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Sustainable Pro-Environmental Attitude: How Does Strategy Bring It to Life in Coastal Communities?

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ABSTRACT

The research aims to investigate, analyze, and establish pro-environmental attitude update strategies in coastal communities in Riau Province, in line with the Sustainable Development Goals (SDGs) of the Regional Government and the Ministry of Environment. By sampling 384 respondents from various coastal areas in Riau Province, the study used survey and interview methods to gather primary data related to the pro-environmental attitudes of coastal communities in Riau Province. Quantitative and qualitative analysis evaluates factors influencing pro-environmental attitudes and formulating appropriate actualization strategies. The research results are expected to provide an in-depth understanding of the factors affecting the pro-environmental attitudes of coastal populations and provide a basis for developing effective strategies for raising their awareness and involvement in environmental conservation efforts. The research findings show that legal knowledge has a significant influence on the pro-environmental attitude of coastal communities. Environmental education also contributes, albeit to a lesser extent, suggesting that there needs to be better integration in efforts to raise environmental awareness. The implications of this research can contribute positively to achieving environmental-related Sustainable Development Goals targets and guide stakeholders, including governments and non-governmental organizations, in designing sustainable environmental protection programs in the coastal areas.

1. INTRODUCTION

A pro-environmental attitude is becoming increasingly essential and receiving greater attention amid Indonesian economic development and growth dynamics. The adverse environmental effects are becoming increasingly known to Indonesian society, encouraging them to act pro-environment. The government has raised this awareness by incorporating environmental education into the school curriculum. The aim is to increase early understanding of the importance of preserving the sustainability of Indonesian ecosystems and nature.

In addition, changing consumption patterns can positively impact environmentally friendly action in Indonesia [1]. Local, organic, and environmentally friendly products are becoming increasingly popular in the market, driving the growth of sustainable economic sectors [2]. Indonesia is also starting to use green technologies, especially in developing renewable energy [3-5]. Private investment and government programs to build green energy infrastructure show that Indonesia is increasingly facing the challenge of climate change [6, 7].

People have become more aware of the importance of pro-environmental action as a direct consequence of climate change, such as extended droughts and increasingly frequent floods [8, 9]. To protect the environment, governments and local communities are making efforts in the face of natural disasters [10, 11]. The cultural shift toward consumerism has also spread to Indonesian society [12, 13]. More and more people are following a minimalist lifestyle, reducing waste, and considering how their decision to buy something will affect the environment [14, 15].

Local environmental movement is growing in Indonesia [16, 17]. In addition, the community and non-governmental organizations (NGOs) play a role in raising public awareness of the importance of environmental conservation [18]. Garbage management, anti-plastic, and tree-planting campaigns are getting more support [19]. The young generation has become a significant force in changing pro-environmental attitudes [20]. Climate demonstrations, environmental activism, and social media campaigns effectively encourage adolescent environmental concern [21].

In addition, increased environmental literacy is essential in determining attitudes that favour the environment in Indonesia [22]. As more information is disseminated, people better understand environmental issues [23]. It is becoming clear that

the role of social media in disseminating information and mobilizing pro-environmental action is growing [24]. Thus, hopes to create a more sustainable and healthy environment for future generations are becoming more robust as pro-environmental attitudes in Indonesia are increasing.

On a small scale, in Riau Province, the current pro-environmental attitude reflects a complex dynamic in which coastal communities heavily depend on natural resources as their primary livelihoods, often resulting in excessive exploitation of coastal ecosystems [25]. The behaviour of coastal communities currently pro-environmental, especially regarding legal knowledge and environmental education, suggests some issues that need to be addressed for sustainability [26]. Regarding legal knowledge, people lack an understanding of environmental regulations and the legal consequences of practices detrimental to the environment [27].

Although there are environmental management rules, they are often rarely implemented and adequately followed with adequate sanctions [28]. In the case of environmental education, despite efforts to include environmental issues in the curriculum, these efforts are often unequal and not integrated [29]. This condition must lead to differences in knowledge of the law and the environment, which can enable an unsustainable attitude [30]. People in societies that are less educated about environmental regulations tend to ignore the legal consequences of their actions against the environment [31]. Similarly, a lack of educational understanding of the importance of environmental conservation leads to a lack of awareness of collective responsibility for the environment [32].

In order to address this situation, actualization strategies are needed to improve public understanding of environmental regulations and the legal consequences of actions that are detrimental to the environment. Further research in this context can enhance public understanding of environmental legislation and the importance of environmental conservation.

2. METHODS

The research was carried out across coastal communities in Riau Province, consisting of Inderagiri Hilir District, Bengkalis District, Rokan Hilir County, Pelalawan District, Meranti Islands District, and Dumai City, with a total population of 2,907,458 people. For clarification, the estimated number of Populations and Samples can be seen in Table 1.

