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THE FORGOTTEN: ACHIEVING SUSTAINABLE DEVELOPMENT IN THE FISHERIES SECTORS THROUGH THE EMPOWERMENT OF LOCAL WISDOM

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ABSTRACT

Understanding prevailing beliefs and cultural norms is crucial to comprehending how culture affects the economy. The fisheries sector also has several attributes that can be developed to create sustainability scenarios that have not yet been studied in the West Pasaman district, West Sumatra province, Indonesia. This study aimed to demonstrate the potential of local wisdom as a valuable asset for fisheries sustainability. The research was conducted between January 2023 and June 2023 in West Pasaman Regency, West Sumatra Province, Indonesia, using RAPFISH and Participatory Prospective Analysis. The study identified key factors essential for achieving sustainable fisheries. The community of West Pasaman has a rich history of local fishing knowledge that can be fully utilised to achieve sustainability in the future. The crucial role of customary rules and local wisdom is highlighted. It is important to note that this knowledge should be considered in any efforts to achieve fisheries sustainability.

Keywords: West Pasaman Local Wisdom; Local Knowledge; RAPFISH; Participatory Prospective Analysis

INTRODUCTION

Environmental sustainability concerns have increased steadily, especially in recent decades (Kakoty, 2018; Taylor et al., 2021; Tranter et al., 2022). Previous research has examined the sustainability of the fisheries sector but only on the ecological dimension (Hametner, 2022). Traditionally, fishery sustainability has been evaluated through stock assessment models focusing solely on biological and ecological aspects (Cope, 2024; Maunder et al., 2020; Peng et al., 2023). Humanity's interactions with natural resources are complex, requiring environmental, conservation, social and economic considerations to be taken into account. This approach overlooks the various dimensions of fisheries and the broader sustainability perspective, including social-ecological aspects.(Alvarez, 2021; Liu, 2023; Lloyd Chrispin et al., 2022).

However, there must be a different approach to the improvement of the welfare of the aquaculture community than the economic approach (Dudayev et al., 2023; Jaya et al., 2022; Rindorf et al., 2017), one of which is to do with something that has been in the possession of the community but has never been empowered, local wisdom can enhance community welfare through cultural assets. In order to gain an understanding of the impact of culture on the economy, it is essential to have an awareness of the cultural values and norms that individuals apply in their economic activities. (Bennett *et al.*, 2021; Dudayev *et al*., 2023; Karnad *et al*., 2021). The people of West Pasaman Regency, West Sumatra Province, have implemented local wisdom values, particularly in the freshwater aquaculture sector. This includes the practice of 'ikan larangan', or forbidden fishing, which has been preserved for generations and is firmly rooted in the community, it is practised in each district of Pasaman Barat. This offers a valuable opportunity to achieve sustainable development, which could be further enhanced by considering the aforementioned local wisdom. The empowerment and involvement of local communities as stakeholders in direct contact

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with the objects to be managed and exploited is a solution to maintain environmental sustainability. Local wisdom can play a crucial role in managing freshwater aquaculture resources sustainably, meeting current needs without compromising the ability of future generations to meet their own. It is essential to recognise the cultural element inherent in local wisdom.(Kakoty, 2018; Vitasurya, 2016).

Assessing the sustainability of fisheries in a multidimensional manner is crucial as it can reveal important attributes that affect fisheries sustainability. However, a measurement of the sustainability status of fisheries from various dimensions has never been conducted in West Pasaman Regency, West Sumatra Province, Indonesia. This research will reveal the main attributes that have a dominant contribution in accordance with the sustainability status. This research also aims to prove that the local wisdom that already exists and has been passed down from generation to generation in the Pasaman Barat community is a forgotten factor and can be empowered to achieve sustainable fisheries. The research findings will assist the government in formulating sustainable scenarios for the fisheries sector and considering the empowerment of local wisdom in future fisheries policies.

MATERIALS AND METHODS

Study Site Description

The study was conducted in West Pasaman Regency, West Sumatra, Indonesia. The regency is situated between 00° 33' north latitude and 00° 11' south latitude and 99° 10' to 100° 04' east longitude. It is one of the regencies in West Sumatra Province, Indonesia. West Pasaman Regency in West Sumatra Province was established by the division of Pasaman Regency under Law No. 38 of 2003. On 18 December 2003, the law established the regencies of Dharmasraya, South Solok, and West Pasaman, with the capital located in Simpang Ampek. The regency covers an area of 3,864.02 Km² and has a population of 436,298 people (2021), distributed at a rate of 110 people/Km² across 11 sub-districts. West Pasaman Regency, West Sumatra Province, has 147 large and small rivers with a dendritic pattern resembling a tree structure. Some rivers that pass through this area include the Batang Pasaman River, Batang Kapar River, Batang Batahan River, and Air Salak River. Most of these rivers have their headwaters on Mount Pasaman and Mount Talamau. The large number of rivers flowing in this area raises the potential for fisheries that can be developed.

