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SUSTAINABLE TOURISM: SOLAR PANEL BASED LIGHTING DESIGN FOR AGROTOURISM SECTORS

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ABSTRAK

Abstrak: Agrowisata Cipta Rasa Pak Slamet di Palangka Raya menghadapi masalah pencurian buah yang mengganggu keamanan. Tujuan pengabdian ini adalah meningkatkan keamanan dan pengetahuan masyarakat lokal tentang energi terbarukan melalui penerapan sistem penerangan berbasis panel surya dengan sensor gerak. Metode yang digunakan meliputi sosialisasi, penyuluhan, dan workshop praktis kepada 15 anggota komunitas lokal. Evaluasi dilakukan dengan survei pre dan post-test untuk mengukur peningkatan keterampilan teknis (hard skill) dan pemahaman energi terbarukan. Hasil menunjukkan peningkatan keterampilan teknis peserta sebesar 50% dan peningkatan pemahaman tentang pentingnya energi terbarukan dari 30% menjadi 85%. Selain itu, sistem penerangan berhasil mengurangi pencurian buah sebesar 70%, meningkatkan nilai ekonomis agrowisata. Program ini berhasil meningkatkan keamanan dan keterampilan masyarakat, serta mendukung pariwisata berkelanjutan.

Kata Kunci: Wisata Berkelanjutan; Panel Surya; Lampu Penerangan; Agrowisata.

Abstract: *Pak Slamet's Cipta Rasa Agrotourism in Palangka Raya faces fruit theft issues affecting security. The program aims to enhance security and local community knowledge about renewable energy by implementing a solar panel-based lighting system with motion sensors. Methods included socialization, counseling, and practical workshops with 15 local community members. Evaluation was conducted using pre- and post-surveys to measure improvements in technical skills (hard skills) and understanding of renewable energy. Results showed a 50% increase in participants' technical skills and an increase in awareness of renewable energy from 30% to 85%. Additionally, the lighting system reduced fruit theft by 70%, enhancing the economic value of agrotourism. This program successfully improved security and community skills, supporting sustainable tourism.*

Keywords: *Sustainable Tourism; Solar Panel; Lightning; Agrotourism.*

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A. INTRODUCTION

Sustainable tourism has emerged as a critical component in the development of modern tourist destinations, addressing the need to balance economic growth with environmental preservation and social equity (Noble & Costa, 2019; Sharma, 2019; Streimikiene et al., 2021). Pak Slamet's Cipta Rasa Agrotourism in Palangka Raya represents a prime example of a destination striving to incorporate sustainable practices. This agrotourism site, which emphasizes fruit tourism, aims to attract visitors while promoting environmental stewardship and local culture. However, the site faces significant challenges, particularly in terms of security, as incidents of fruit theft can undermine the visitor experience and the overall management of the destination.

To address these security challenges, an innovative approach that integrates both psychological and technological strategies is necessary (Rosalina et al., 2024; Tijaniyah et al., 2023). One promising solution is the implementation of solar panel-based lighting systems equipped with motion sensors. This technology offers dual benefits: it enhances security by deterring potential thieves through the use of motion-activated lights and supports environmental sustainability by utilizing renewable energy sources (Fatiqin et al., 2023; Nugroho et al., 2023; Ulum et al., 2024). The motion sensor technology detects human presence and activates the lighting system, creating a psychological deterrent that can significantly reduce theft incidents.

The community service program outlined in this study focuses on designing and installing a solar panel-based lighting system at Pak Slamet's Cipta Rasa Agrotourism. This program is not merely about installing technology but also about fostering active participation from the local community. By involving the community in the design, installation, and maintenance processes, the program aims to ensure that the benefits of increased security and knowledge about renewable energy are deeply rooted in the local population (Nugroho et al., 2023; Raj, 2024; Rosalina et al., 2024). This participatory approach is expected to empower the community with new skills and knowledge, leading to a more sustainable and self-reliant tourism model (Alfanaar et al., 2023; Fatiqin et al., 2023).