Table 1. Population and sample

No.	Area	Population (person)	Sample (person)
1	Inderagiri Hilir District	663,248	64
2	Bengkalis District	593,390	64
3	Rokan Hilir District	669,996	64
4	Pelalawan District	422,907	64
5	Kepulauan Meranti District	217,607	64
6	Dumai City	340,310	64
	Total	2.907.458	384

Data is collected through lift interviews and checklists to identify the sustainability index and status value of each indicator of the pro-environmental attitude of coastal communities in Riau Province. The questionnaire is used to obtain an image and data on the existing conditions of pro-environmental attitude, legal knowledge, and environmental education of coastal communities in Riau Province based on indicators, including indicators of each variable. The indicators mentioned can be seen in Table 2.

Table 2. Sketches of research instruments

Variable	Indicators
Pro-environmental attitude [33]	Energy saving Mobility and transportation Waste prevention Repeat Attitude aimed at preserving nature
Legal Knowledge [34]	Compliance Identification Internalization
Environmental Education [35, 36]	Participation Articulation Approach information Program implementation Continuity

Subsequently, the data obtained through interviews were conducted with experts whom the researchers considered experts in their field, according to the research study. They were given a series of statements that could be considered to explain each attribute for each sustainability assessment dimension of the application of pro-environmental attitudes to coastal communities in Riau Province. The researchers used the Checklist Sheet and then identified or contrasted respondents' responses/opinions to conditions at the study site and compared them with criteria or indicators of pro-environmental attitude sustainability. More checklist sheet format can be seen in Table 3.

The checklist (Table 3) assesses several attributes and parameters related to the pro-environmental attitudes of coastal communities. The scoring category consists of three levels: ‘Good’ indicates that the community has high compliance with environmental regulations, actively participates in programs, has good legal knowledge, and consistently applies pro-environmental practices, with a score of 2. ‘Less Good’ reflects moderate compliance, limited participation, insufficient legal knowledge, and inconsistent application of pro-environmental practices, with a score of 1. Meanwhile, ‘Bad’ indicates that the community does not comply with environmental regulations, does not participate in programs, has very low legal knowledge, and does not apply pro-environmental practices, with a score of 0.

In this study, interviews were conducted using two (two) approaches: structured and semi-structured interviews. Interviews are aimed at key personnel with more in-depth knowledge of the subject of research according to the expertise and authority of respondents. Respondent selection techniques are carried out using nonprobability approaches through purposive sampling methods. The selected respondents are the respondents who know the most about the application of pro-environmental attitudes.

The interview was conducted using the Rapid Rural Appraisal (RRA) approach. Through the RRA approach, the needs of stakeholders (Community and experts) in the application of pro-environmental attitudes to coastal communities in Riau Province will be identified. The researchers gathered information on implementing sustainable

pro-economic attitudes based on the respondents' information. Then, they synthesized the interview results as a determining factor in the sustainable application of the pro-environmental attitude to the coastal community in the Riau province.

Table 3. Sheet format checklist

No.	Dimension	Attribute / Parameter	Score		
			Good (2)	Less Good (1)	Bad (0)
1	Energy Saving	Education and energy awareness Technology innovations that are easily adopted by coastal communities Strengthening sustainable energy regulations and policies Sustainable infrastructure Community participation and engagement Performance assessment and measurement			
2	Mobility and Transportation	Affordable transport for everyone Use of environmentally friendly transportation Safe and comfortable highways Active participation in decision making Waste management and cleanliness in public places Adoption of transportation technology for areas that do not have it yet			
3	Waste Prevention	Reducing plastic use Managing waste properly Socialisation of waste impacts on the environment Applying compost for organic waste Legal and institutional strengthening of communities in waste prevention The availability of a flagship waste prevention programme in each coastal zone area			
4	Repeat	Socialising the importance of recycling efforts Availability of technical guidelines for sorting waste for recycling Availability of recycling centres at home Sorting of products that are easily recyclable Join the community recycling programme Buying items with eco-friendly packaging			
5	Attitude Aimed at Preserving Nature	Interesting environmental education content The existence of an environmental management partnership pattern Community-based waste management programme Implementation of efficient and strategic waste management Green open space utilisation Environmental management campaign			

To answer the problem, some data analysis was done. Data analysis is carried out through descriptive statistical analysis and Structural Equation Model (SEM) with the help of the SmartPLS program to analyze the influence of inter-variables in this study. The purpose of the analysis of this data is to determine whether knowledge of law and environmental education affects the pro-environmental attitudes of the researchers in Riau Province. Further modeling analysis can be seen in Figure 1.