Aspects of the Sustainability Indicators

Sustainability is measured in terms of economic, social, technology, ethics and governance aspects. The economic aspects included an analysis of the economic value of fishery products, the marketing and distribution of fishery products, market concerns regarding sustainability, the dependence of the region on the fisheries sector, the business advantages of the fisheries sector, the income generated relative to the regional minimum wage, the absorption of labour, and the potential business alternatives. The Social aspects included number of actors, knowledge of environmental sustainability, conflict level, cultural/ ethical impact on fishing communities, level of socialisation of environmental conservation and fisheries household involvement in fisheries policy. The echnology aspects included number of fishponds, size, fishing gear, risks of using fishing gear, harvest handling and access to fisheries technology. The ethics and governance aspects included the number of regulations, regulatory violation rate, regulations for resource limitations, ecosystem damage mitigation, traditional rules and local wisdom and the role of fisheries actors in policy making.

Data Collection and Data Analysis

This research employs a mixed-method approach using an embedded strategy model to address the research question. Data collection utilises a concurrent embedded strategy model, using quantitative research methods to analyse attributes to determine sustainability status. Subsequently, qualitative research methods are employed to conduct a deeper exploration of the sustainability attributes and formulate sustainability scenarios. The research also employs snowball sampling techniques, considering potential challenges during the study.

Respondents were identified using non-probability purposive sampling based on predetermined goals and objectives aligned with the research objectives. The sample selection method involves intentionally selecting specific samples while disregarding others because the selected samples possess unique characteristics. The respondents or key informants consist of 30 community respondents, and 3-7 experts were purposively selected based on their knowledge of the object under study and familiarity with the research topic (Godet & Roubelat, 1996a). This research selected respondents from 11 sub-districts in West Pasaman Regency, West Sumatra Province, based on their expertise in the field. They included community leaders, religious scholars, and resource persons from the Office of Maritime Affairs and

Fisheries.

The score value is determined based on the results of interviews with respondents, then analysed with the RAPFISH program based on four dimensions: economic, social, technology, ethical and governance., to determine which attributes have the greatest influence on the sustainability index value, sensitivity analysis (leverage analysis) was conducted. To ensure the accuracy of the sustainability dimension attributes measured by MDS analysis, the stress value must be less than 0.25 points or 25%. Furthermore, a coefficient of determination (R^2) close to 1 is an indicator of the high accuracy of the analysis results. (Pitcher & Preikshot, 2001; Tesfamichael & Pitcher, 2006). Monte Carlo analysis is utilised to evaluate the extent of error factors in sustainability analyses arising from variances in respondents' ratings of features, data entry errors, and incomplete or absent data (Pitcher & Preikshot, 2001; Tesfamichael & Pitcher, 2006). The ordination model appears accurate based on the Monte Carlo analysis, which was conducted by performing 25 repetitions with a 95% confidence level. The errors during the ordination determination process were minimal, as evidenced by comparing the ordination results and the Monte Carlo value, which showed only slight or insignificant differences. The purpose of Monte Carlo analysis is to evaluate the impact of calculation errors and misjudgments of attributes by respondents on the sustainability index. If the difference between the Monte Carlo sustainability index and the MDS sustainability index is small, it indicates that the influence of errors in the analysis is small (Pitcher & Preikshot, 2001). The value of the analysis results is then interpreted in 4 groups that describe the condition of sustainability, namely: 0-25 points means poor (unsustainable), 25.01-50 points means poor (less sustainable), 51-75 points means fair (moderately sustainable) and 76-100 points means good (highly sustainable (Godet & Roubelat, 1996b). From estimates of the future condition of these variables, possible scenarios related to fisheries management can be developed using prospective analysis (Participatory Prospective Analysis).

For qualitative analysis, Data was collected through interviews, observation, documentation, and Focus Group Discussions (FGDs) using relevant interview guidelines. The guided interview technique was employed to ensure the interviewer was guided during the interview. The researcher was responsible for conducting the interview and determining its duration in a deep interview manner. Focus Group Discussions (FGDs) are conducted to gather in-depth information related to the research objectives. A group of respondents or informants are interviewed in a meeting or discussion.