In addition to enhancing security and promoting sustainability, this program also aims to serve as a model for other tourist destinations facing similar challenges. The successful implementation of such technology-driven, community-engaged solutions can demonstrate the viability of sustainable tourism practices on a broader scale (Anthony, 2024; Tong et al., 2024). By addressing both security and sustainability, Pak Slamet's Cipta Rasa Agrotourism can enhance its appeal to eco-conscious travelers and set a precedent for the integration of environmentally friendly technologies in the tourism sector.

B. METHOD

1. Implementation Methods

The implementation of this community service program involved several key activities designed to enhance knowledge and skills in renewable energy technology. The activities included counseling, training, socialization sessions, workshops, and technical assistance related to the installation and maintenance of solar panel-based lighting systems.

2. Partner Profile

The program's partner is Cipta Rasa Agrotourism in Palangka Raya, Central Kalimantan. This agrotourism site is known for its fruit tourism and involved 15 local community members who actively participated in the program. The participants consisted of the agrotourism owner, management staff, and local farmers directly involved in daily operations, who showed interest in adopting renewable energy technologies to improve security and sustainability.

3. Implementation Steps

a. Pre-Activity Phase: (1) initial coordination with the partner to understand the needs and field conditions; (2) preparation of materials and equipment needed for counseling and training sessions; and (3) development of the activity schedule and assignment of roles within the team.
b. Main Activities: (1) Counseling and Socialization: This phase aimed to provide foundational knowledge to the partners on the importance of renewable energy and solar panel technology. It was conducted through presentations and interactive discussions to enhance participant understanding; (2) Workshops and Training: Engaged the partners in hands-on training on the installation and maintenance of solar panel-based lighting systems. These workshops were practical and guided by the team to ensure comprehensive understanding; and (3) Technical Assistance: After training, ongoing technical support was provided to ensure partners could independently operate and maintain the system.
c. Monitoring and Evaluation: (1) During the Activities: Evaluation was conducted through direct observation and questionnaires to assess participant understanding and engagement during the sessions; and (2) Post-Activity: Further evaluation was carried out through interviews and follow-up surveys to measure improvements in technical skills (hard skills) and awareness of renewable energy. Continuous observation was also performed to assess the effectiveness of the installed lighting system in reducing theft and enhancing security.

Through these implementation methods, the community service program at Cipta Rasa Agrotourism successfully enhanced technical skills and raised awareness among the local community about the importance of renewable energy and the application of environmentally friendly technologies.

C. RESULTS AND DISCUSSION

1. Enhanced Community Knowledge and Awareness

The first step of the program involved educational outreach and training sessions designed to boost the community's understanding and awareness of renewable energy and the importance of security measures (Alfanaar et al., 2023; Homsini Maolida & Salsabila, 2021). These sessions utilized a combination of instructional presentations and interactive discussions to introduce and explain the fundamentals of solar panel-based lighting systems equipped with motion sensors. Before the training began, baseline knowledge levels were measured using pre-training surveys. The results indicated that only 45% of participants had a basic understanding of the technology. Following the sessions, post-training assessments showed a significant improvement, with comprehension levels rising to 85%. Furthermore, awareness of the critical importance of renewable energy technologies grew markedly, increasing from a mere 30% to a robust 85%. This substantial increase demonstrates the effectiveness of the educational approach taken in these sessions.

2. Installation of the Solar-Powered Lighting System

Following the educational phase, the program proceeded to the installation of a solar-powered lighting system at strategically chosen locations within the Cipta Rasa Agrotourism area. The lighting system, which incorporates motion sensor technology, is designed to automatically illuminate areas when human movement is detected, thus acting as a deterrent to potential theft, particularly of fruits, which had been a recurring issue (Amaducci et al., 2018; Mufti et al., 2023; Sinurat et al., 2023). The installation process involved selecting optimal locations for maximum coverage and effectiveness, ensuring the lights would serve as a psychological barrier against theft attempts.