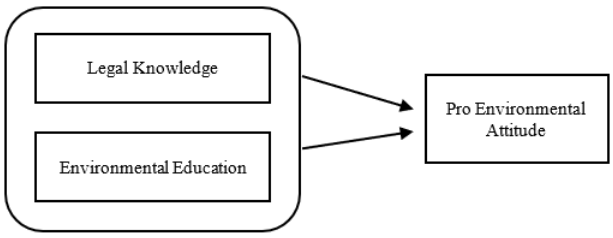

Figure 1. SEM analysis model

Multidimensional Scaling Analysis (MDS) is used to assess the spread of indices and the sustainability status of coastal communities in Riau Province. It is done using Rap-Pro software, which is a modification of Rapfish. Primahardani et al. [37] stated that Rapfish is the abbreviation of Rapid Appraisal for Fisheries, which is a nonparametric multidimensional measurement method.

This Rap-Pro analysis is done in several steps, namely: (1) determining the attributes of sustainable learning management; (2) assessing (good or bad) each attribute on an ordinal scale based on the sustainability criteria of each dimension; (3) inserting the value or score of the assessment results of each attribute into the Rap-Pro software and running Rap-Pro; (4) building indexes and sustainability status. The score of each attribute is evaluated through multidimensional analysis to identify points that reflect a more sustainable quality.

Prospective analysis is used to analyze and develop strategies to update the pro-environmental attitudes of coastal

communities in Riau Province. It is also used to predict the possibilities of what will happen in the future [37]. From the prospective analysis, there is information about key factors and the strategy for actualizing the pro-environmental attitudes of coastal communities in Riau Province. Prospective analysis was conducted in three stages. The first stage identifies key factors from the MDS results of the current condition (existing condition). In the second stage, stakeholders determine key factors from the needs analysis results. In the third stage, stakeholders determine key factors from a combined analysis of the results of the first and second stages or a combination of current conditions and needs analysis. After doing the prospective analysis, experts must get expert judgment from experts to establish a pro-environmental attitude update strategy for coastal communities in Riau Province. The resulting strategy is a means of decision-making that can be used by various parties, especially planners and policymakers, to determine the right policy priorities for realizing the updated pro-economic attitude of the coastal community in the Riau Province, Indonesia.

3. RESULTS AND DISCUSSION

3.1 The influence of each variable

Data analysis is carried out through descriptive statistical analysis and Structure Equation Model (SEM) with the help of the SmartPLS program to analyze the influence between variables in this study.

From the validity test results on the three variables, all question items can be stated as valid (refer to Table 4). The next step is to conduct a reliability test to see if the data used in this study is reliable. This research has to do a reliability test to measure whether it is consistent or non-questionable. The research used to measure the influence of variables X and Y Before doing the reliability testing, there must be a decision-making basis, i.e., an alpha of 0.60. Variables are considered reliable if the variable's value is more significant than 0.60. If it is smaller, then the variables studied cannot be said to be reliable because < 0.60. The results of the reliability test on this study variable are shown in Table 5.

Table 4. Validity test result

Variable	No. of Item	Description
Pro-Environmental Attitude	18	Valid
Legal Knowledge	9	Valid
Environmental Education	15	Valid

Source: 2024 processing data

Table 5. Variable reliability test results

Variable	Cronbach's Alpha	No. of Items
Environmental Attitude	0.980	18
Legal Knowledge	0.948	9
Environmental Education	0.980	15

Source: 2024 processing data

The reliability test results on the variables environmental attitude, legal knowledge, and environmental education can be seen by Cronbach's alpha value > 0.60. The results prove that all the statements in the questionnaire are declared reliable. The normality test used the Kolmogorov-Smirnov normality test because the total number of samples was more than 30, indicating the significance (p-value < 0.05) that can be seen in Table 6.

Table 6. Results of the normality test

Variable	Sig	Description
Environmental Attitude	0.000	Normal Undistributed Data
Legal Knowledge	0.000	Normal Undistributed Data
Environmental Education	0.000	Normal Undistributed Data

Table 6 shows that the environmental attitude variable shows a sig value of 0.000 < 0.05, the legal knowledge variable indicates a sig value of 0.05 < 0.05, and the environment education variable shows a sig value of 0.00 < 0.05. These results show that the data is not distributed normally because it is less than the significant level of 0.05.