RESULTS AND DISCUSSION

Sustainability Analysis

The sustainability status of West Pasaman Regency, West Sumatra Province, is determined through an assessment of attributes presented in Table 1.

The research results in Table 1 indicate that the RAPFISH output accurately reflects the sustainability status. This result is evidenced by the low-stress value (S), which falls below 20% of the range of values (0.14-0.15 points), and the high average coefficient of determination of 94%, indicating a high confidence level in each dimension. Based on these calculations, the model is considered suitable for explaining fisheries sustainability in West Pasaman Regency, West Sumatra Province, Indonesia. The sustainability analysis results in each dimension can be seen from the MDS value.

The multidimensional analysis (MDS) results in Table 1 demonstrate that the economic dimension has the lowest sustainability index value of 32.61 points, categorising it as poor (less sustainable). Following this, the social dimension has a sustainability index value of 47.69 points, placing it in the category of people with low incomes (less

Table 1. Multidimensional Sustainability Index Values (Points)

No	Dimensions	Stress	R-squared	MDS	Monte Carlo	Difference
1.	Economic	0,140	94,64	32,61	31,72	0,89
2.	Social	0,151	94,02	47,69	49,51	1,82
3.	Technology	0,143	94,01	69,16	72,24	3,08
4.	Ethical and Governance	0,149	94,02	49,20	52,56	3,36

Source: RAPFISH

sustainable). Finally, the technological dimension has a sustainability index value of 69.16 points, categorising it as fair (moderately sustainable). The ethics and governance dimension is 49.20 points, categorised as poor (less sustainable). The multidimensional sustainability index value is 49.67 points, indicating a poor (less sustainable) status.

The RAPFISH method will likely have errors due to scoring errors, scoring variability due to differences in judgement, or data entry errors, so a Monte Carlo analysis was performed—the results of the Monte Carlo analysis for each dimension. Table 1 demonstrates that the RAPFISH analysis yielded a value with minimal uncertainty factors, such as scoring errors, variations in scoring due to differences in judgment, or errors in inputting data. As a result, the analysis can still be utilised to determine the sustainability status following the rules of MDS (multidimensional scaling), so the sustainability status of the economic dimension can still be determined using MDS (multidimensional scaling) analysis.

Based on the results of the analysis, it can be seen that each dimension has aspects with the highest values, which are aspects that have the most significant leverage factors so that they are very influential on the sustainability of freshwater aquaculture in West Pasaman Regency, West Sumatra Province, Indonesia. The aspects with the most significant leverage factors in each dimension are further presented in Table 2.

Table 2. Leverage Analysis on Each Sustainability Dimension (Points)

No	Dimension	Attribute	Value
1.	Economic	Dependence on the fisheries sector	5,55
2.	Social	Knowledge of environmental sustainability	5,80
3.	Technology	harvest handling	10,26
4.	Ethical and Governance	Traditional rules and local wisdom	6,33

Source: RAPFISH

Table 2 shows that dependence on the fisheries sector highly influences the economic dimension, as evidenced by a leverage value of 5.55 points. The analysis results show that the leverage factor attribute of dependence on the aquaculture sector has the most significant influence on the sustainability status in the economic dimension. Therefore, any intervention on this attribute will significantly impact the sustainability index's value in the future economic dimension.

Table 2 shows that the aspect with the most decisive leverage value for sustainability in the social dimension is the attribute of knowledge of environmental sustainability, with a value of 5.80 points. The analysis shows that the leverage factor of knowledge of environmental sustainability has the most significant influence on the sustainability status, so if an intervention is made on this attribute, it will affect the sustainability status in the social dimension in the future.

According to Table 2, the harvest handling attribute has the highest leverage value for sustainability in the technology dimension, with a value of 10.26 points. The results of the analysis show that the harvest handling leverage factor has the most significant impact on sustainability in the technological dimension. Therefore, any intervention made on the harvest handling attribute will affect the sustainability index value in the technological dimension in the future.

Table 2 also shows that the attribute with the highest Leverage value for sustainability in terms of ethics and governance is traditional rules and local wisdom, with a value of 6.33 points. Therefore, this analysis demonstrates that traditional rules and local wisdom significantly impact sustainability regarding ethics and governance. Interventions to the attributes of local customs and wisdom will impact the sustainability index value in the ethical and governance dimension in the future.

