Research Article

Engaging Youth in Sustainable Energy: Strategies for Empowerment and Participation

Arief Bowo Prayoga Kasmo[1]*, Diah Fistiani Sukardiman[1], and Unang Toto Handiman[2]

[1]Faculty of Economics and Business, Universitas Mercu Buana, Jakarta, Indonesia
[2]Study Program of Management, Sekolah Tinggi Ilmu Ekonomi Wikara, Purwakarta, Indonesia

ORCID
Arief Bowo Prayoga Kasmo: http://orcid.org/0000-0002-7449-386X

Abstract.
This research paper investigates effective strategies to engage youth in sustainable energy initiatives, aiming to empower them for active participation in environmental sustainability. It focuses on understanding youth awareness, interest, and involvement by collecting quantitative data from 170 urban and rural young people on their attitudes, behaviors, and preferences toward sustainable energy. The study conducted the statistical analysis using structural equation modeling (SEM) with partial least squares (PLS). The main findings indicate that effective education and awareness programs, community involvement, and strategic communication positively impact youth's willingness to adopt renewable energy. Theoretically, these findings enhance our understanding of how educational programs, community engagement, and communication can boost youth participation in sustainable energy awareness. From a policy perspective, the study provides recommendations for policymakers to increase youth involvement in renewable energy conservation. Practically, it encourages educators and community leaders to foster greater youth engagement in sustainability activities. The research also serves as a foundation for future studies, particularly those examining the active role of youth in renewable energy initiatives across different cultural and sectional contexts, thereby contributing to the broader goal of promoting sustainable energy conservation.

Keywords: youth engagement, sustainable energy initiatives, environmental sustainability, awareness enhancement, community involvement

Corresponding Author: Arief Bowo Prayoga Kasmo; email: ariefbowo@mercubuana.ac.id

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1. Introduction

Due to its numerous implications for social empowerment, environmental sustainability and the future of renewable energy, youth engagement in sustainable energy has recently become a highly researched topic. According to Jegede et al. [1], who addressing urgent environmental issues can be sparked by the empowerment of young people. In a similar vein, Khuc et al. [2], stressed the value of educational curricula in fostering a younger generation that is ecologically concerned. According to Estévez et al. [3],

that youth involvement is essential to the execution of renewable energy initiatives. Zhu [4], acknowledged youth engagement as a critical component in the formulation of renewable energy policies. Cardarelli et al. [5], highlighted the necessity of youth empowerment techniques to strengthen their commitment to sustainable practices.

There are significant gaps in the literature because few studies explicitly examine the relationship between youth engagement and sustainable energy programs. Cardarelli et al. [5] and Boyd et al. [6] emphasize the significance of youth involvement in environmental and health advocacy. Furthermore, middle-class youth are generally more active than their working-class counterparts [6]. Cardarelli et al [5], emphasize the need for sincere engagement strategies that encourage the development of competencies best suited for sustainable energy. Metris [7], also highlights how technology and digital platforms may help young people become more involved in sustainable energy.

Several previous researchers have studied the importance of educational programs to raise awareness of renewable energy among young people. For example, Genç [8], emphasized that teachers play an important role in transferring knowledge about renewable energy to the younger generation. Ntanos et al. [9], showed that individuals with higher levels of education are more likely to accept and adopt renewable energy technologies. Saibu [10], underlined that targeted educational policies can increase the adoption of renewable technologies.

Numerous prior scholars have examined the significance of community (youth) involvement in promoting youth understanding regarding renewable energy. For instance, Flacke & Boer [11], discovered that high levels of public participation characterize community-based renewable energy initiatives. According to Schwanitz et al. [12], citizen-led initiatives give people access to technical and environmental knowledge, enabling them to make educated decisions about energy use and advocacy. The significance of a place-based strategy in the development of renewable energy [13], who noted that it can assist projects connect with the priorities and values of the community.

Prior studies have examined the significance of communication tactics in raising youth knowledge of renewable energy sources. Hawke et al. [14], for instance, stress the need for open communication and transparency in getting young people involved in community projects and research. According to Folkvord [15], effective communication techniques can foster a positive atmosphere that inspires young people to investigate and embrace renewable energy sources. Reynolds [16], covers stakeholder engagement

in renewable energy projects, but these references do not specifically address youth engagement.

To address this gap, this study conducted a quantitative research design to answer the following research questions:

RQ1: How can education and awareness programs impact on willingness to adopt renewable energy?

RQ2: How can community engagement activities impact on willingness adopt renewable energy?

RQ3: How can communication strategic impact on willingness to adopt renewable energy?

This research question aims to fill this gap by investigating effective strategies for engaging youth in sustainable energy initiatives.