Test results of the Structure Equation Model (SEM) using the SmartPLS (Partial Least Square) application can be seen in the following image:

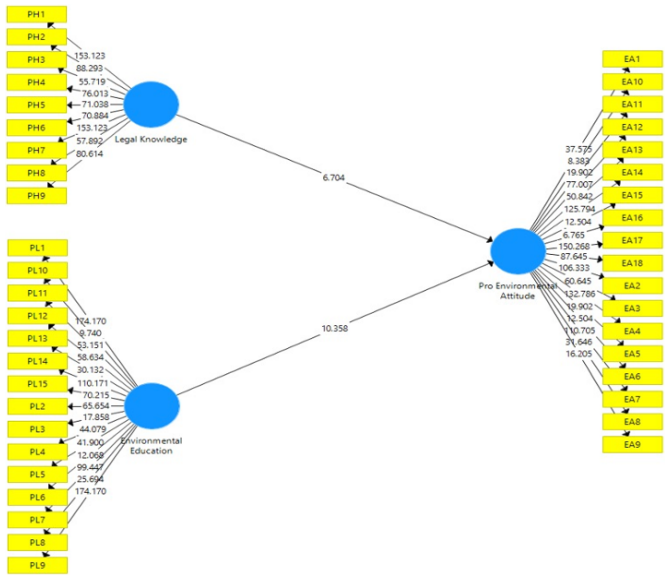

Figure 2. Results of SEM analysis of three variables

The results of the SEM analysis showed the influence of the Legal Knowledge (X1) variable against the pro-environmental attitude (Y) variable. From the statistical test results, a p-value of 0.000 < 0.05 was obtained, which means that the p-value is less than the significance level of 0.05, so there is an effect of the Juridical Knowledge variable against the pro-environmental attitude variable (Figure 2).

The contribution size can be seen in the estimated value of 6.704. The figure means that the influence of the legal knowledge variable on the pro-environmental attitude variable is 6.704, and other variables outside the legal knowledge variable indicator influence the remainder.

Further, the results also showed the influence of the Environmental Education Variable (X2) on the Pro-Environmental Attitude (Y) variable. From the statistical test results, a p-value of 0.000 < 0.05 means the p-value is less than the significance level of 0.05, so the environmental education variable influences the pro-environmental attitude variable.

The size of the contribution can be seen in the estimated

value of 10.358, which means that the influence of the Environmental Education Variable on the Pro-Environmental Attitude Variable is 10.358, and other variables outside the indicator influence the remainder.

Then, based on the indicators from the legal knowledge variable, namely nine indicators, the Environmental Education variable with 15 indicators, and the pro-environmental attitude variable with 18 indicators, all of these indicators can form each variable because they have a value of > 0.70.

3.2 Index and sustainability status of the pro-environmental attitude of coastal communities in Riau Province

Based on the results of the multidimensional analysis of pro-environmental attitudes in coastal communities in Riau Province, it is possible to identify the status of multidimensional sustainability at a value of 72.10, where this value is in the range of 50.01-75.00, which is entirely sustainable. This condition indicates that the actualization of a pro-environmental attitude on the coastal archipelago in Riau Province is only sufficient or can be said to be in a state of warning or warning for stakeholders, graphically presented in Figure 3.

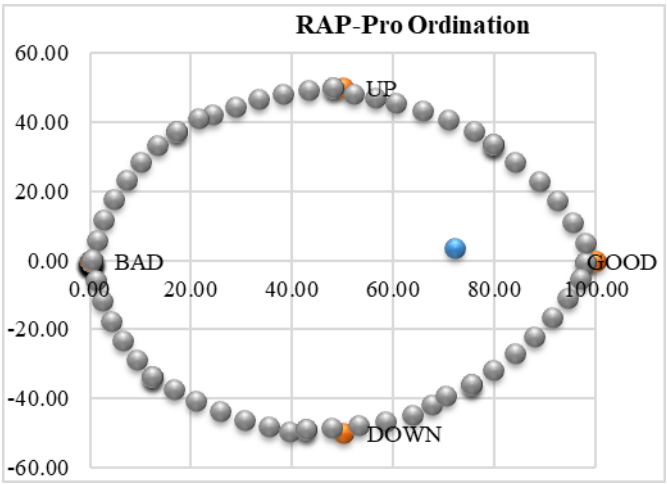

Figure 3. Multidimensional sustainability and pro-environmental attitudes of coastal communities in Riau Province, Indonesia

The sustainability status of the pro-environmental attitude of coastal communities in Riau Province and validated index values with a Monte Carlo value of about 73.05%, less than 1%. These results show that the influence of errors or errors in scoring is relatively tiny, explaining that the Monte Carlo value could be used as a validation value for the impact of random error [37].

In the multidimensional sustainability context shown in Figure 3, the labels 'UP,' 'DOWN,' 'GOOD,' and 'BAD' have important meanings. The label 'UP' indicates a positive direction, reflecting an increase or progress in pro-environmental practices, meaning the assessed attribute or parameter indicates better conditions and success in the implementation of sustainability strategies. Conversely, a 'DOWN' label indicates a negative direction, meaning that the attribute or parameter is experiencing a decline or regression in pro-environmental practices, reflecting challenges or problems faced in achieving sustainability. The 'GOOD' label refers to a condition that is considered good, where the attribute or parameter shows positive results and meets expected sustainability standards, reflecting success in achieving pro-environmental goals. On the other hand, a 'BAD' label indicates a poor condition, where the attribute or parameter does not meet the expected standard and shows a negative result, reflecting failure in achieving pro-environmental goals and the need for improvement. With this explanation, the reader is expected to understand the meaning of each label and its contribution to the multidimensional sustainability analysis presented in the study. Further, the sensitive attributes of each indicator are presented in Table 7.