The analysis results indicate that each dimension has aspects with the highest value and the most significant leverage factors, making them crucial for sustainability. The aspect with the most significant leverage factor is the most influential. West Sumatra Province, Indonesia, plays a significant role in this regard. Table 2 presents the aspects with the largest leverage factors in each dimension and demonstrates that traditional rules, local wisdom, and harvest landing determine the sustainability of the fisheries sector. Moreover, the community's existing knowledge of environmental sustainability can be effectively harnessed to achieve the goal of sustainable fisheries. The community continues to rely on the fisheries sector as a primary source of daily income, although some individuals may have additional sources of income. It is important to note that this statement is grounded in objective evidence rather than subjective evaluations.

Sustainability Scenarios

The key components that strongly influence the

scenario of fisheries are shown in Figure 1. These components were obtained from the sustainability analysis using the PPA application

Based on Figure 1, quadrant 1 (top left) is the area of driving variables, which are mostly the most decisive in the system. Key variables with a strong influence but a less intense level of dependence between variables are then used as inputs. Quadrant 2 (top right) relates to both influent and independent stakes variables. Some of these variables can be considered as solid variables. Quadrant 3 (bottom right) contains output variables that are highly dependent on other variables and have little effect. Meanwhile, quadrant 4 (bottom left) contains marginal or independent variables with little effect and a low level of dependency.

Key components are indicators that assess the success of sustainable management. The success of such management greatly depends on the variation of dependence between key components, customary rules, and local wisdom, as well as the mitigation of ecosystem damage in quadrant 1. In this quadrant, the variables have a high influence, so adding or reducing these variables will directly and significantly affect the results. Table 3 presents the key components for preparing sustainability scenarios in the future. This research demonstrates that the local knowledge transmitted through generations in the Pasaman Barat community of West Sumatra province, Indonesia, is a neglected factor that can be utilised to achieve sustainable fisheries.

Table 1 shows that the economic dimension sustainability index value is the lowest sustainability index in the less sustainable category, further supported by Table 2 and Figure 1, indicating that the fisheries sector is a primary source of income for the community. Previous research has demonstrated that households based on fisheries have the potential to make a positive contribution to the local economy (Ng'onga et al., 2019; Wang & Wang, 2021). However, the fishing community has not been able to prosper. It is necessary to empower the existing attributes that have been ignored.

Local wisdom or local knowledge is not limited to technical matters but is also interpreted from belief systems and social norms expressed in the form of culture, traditions and myths. Previous research shows the role of local wisdom in positively influencing the management of fish resources through myths, perception, and knowledge. The local tradition, which has been established for a long time, is still being followed despite the changes brought about by globalisation and other factors. This tradition has customary rules that aim to maintain and preserve the river ecosystem. Community efforts to protect the environment also require ethics and environmental awareness (Patria Keliat et al., 2021; Rizal et al., 2022; Zamzami et al., 2017).

The fisheries community in West Pasaman Regency, West Sumatra Province, Indonesia, has long applied various local wisdoms to freshwater