2. Methods

The research design employed in this study is quantitative, focusing on examining the relationships between different variables through a systematic and empirical investigation. The population targeted for this research consists of Indonesian youth, specifically those aged 15 to 30 years. Researcher selected participants from both rural and urban areas, representing a broad demographic across various socio-economic backgrounds. A total of 170 respondents participated in the study, providing a comprehensive overview of youth perspectives across different geographical and socio-economic contexts.

Researcher conducted data collection using structured questionnaires with closed-ended questions, designed to gather specific, measurable responses. Researcher distributed the questionnaires using both online and offline methods to reach a diverse set of participants, irrespective of their location or access to technology. We chose this dual-distribution approach to maximize participation rates and ensure inclusivity, especially for youth in rural areas with limited internet connectivity. The structured nature of the questions helped standardize responses and simplify the subsequent data analysis process.

To analyze the relationships between the variables, structural equation modeling (SEM) was used, employing the Partial Least Squares (PLS) approach. SEM-PLS is particularly suited for this research because of its effectiveness in handling complex models with multiple constructs and indicators, even with relatively small sample sizes. This

method allowed the researchers to simultaneously test the hypotheses and measure the direct and indirect effects among the constructs in the model. The use of PLS-SEM provided robust insights into the influence and interactions of the different variables, thus supporting the overall research objectives.

2.1. Building hypothesis

Education and Awareness Programs: These programs provide the necessary information to understand the benefits and techniques of renewable energy, leading to an increased willingness to adopt such technologies [17].

Community Engagement Activities: It offer hands-on experiences and allow individuals to participate in renewable energy projects [18].

Communication Strategies: such as social media and campaigns, can enhance awareness and positive attitudes toward renewable energy [19].

Willingness to Adopt Renewable Energy: Behavioral intentions to adopt renewable energy practices are influenced by various factors such as education, community engagement, communication strategies, and policy support [20].

Hypotheses:

Hypothesis 1: Education and awareness programs significant impact on willingness to adopt renewable energy.

Hypothesis 2: Community engagement significant impact on willingness adopt renewable energy.

Hypothesis 3: Communication strategic significant impact on willingness to adopt renewable energy.

3. Results and Discussion

This section presents the research results which are then followed by a discussion. The research results can be seen through Table 1 which presents the results of the structural model test. Figure 1 will illustrate the relationship between variables that show the path diagram of the hypothesis built in this study.

Based on Figure 1 and Table 1, the results of the structural model indicate a t value of 2.599 and a p value of 000. These results indicate that education and awareness programs have a significant influence on the willingness to adopt renewable energy.

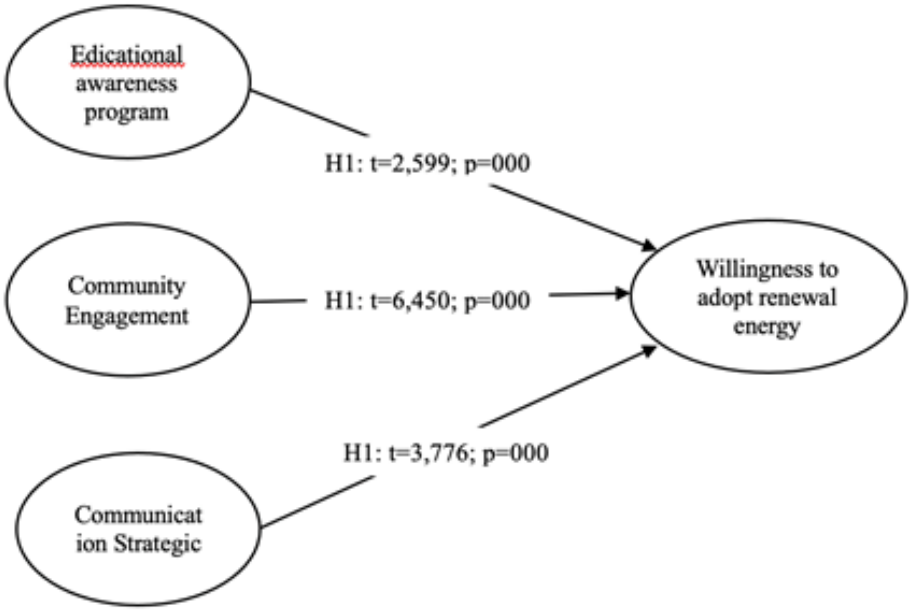

Figure 1: Diagram of the relationship path between EAP, CE and CS with WARE.

Table 1: Hypothesis Testing between education programs (EP), community engagement activities (CEA), strategic communication strategies (SCS), and willingness to adopt renewable energy (WARE).