Table 7. Sensitive attributes affecting the sustainability index in the actualization of the pro-environmental attitude of coastal communities in Riau Province

Indicators	Sensitive Attribute
Energy Saving	Technological innovations that are quickly adopted by coastal communities
	Education and energy awareness
Mobility and Transportation	Environmentally friendly transportation
	Affordable transportation for all
Waste Prevention	There are excellent waste prevention programs in every coastal district.
	Manage garbage properly
Repeat	Buying items with environmentally friendly packaging
	Available technical instructions for sorting garbage for recycling
	Community-based garbage management program
Attitude Aimed at Preserving Nature	There is an environmental management partnership pattern.

Source: 2024 processing data

Table 8. Index and multidimensional sustainability status of the pro-environmental attitude of coastal communities in Riau Province

No.	Indicators	Index	Status
1	Energy Saving	66.67	Quite Sustainable
2	Mobility and Transportation	74.13	Quite Sustainable
3	Waste Prevention	70.69	Quite Sustainable
4	Repeat	77.37	Sustainable
5	Attitude Aimed at Preserving Nature	71.66	Quite Sustainable

*) 50.01-75.00 It's categorized as quite sustainable.
*) 75.01-100 It's categorized as sustainable
Source: 2024 processing data

Based on the results of the analysis, the following are presented in Table 8: index value and sustainability status of each dimension or indicator.

Based on the identification of index values and the sustainability status of each dimension, it is known that only one dimension or indicator in the status category of sustainability and four other dimensions or indicators are in a sufficiently sustainable position.

3.3 Strategy for actualizing pro-environmental attitudes of coastal communities in Riau Province, Indonesia

The strategy for actualizing the pro-environmental attitude of coastal communities in Riau Province was formulated with experts who the researchers considered qualified in their fields. Guided by the prospective analysis sheet instrument,

the expert identifies the influence of the determining factors that have been previously identified. With the help of prospective analysis software, the expert has assessment data, which is analyzed and can be seen in Figure 4.

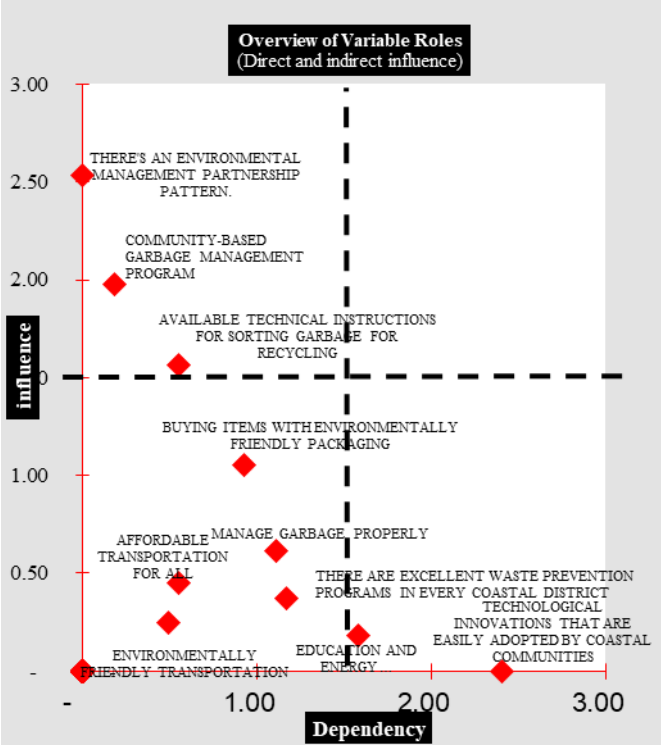

Figure 4. Results of prospective analysis

Figure 5. Strategy summary of the pro-environmental attitude of coastal communities

The results of the prospective analysis show three components that significantly influence the sustainability of pro-environmental attitudes of coastal communities in Riau Province, as shown in Figure 4. Those components consist of one major success determinant (input factor) and two success linking or supporting factors (stakes factor). The input factor is the existence of environmental management partnership patterns, and the two linking factors are (1) community-based waste management programs and (2) technical guidelines for sorting waste for recycling, which are available. Thus, these three factors form the basis for preparing a strategy to update the pro-environmental attitude of coastal communities in Riau Province. The strategy of actualization of the pro-environmental attitude of coastal communities in Riau Province was established based on expert judgment [37]. So, of the three dominant factors above, the strategy can be formulated as shown in Figure 5.