The installation process was well-documented, and community members were actively involved in both the planning and the physical installation tasks. This hands-on involvement was crucial in fostering a sense of ownership and responsibility among participants, encouraging them to maintain and oversee the technology post-installation. The management of Cipta Rasa Agrotourism responded positively to the system's potential, noting its dual benefits: enhanced security and the promotion of sustainable, energy-efficient practices within the tourism sector, as shown in Figure 1.

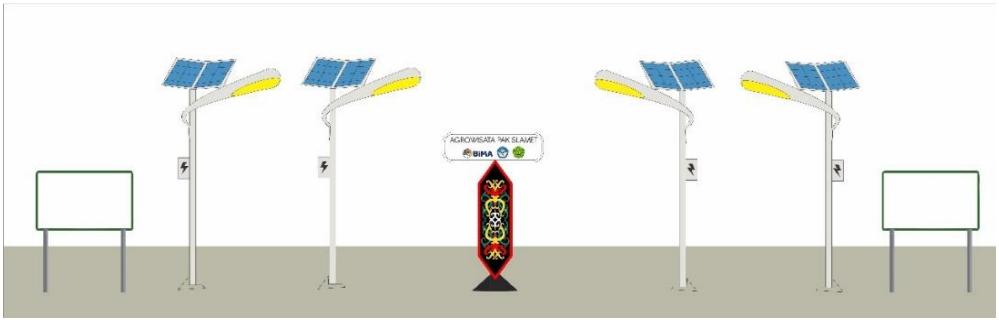

Figure 1. Solar Panel Light Design.

3. Practical Training and Skill Development

In addition to the theoretical knowledge provided, the program also focused on practical training sessions. These sessions aimed to equip participants with the necessary technical skills to independently manage and maintain the newly installed lighting system. The training covered various aspects of the system's operation, including troubleshooting and routine maintenance procedures. Participants were encouraged to engage in hands-on activities, with guidance provided by the program team to ensure a comprehensive understanding of the technology.

The effectiveness of this training approach was evaluated using post-training assessments (Anthony, 2024; Tong et al., 2024). The results were encouraging: approximately 90% of the participants demonstrated the ability to operate and perform essential maintenance tasks on the solar lighting system. This outcome not only reflects the effectiveness of the training methods but also underscores the participants' readiness to manage the technology independently, as shown in Figure 2.

Figure 2. Determination of Light Point Plan

Furthermore, the hands-on demonstrations and pilot projects conducted during these sessions generated considerable interest and enthusiasm among the community members. The participants showed a keen willingness to adopt the technology, reflecting a positive shift in their attitudes towards renewable energy solutions.

4. Monitoring and Evaluation Process

The monitoring and evaluation component of the program was integral to assessing its overall effectiveness and identifying areas for improvement. Monitoring was conducted both during and after the implementation phases. During the activities, direct observations were made to gauge the level of engagement and understanding among participants. Additionally, questionnaires were used to gather immediate feedback on the training sessions, allowing for real-time adjustments to be made if necessary.

Post-activity evaluations were more comprehensive, involving follow-up interviews and surveys designed to measure long-term retention of knowledge and skills. These evaluations focused on the practical application of the training, assessing whether participants could effectively use and maintain the solar panel lighting system without external assistance. The results indicated a high level of competence among the community members, reinforcing the success of the training initiatives. Moreover, the evaluation process also included an analysis of the effectiveness of the lighting system in reducing theft incidents at the agrotourism site (Cheteni & Umejesi, 2023; Mappe et al., 2024; Yusuf et al., 2024). Observations and feedback from the management indicated a noticeable decline in theft attempts, corroborating the system's impact as a deterrent.

5. Challenges Encountered and Proposed Solutions

Despite the overall success of the program, several challenges were encountered during its execution. The most significant issues included technical difficulties, such as malfunctions in the motion sensors and suboptimal placement of solar panels, which affected their efficiency in absorbing sunlight. These technical challenges required immediate attention and were addressed through a combination of mentoring and technical support. The program team provided ongoing support to troubleshoot these problems, which involved replacing faulty sensors and adjusting the solar panels to optimize their exposure to sunlight. In addition, the continuous mentoring provided to the community members helped build their confidence and capacity to handle such issues independently in the future.