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
EAP WARE	0.162	0.160	0.062	2.599	0.009
CE WARE	0.475	0.479	0.074	6.450	0.000
CS WARE	0.338	0.339	0.090	3.776	0.000

Therefore, hypothesis 1 can be accepted. Table 1 also reveals that the t value is 6.450 and the p value is 000. These results indicate that community engagement has a significant influence on the willingness to adopt renewable energy. Therefore, hypothesis 2 can be accepted. Finally, Table 1 reveals that the t value is 3.776 and the p value is 000. These results indicate that strategic communication has a significant influence on the willingness to adopt renewable energy. Therefore, hypothesis 3 can be accepted.

3.1. Education and awareness programs impact on willingness to adopt renewable energy

The results of the study indicate that education and awareness programs impact willingness to adopt renewable energy. These results are in line with several previous studies; for example, Tishkov et al. [21], stated that by providing comprehensive information

on the environmental, economic, and social benefits of renewable energy, educational initiatives can help achieve this goal. Karasmanaki et al. [22], stated that education can foster a sense of environmental responsibility among young people, encouraging them to adopt sustainable practices and consider renewable energy as a viable option.

Education and awareness programs play a critical role in increasing the willingness to adopt renewable energy technologies among youth. By increasing knowledge, building positive attitudes, leveraging social influence, empowering individuals, and addressing economic considerations, these programs can have a significant impact on youth engagement with renewable energy. Therefore, it is important for policymakers and educators to prioritize the development and implementation of effective education initiatives that encourage renewable energy adoption.

3.2. Community engagement impact on willingness adopt renewable energy

The results of the study show that community engagement impacts willingness to adopt renewable energy. Several previous studies, such as Marrero et al. [23], have found a positive correlation between social acceptance and public participation in renewable energy initiatives. Bidwell [24], highlighted the importance of providing information to the public, as informed stakeholders are more likely to develop positive attitudes towards renewable energy.

Community engagement significantly impacts the willingness to adopt renewable energy technologies. By enhancing social acceptance, disseminating knowledge, empowering individuals, establishing trust, and providing local benefits, community engagement creates a conducive environment for the successful implementation of renewable energy projects. As such, it is essential for policymakers and project developers to prioritize community engagement strategies in their efforts to promote renewable energy adoption.

3.3. Strategic communication impact on willingness to adopt renewable energy

The results of the study indicate that strategic communication impacts willingness to adopt renewable energy. This result is in line with several previous studies; for example, Pechancová [25], emphasized that strategic communication initiatives that provide clear,

accessible, and relevant information can help reveal renewable energy technologies. Hess and Gentry [26], highlighted that by actively involving stakeholders in the communication process, organizations can foster a sense of ownership and collaboration that is important for building support for renewable energy initiatives. Strategic communication is essential for increasing the willingness to adopt renewable energy technologies. By focusing on information dissemination, stakeholder engagement, trust-building, framing narratives, and leveraging communication technologies, organizations can effectively influence public attitudes and behaviors towards renewable energy. As such, it is imperative for policymakers, energy providers, and community organizations to prioritize strategic communication in their efforts to promote renewable energy adoption.

4. Conclusion

This study reveals that education and awareness programs play a crucial role in influencing the willingness of youth to adopt renewable energy. By equipping young people with knowledge about renewable energy and environmental sustainability, these programs foster a deeper understanding and create positive attitudes towards adopting cleaner energy solutions. Furthermore, community engagement also significantly impacts youth's willingness to adopt renewable energy. When young people are involved in community activities centered on sustainability and renewable energy practices, they experience the practical benefits of these initiatives firsthand. Additionaly, researchers identify strategic communication as a critical factor in increasing youth willingness to adopt renewable energy. Effective communication that speaks directly to the interests and concerns of young audiences can make the benefits of renewable energy more tangible and relatable.

The study contributes to the literature on youth empowerment and sustainable energy by demonstrating the effectiveness of combining education, community engagement, and strategic communication. The study offers empirical evidence to back up the theoretical framework, which suggests that a combination of awareness, community interaction, and tailored messaging is the most effective way to achieve behavioral change. Additionaly, for practitioners, the research underscores the importance of creating educational programs and community projects that engage young people. Managers and program developers in the energy sector should prioritize partnerships

with schools, universities, and community organizations to implement educational initiatives and encourage active community participation. We should also tailor communication strategies to align with the values and preferences of young audiences. Finaly, policymakers should consider incorporating youth-focused education and community engagement into national energy strategies. Policies that incentivize community-led renewable energy projects and promote awareness campaigns tailored for younger audiences can significantly enhance adoption rates. Such policies would ensure that the younger population is well-informed and motivated to participate in the shift towards renewable energy.

Future researchers should explore the long-term impact of education, community engagement, and communication strategies on renewable energy adoption behaviors among youth. Further research could also investigate how different demographic factors, such as socioeconomic status or educational background, influence the effectiveness of these strategies. Additionally, studies could focus on developing specific models to optimize the integration of educational content, community activities, and communication tools for engaging youth in sustainable energy initiatives across various cultural and regional contexts.

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