This study found that the knowledge of the community's law plays an essential role in creating a pro-social attitude in the coastal community in the Province of Riau. The analysis results of the current conditions indicate that the public's knowledge of law receives the highest score, at 89.50%.

Overall, it can be said that research conducted in Riau Province shows that legal knowledge is the most critical factor compared to other factors, such as environmental education and pro-environmental attitudes of coastal communities.

The findings align with a study conducted by Tang et al. [38], where legal knowledge plays an essential role in establishing a pro-environmental attitude. The high level of legal knowledge in coastal communities is a strong foundation for managing natural resources [39, 40]. The existence of an understanding of environmental law provides a solid foundation for the involvement of communities in efforts to preserve coastal ecosystems [41].

Furthermore, the results of this study are also consistent with the research conducted by Tozdan and Keles [42], which shows that the environmental education variable is at a lower level than the legal knowledge. Although legal knowledge is crucial in implementing a pro-environmental attitude, environmental education is essential in building environmental sustainability awareness [43]. Efforts by governments and associated agencies to provide easily accessible legal information and understanding can contribute to a high level of legal knowledge in coastal communities [44].

Statistical tests show that legal knowledge affects the pro-environmental attitude of coastal communities in Riau Province. The statistical test results indicate that the p-value (0.000) is less than 0.05, which indicates that the p-value is lower than the significance level of 0.05, indicating that the knowledge of the law affects the pro-environmental attitudes of the coastal community in the Riau province. This result is in line with a study conducted by Wan and Du [45], which stated that knowledge of the community's law influences the public's environmental awareness, which affects the community's pro-environmental attitude. Similar results were also stated by Su et al. [46], who stated that there was an influence between the two variables.

Next, statistical tests were conducted to evaluate the relationship between environmental education and pro-environmental attitude variables. The results show that the environmental education variable (X2) influences the pro-environmental attitude variable (Y). The p-value is less than 0.05, which indicates that the p-value is less than the 0.05 significance level. These results also align with a study conducted by Xie et al. [47], which states that the environmental education that one teaches will influence pro-environmental attitudes.

The next step is to analyze the value of the index and the sustainability status of the pro-environmental attitude of coastal communities in Riau Province. To analyze the index and the status of sustainability of the exposure of indexes and the state of the sustainable status of pro-environmental attitudes of the coastal community in the Riau province, the Multidimensional Scaling (MDS) analysis approach is used with the help of the Rap-Pro software. The analysis is performed against the five dimensions or indicators of the pro-environmental attitude.

In the first dimension or indicator of energy savings, it can be identified that the value of the index and the sustainability status of the pro-environmental behaviour of coastal

communities in Riau Province is 66.67. These values range from 50.01 to 75.00 or are relatively sustainable. Further on the results of leverage analysis, it can be identified that of the six sustainability attributes of pro-environmental behaviour of coastal communities in Riau Province, on the energy saving indicator, there are 2 (two) main attributes with high power positions, namely the technology innovation attribute that is easy to adopt in coastal communities with a sustainability value of 13.90 and the education and energy awareness attribute with a value of 12.70. These results align with Wenlong et al.'s research [48], and energy conservation plays an essential role in preserving the environment because the energy used comes mostly from limited natural resources. Similar statements are also made by Hui et al. [49], who state that reducing energy consumption can reduce the pressure on ecosystems, forests, and other natural habitats that are often victims of resource exploitation. In addition to technological innovations that are easy to adopt, energy awareness also plays an essential role in environmental conservation [50-52].

Next, the second dimension or indicator, mobility and transportation, is studied, and according to a supported analysis carried out using Rap-Pro software, the sustainability status of the pro-environmental attitude of coastal communities in Riau Province on mobility and transportation indicators reached 74.13, which is in the range 50.01–75.00, or is in a quite sustainable category.

Further on the results of the leverage analysis, it can be identified that of the six sustainability attributes of the pro-environmental attitude of coastal communities in Riau Province, on the energy saving indicator, there are 2 (two) main attributes with a high-power position, namely environmentally friendly transportation usage attribution with a sustainability value of 12.86 and affordable transportation attribution for all with a rating of 12.98. These results align with a study by Milewicz et al. [53] that emphasizes that using environmentally friendly transport is crucial in efforts to protect and maintain environmental sustainability. Ding and Liu [54] also found similar findings; adopting more environmentally friendly transportation technologies and modes helps reduce the pressure on natural resources, including oil and natural gas. In addition to environmentally friendly transportation, affordable transportation for all also plays a role in environmental conservation [55, 56].

Further analysis is done for the third dimension or indicator, waste prevention. The results of the Rap-Pro analysis show that the index and sustainability status of the pro-environmental attitude of coastal communities in Riau Province is 70.69. These values range from 50.01 to 75.00 or are quite sustainable. Further on the results of leverage analysis, it can be identified that of the six sustainability attributes of pro-environmental behaviour of coastal communities in Riau Province, on the energy savings indicator, there are 2 (two) main attributes with high power positions, namely the attributes available of waste prevention program superiority in each coastal area with a sustainability rating of 13.12 and properly managed garbage with a rating of 12.98.