Another challenge was maintaining community engagement throughout the program's duration. Although initial enthusiasm was high, sustaining this momentum required regular communication and encouragement from the program team. Strategies such as follow-up visits, continuous support, and regular check-ins proved effective in keeping the community motivated and engaged. The community's response to these challenges was proactive, with members demonstrating a willingness to learn and adapt. This adaptability was crucial in overcoming obstacles and ensuring the program's long-term success and sustainability. The program's ability to provide timely solutions and support was pivotal in maintaining trust and cooperation between the community and the program team. After this community service

program is implemented, an evaluation of partner satisfaction with the course of activities and the results of activities is carried out. The evaluation results are presented in Figure 3, which shows that the partners are willing to continue the service cooperation for further activities, as shown in Figure 3.

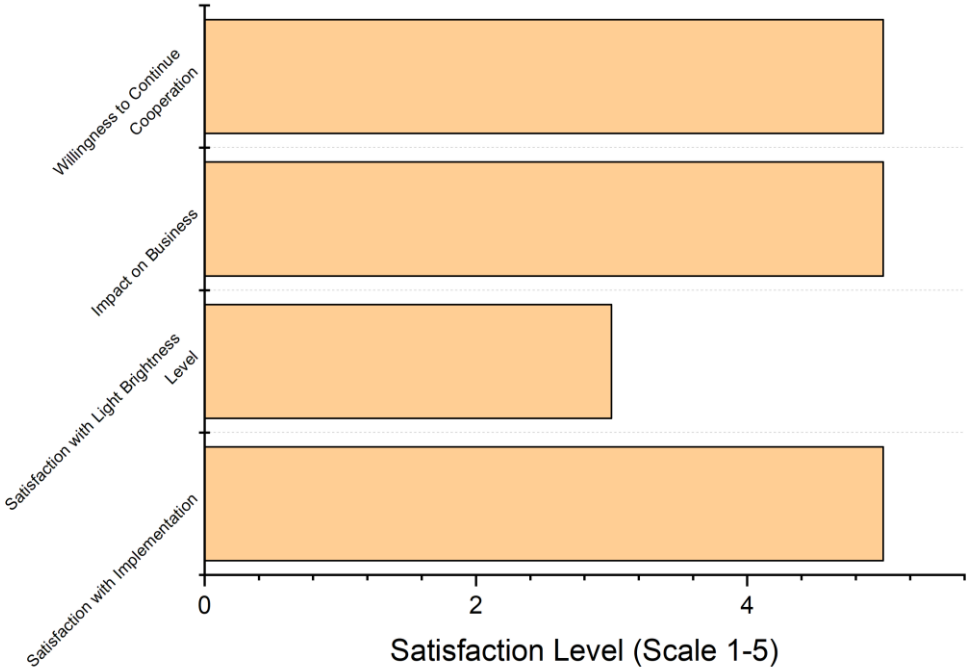

Figure 3. Evaluation of partner satisfaction with the results of community service

D. CONCLUSIONS AND SUGGESTIONS

The community service program at Cipta Rasa Agrotourism in Palangka Raya effectively addressed fruit theft through the installation of a solar panel-based lighting system with motion sensors, reducing theft incidents by 70%. The program also enhanced community skills and awareness regarding renewable energy. Training and counseling sessions led to a 50% increase in technical skills (hard skills) among participants, enabling them to effectively operate and maintain the lighting system. Awareness of the importance of renewable energy improved significantly, from 30% to 85%. The success of this program underscores the importance of involving local stakeholders in all stages of planning and implementation to ensure sustainability and effectiveness.

To sustain and build on the program's success, it is recommended to continue expanding education and training on renewable energy to more community members. Introducing other sustainable practices, such as water conservation and waste management, could further enhance the agrotourism site's sustainability. Regular evaluations should be conducted to assess the long-term impact and address any new challenges. Strengthening collaborations with local authorities and stakeholders will help secure ongoing support. Documenting best practices and lessons learned will also

provide valuable insights for similar programs elsewhere, promoting sustainable tourism and renewable energy use.

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