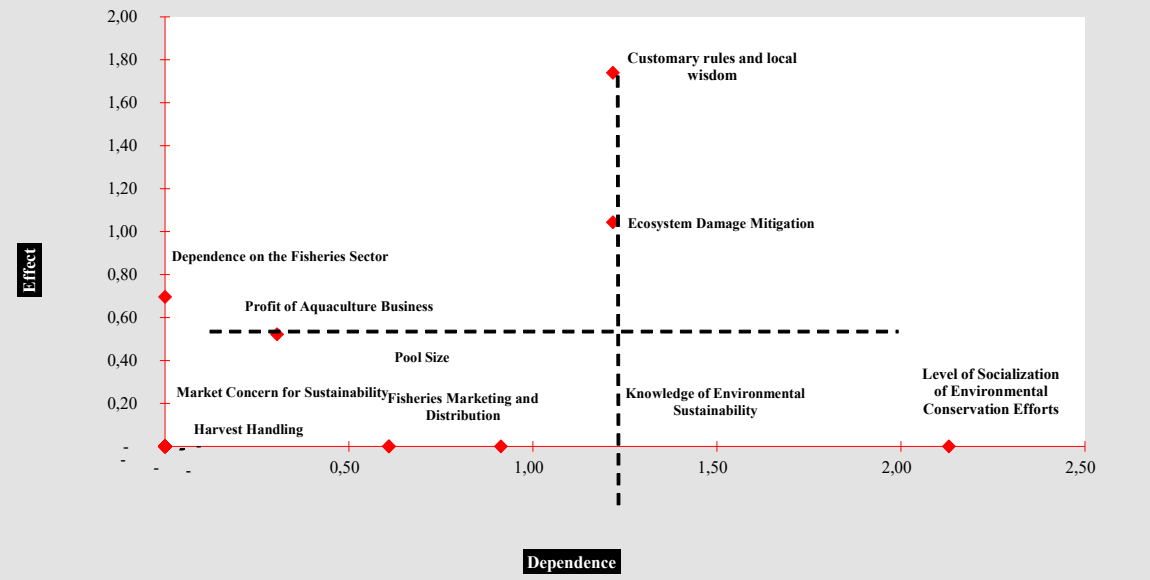

Figure 1. Interdependence of Key Components of Sustainability

Source: PPA Software

aquaculture, with forbidden fishing being the dominant practice. The economic results are mainly used for community activities, such as filling village or village treasury funds, financing the construction of worship facilities, and supporting village activities. From a social perspective, they aim to improve the relationship within the village or village community. The values of local wisdom are the foundation of freshwater aquaculture farming activities. These values are a cultural advantage of the community, formed as a product of past culture, and continuously used as a guide for life. Based on Table 1,2 and Figure 1, it can be seen that customary rules, local wisdom, and mitigation of ecosystem damage are critical components for achieving the sustainability of freshwater aquaculture. The sustainability analysis results (leverage analysis) with the RAPFISH and PPA application in Table 1,2, and Figure 1 also show that customary rules and local wisdom are the second order in the analysis. Values and norms in the form of local wisdom adopted by a community, which is the wisdom of the community in the management of natural resources and the environment, can be empowered where fisheries activities with people's economy-based empowerment are very important and strategic for economic progress in the form of freshwater aquaculture management to improve community welfare in Pasaman Barat Regency, West Sumatera Province, Indonesia.

Table 2 and Figure 1 also reveal something interesting, the community has knowledge of environmental sustainability in the form of local wisdom, which can be observed from the rules and norms that are still valid and continue to be maintained and applied to community life. They know about the local wisdom because it has been known and taught from generation to generation in their families. Local wisdom values of forbidden fishing are knowledge embedded in the community that continues to develop in everyday life through direct teaching by parents to children and the community.

In utilising natural resources, the people of West Pasaman, West Sumatra Province, apply the principle of eco-efficiency, namely not damaging the ecosystem, taking is done efficiently and thinking about the sustainability of natural resources derived from the values of local wisdom (local wisdom) fish prohibition. In utilising natural resources, the people of West Pasaman, West Sumatra Province, apply the principle of eco-efficiency, not damaging the ecosystem, taking it efficiently and thinking about the sustainability of natural resources sourced from the values of local wisdom. Table 2 also provides evidence that the community implements efficient harvest-handling practices prioritising environmental preservation. The harvest is utilised to its fullest potential without causing harm to the environment.

Previous research has shown that Leveraging factors in each dimension can be a key to developing a sustainable strategy (Sukwika & Sukamdani, 2023). In this research, applying local wisdom to regulations and policies increases the income of local communities (Tetelepta et al., 2023). This research demonstrates that empowering customary rules, local wisdom, and knowledge of environmental sustainability is crucial for mitigating ecosystem damage and achieving sustainability in freshwater aquaculture in West Pasaman Regency, West Sumatra Province, Indonesia. The community has implemented these measures, but they have not been fully empowered. Improving management forms and establishing regulations and incentives are necessary to encourage the community to implement customary rules and local wisdom in freshwater aquaculture activities.

CONCLUSION

This study highlights the significance of utilising local knowledge and mitigating ecosystem damage. The research demonstrates that the concept of local knowledge, which has long existed in society, has contributed to conserving the environment and preventing degradation. The community has implemented these practices but has not been fully empowered. The adoption of local wisdom by a community in the management of natural resources and the environment can be a powerful tool for community empowerment. The empowerment of natural resources based on economic considerations is a crucial and strategic step for improving community welfare. Local wisdom offers significant economic and social advantages, while also ensuring the continued of cultural traditions and the sustainability of ecosystems.

The practice of 'ikan larangan' or forbidden fishing represents an instance of conservation practices founded upon the local knowledge of communities with regard to their surrounding environment. Local communities possess the requisite knowledge to utilise natural resources, which has an indirect positive impact on conservation efforts. The principle of conservation represents a conscious and deliberate effort made by communities to ensure the long-term preservation of the resources they have at their disposal. This local wisdom has the potential to support the sustainability of resource management. In order to achieve ecosystem mitigation efforts, it is necessary to empower local wisdom. Moreover, it is

imperative to underscore the significance of decentralising fisheries policy and facilitating the active involvement of indigenous communities in decision-making processes.

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