These results are supported by research conducted by Rafey and Siddiqui [57], which states that a waste prevention program can focus on reducing environmental damage, such as using single-use plastic, which has a crucial impact on coastal and aquatic areas. The availability of this waste prevention program also anticipates the amount of waste that is thrown away so that waste can be adequately managed [58, 59].

Next, the fourth dimension, or indicator recycling, is analyzed. Based on the Rap-Pro analysis, we found that the sustainability status of the pro-environmental attitude of coastal communities in Riau Province on the recycling indicator has a value of 77.37, which is in the range of 75.01–100, or the sustainable category. Further on the results of leverage analysis, it can be identified that of the six sustainability attributes of the pro-environmental attitude of coastal communities in Riau Province on the energy saving indicator, there are two main attributes with a position of high leverage power, namely the attribute of buying goods with environmentally friendly packaging with a sustainability value of 12.34 and the attributes available technical guidelines sorting garbage for recycling with a value of 13.26.

The findings are supported by Oliver et al. [60], who state that environmentally friendly packaging can be made from recyclable materials or renewable resources, helping to maintain ecosystem balance and reduce pressure on natural resources. It will only work optimally when technical guidelines are available to sort garbage for recycling [61-63].

Next, we look at the fifth dimension, the behaviour aimed at preserving nature. Based on the Rap-Pro analysis, we found that the index and sustainability status of the pro-environmental attitude of Riau Province's coastal communities is 71.66, which is 50.01–75.00 or is entirely sustainable.

Further on the results of leverage analysis, it can be identified that of the six sustainability attributes of the pro-environmental attitude of coastal communities in Riau Province on the attitude indicators aimed at preserving nature, there are two main attributes with a high-power position, namely community-based waste management program attribution with a sustainability rating of 12.59 and attribution of existing environmental management partnership pattern with a value of 12.37. The results are supported by Nugraha [39], which found that community-based approaches and partnership patterns enable more appropriate waste management to meet local needs and conditions in coastal areas. Besides, the partnership pattern also promotes sustainable environmental conservation [64].

The results of the prospective analysis identify three factors that have a very high influence on the sustainability of pro-environmental attitudes in coastal communities in Riau Province. Those three factors consist of one major factor determining success (input factors) and two factors linking or supporting success (stakes factors). Then, two linking factors are (1) a community-based waste management program and (2) the availability of technical guidelines for sorting garbage for recycling. Thus, these three factors form the basis for preparing a strategy to update the pro-environmental attitude of coastal communities in Riau Province.

For the first determining factor of success, experts have identified three strategies for implementing them in coastal communities in Riau Province, namely: (1) development of environmental partnership and education; (2) establishment of coastal environment partnership forums; and (3) sustainable economic incentives. Agirreazkuenaga [65] emphasized that developing partnerships in environmental management and environmental education is an essential step towards achieving the goals of sustainability and conservation of the living environment. Partnerships involve cooperation among various parties, including governments, civil society, educational institutions, and non-governmental organizations [66-68].

Buchan and Yates [69] emphasized that establishing a

coastal environmental partnership forum is a positive step in managing and preserving coastal ecosystems. In addition to developing partnerships and the existence of an environmental partner forum, providing sustainable economic incentives will stimulate economic motivation that is in line with environmental conservation so that coastal communities have a positive economic impetus to maintain environmental sustainability around them [70-72].

Therefore, establishing environmental partnerships or coastal community communities will also encourage people always to maintain environmental sustainability [73-75]. Furthermore, a good partnership model must also be supported by sustainable economic incentives supporting pro-environmental attitudes in coastal communities [76].

For the second determining factor of success, the experts set out three strategies to update it for coastal communities in Riau Province, namely (1) community empowerment, (2) technological innovation, and (3) an incentive and reward system. First, community empowerment becomes a key pillar in running this program. Involving communities in the entire waste management process, from disposal to recycling, builds environmental awareness and empowers them as agents of change [77, 78].

Furthermore, technology innovation is key to improving the efficiency and effectiveness of community-based waste management [79]. Using the latest technologies, such as mobile applications for monitoring and reporting garbage and environmentally friendly recycling technologies, can optimize the waste management process [80-83]. Finally, the Incentive and Reward System is a strategy to motivate active public participation [84]. Incentives, such as reducing the cost of garbage or giving rewards to communities that meet specific recycling targets, can encourage further involvement [85].

