenous communities. Even with high initial costs, there are benefits to safety, social activity,

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and economic savings. There is no disruption in culture or environment, but satisfaction is high, with unanimous recommendation for adoption-which means SSL technology is a good and feasible intervention for similar communities.

Identifying Barriers and Facilitators to Solar Technology Adoption. The main challenge was not found to be technical or cultural, but financial, which shows that the technology itself might be very appropriate for the community's needs and capabilities.

Evaluating the Technological Adaptation and User Experience. Multiple benefits were obtained from this implementation process: (a) a safer and more secure community, (b) more hours spent working and studying, (c) more social contact and community mobilization, (d) fewer household expenditures, and (e) minimal environmental impact.

Measuring the Environmental and Economic Impact of Solar Street Lights. There was a positive scale result with the environmental and economic impact of Solar Street Lights, as the community testified that they would have reduced expenses for lights and claimed that the SSL would have no negative impact on their community.

Deploying Solar Street Lights as the adopted technology of the community. Implementation of solar street lights in the Aeta community has been astonishing in proving that sustainable technologies can be very feasible to integrate with indigenous communities without trading off either cultural integrity or environmental integrity.

RECOMMENDATIONS

Based on the findings and conclusions of the study, the following are recommended to be implemented:

Financial Support Mechanisms

Develop subsidization programs or flexible payment schemes to eliminate the high initial cost barrier. Explore partnerships with government agencies and NGOs for funding support. Consider community cooperative funding models.

Technical Support

Set up a regular maintenance program to address the technical problems listed, to be reported by 40% of the response maintenance and troubleshooting to the members of the community. Establish a transparent reporting system for technical problems to be tackled.

Community Involvement

Implement programs that are designed for the enlightenment of the community concerning the benefits and proper maintenance of SSLs. Publish and promote best practices that emerge from a successful application. Develop local capacity as a way to ensure that the practice is supported in the long term.

The successful implementation of Solar Street Lights in the Aeta community can be a model for indigenous communities to adopt sustainable technology. Appropriate support mechanisms, coupled with careful attention to community needs, can really make a difference and allow SSL technology to improve quality of life while respecting cultural and environmental values.

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