For the second determining factor of success, experts have identified three strategies for updating them for coastal communities in Riau Province, namely: (1) intensive education and communication, (2) waste management infrastructure, and (3) incentives and sanctions. First, intensive education and communication are essential foundations for shaping public awareness and understanding of the importance of waste management [86, 87]. Through intensive educational campaigns, workshops, and dissemination, the public can understand the right ways to sort waste, differentiate recyclable materials, and raise awareness of the positive impact of waste treatment practices [88].

Furthermore, waste sorting infrastructure is crucial to simplifying the sorting process [89, 90]. Building waste sorting sites that are structured and easily accessible to the public can reduce physical obstacles to implementing waste sorting practices [61]. Finally, incentives and sanctions are needed as regulatory mechanisms to encourage compliance and active participation in waste sorting [91-93]. Sanctions given for violations of waste segregation practices can increase community compliance and support overall program success [94, 95].

This research shows that legal knowledge is critical in shaping pro-environmental attitudes among coastal communities in Riau Province. This is in line with previous research that emphasizes the role of the legal framework in enhancing environmental awareness and compliance. For example, research conducted by Shah and Asghar [96] showed that communities that have a strong understanding of environmental law have a greater propensity to participate in sustainable practices. Among the factors influencing pro-environmental attitudes, legal knowledge scored the highest, with a score of 89.5%. The results of this study suggest that improving legal literacy may serve as an important way to encourage environmental stewardship in these communities.

While the legal knowledge factor is critical, it is important to analyze these results in a broader context, including environmental education and community engagement approaches. According to the literature, environmental education plays an important role in shaping attitudes and actions towards sustainability [97]. Educational interventions can significantly influence pro-environmental behavior, especially when incorporated into community programs [98]. Environmental education should not be overlooked in our study, although legal knowledge emerged as the most important component. As shown by previous research, inconsistency and lack of integration in the curriculum indicate the current state of environmental education in coatal community. This gap shows how important a more cohesive approach to environmental education that complements legal knowledge is.

To address this issue, we suggest a multi-stage approach that combines legal education with environmental literacy programs. To achieve this goal, government agencies, educational institutions, and non-governmental organizations should work together to develop an all-encompassing education program. This strategy should emphasize the principles of environmental conservation and the legal framework. In this way, we can raise public awareness about the laws governing environmental protection and the ecological consequences of actions taken.

The study also showed that community-based waste management programs and technical guidelines for waste segregation are important components in encouraging pro-environmental attitudes. Community involvement in waste management significantly increases environmental awareness and participation [99]. Our research shows that building a structured waste segregation infrastructure can help people participate more and encourage more sustainable practices. This is especially important for coastal areas, where, due to their dependence on marine resources, waste management is often a very important issue.

Integrating these strategies into a broader environmental management framework can help environmental campaigns become more effective. As suggested by previous studies on waste management, providing incentives for participation in waste management programs can motivate community members to actively participate in sustainability efforts [100].

Furthermore, the literature increasingly recognizes the role of social media in disseminating information and mobilizing pro-environmental action. Social media can be a powerful tool to raise awareness and encourage communities to engage in environmental issues [101]. Utilizing social media to inform people about legal rights and responsibilities and environmental education resources can increase community participation and encourage a culture of sustainability for coastal community.

In addition, it is important to consider the social and economic conditions of coastal communities. There can be a conflict of interest between economic development and environmental conservation, as many residents depend on natural resources to live. Management practices must balance economic and environmental objectives [102]. Our study shows that incorporating economic incentives into pro-environmental approaches can help balance community

aspirations with sustainability goals [103]. For example, encouraging ecotourism or sustainable fishing practices can help conserve coastal ecosystems and simultaneously generate alternative sources of income.

Despite the fact that our research shows that legal knowledge is critical to shaping pro-environmental attitudes, it is important to take an approach that includes environmental education, community engagement, and socio-economic considerations. To increase the effectiveness of pro-environment initiatives in Riau Province, we must develop comprehensive strategies that address these interrelated factors.

Future research should look at how these strategies are implemented in practice, assessing their impact on community attitudes and behavior over time. Additional studies could also investigate how social norms and cultural principles shape pro-environmental attitudes, providing a better understanding of the components that influence sustainability in coastal communities. Ultimately, to build a culture of environmental stewardship, all stakeholders must work together to achieve sustainable development goals.

4. CONCLUSIONS

This research reveals that a holistic analytical approach to developing a strategy for actualizing the pro-environmental attitude of the people of Riau Province provides significant advantages. This research can provide a comprehensive view of environmental dynamics and social factors influencing people's pro-environmental attitudes. The resulting strategy can be more effective because it can integrate various elements essential in forming a pro-environmental attitude. However, this research has limits, especially regarding its perspective, which is limited to the knowledge of law and society. Therefore, there is room for further development. Variables that have not been studied in this study should be studied further. By doing so, further research can provide a deeper and more comprehensive understanding of the strategies that the Riau Province community can use to update pro-environmental attitudes.

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