



Local Wisdom and Blue Economy Transformation in Sustainable Coastal Governance of Banda Aceh

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Abstract

Local wisdom remains central to coastal resource governance in many communities, yet its contribution to blue-economy transformation across different dimensions of sustainability remains insufficiently understood. This study examines how local wisdom contributes to sustainable coastal resource management and blue-economy development in Banda Aceh, Indonesia. Using a convergent mixed-methods design, data were collected from 74 respondents through interviews, questionnaires, observations, and document analysis and were analyzed using qualitative analysis and Rapid Appraisal for Fisheries (RAPFISH). The findings show that Hukum Adat Laot, including customary fishing prohibitions, and the institutional role of Panglima Laot continues to shape fishing behavior, community compliance, and coastal resource governance. RAPFISH reveals an uneven sustainability profile: institutional (90.2%), social (79.5%), and ecological (77.2%) dimensions are substantially stronger than economic (50.3%) and technological (27.1%) dimensions. These findings demonstrate that locally legitimate institutions provide robust social and institutional foundations for sustainable marine governance but are insufficient alone to achieve a balanced blue-economy transformation. The study contributes to socio-ecological and marine governance literature by showing that sustainable coastal transformation requires bridging locally embedded institutions with ecological protection, technological adaptation, and viable economic opportunities.

A. Introduction

The global shift toward a blue economy presents a fundamental paradox: expanding marine economic value does not necessarily ensure ecological sustainability or social inclusion. For Indonesia, with 17,508 islands and 5.8 million km² of marine territory, this transition demands governance that balances economic development, ecological integrity, and community interests (Walsh, 2019). Taufiq et al. (2025) emphasize the importance of ecological justice in coastal development, while Nurdiansyah and Witro (2023) highlight the role of customary institutions in community governance. Aligned with the Sustainable Development Goals, sustainable marine resource management requires integrating ecological protection with economic productivity (Mukti & Sobirov, 2023; Putri & Ehsonov, 2024). Accordingly, the blue economy offers a framework for reconciling resource utilization with ecosystem conservation (Pauli, 2010), supported by institutional and regulatory transformation in the maritime sector (Rachman et al., 2025).

However, sustainable coastal governance requires attention not only to ecological and economic considerations, but also to the social, cultural, and institutional contexts in which coastal resources are managed. Community-based resource management demonstrates that local knowledge, environmental awareness, cultural values, and collective institutions shape how communities interact with natural resources (Haapasaari & van Tatenhove, 2022). Local wisdom represents accumulated cultural knowledge embedded in collective experience and transmitted across generations (Syakur & Khoiroh, 2021; Hidayati et al., 2020; Elbaar & Limantara, 2019; Lubis et al., 2021). Its persistence is reinforced by cultural roots and shared beliefs (Irham et al., 2022), while its practical significance lies in its capacity to regulate human behavior toward coastal resources (Gacutan et al., 2022). Such knowledge becomes socially consequential when it is institutionalized as enduring community values and practices (Keliat et al., 2021; Rasyid et al., 2023), particularly where environmental pressures require simultaneous ecological, economic, and socio-cultural responses (Abdillah et al., 2023).

This relationship is particularly visible in Aceh, where coastal resource governance operates through an interaction between formal regulation and *Hukum Adat Laot*. Although social, cultural, economic, and political transformations may weaken inherited practices, the effectiveness of customary governance depends on the relevance,

clarity, legitimacy, socialization, enforceability, and moral foundations of its rules (Dewiyanti et al., 2020). Law No. 11 of 2006 recognizes Aceh's authority over marine resources and the maintenance of *Hukum Adat Laot* (Abdullah et al., 2018), while Aceh Qanun No. 7 of 2010 and Qanun No. 16 of 2002 reinforce the place of customary principles in fisheries management (Azizah, 2025). This legal framework also formally recognizes *Panglima Laot* as an institution embedded in fishing communities (Salmarika et al., 2022), transforming local wisdom from mere cultural inheritance into an operative mechanism of coastal governance (Mawar & Iqbal, 2025; Fikri et al., 2026).

Institutionally, *Panglima Laot* regulates fishing activities within territorially defined *Lhok* boundaries and connects customary authority with community practices (Susetyo et al., 2023; Rahmah et al., 2021). Under Aceh Qanun No. 10 of 2008, this institution operates across *Lhok*, regency or municipal, and provincial levels, with responsibilities ranging from supervising *Hukum Adat Laot* and coordinating fishing activities to resolving disputes and mediating relationships among fishermen, government, and other stakeholders (Utama et al., 2020). Its significance therefore extends beyond sanctioning violations; it represents an institutional arrangement through which community participation, resource access, social order, and fishermen's welfare are negotiated (Miswar et al., 2019; Swardhana & Jenvitchuwong, 2023). This institutional dimension is particularly relevant to the blue economy, which seeks sustainable marine productivity through ecosystem protection (Rani & Cahyasari, 2015) while responding to broader challenges of environmental change, development, and coastal poverty (Harsono, 2020; Nurdiansyah & Witro, 2023).

Despite growing attention to sustainable coastal resource management, the role of socio-cultural practices and local institutions in shaping blue-economy development remains insufficiently understood. Studies on coastal and marine resources have largely focused on natural-resource management, while the agency of fishermen and other local actors has received comparatively limited attention (Haapasaari et al., 2021). Other studies highlight economic resource potential and vulnerabilities among coastal communities but provide limited explanation of how community knowledge and institutions actively structure sustainable marine practices (Sari et al., 2022). More specifically, the relationship among compliance with *Hukum Adat Laot*, the institutional authority of *Panglima Laot*, and community awareness remains insufficiently explained (Reid et al., 2021). Recent research nevertheless confirms the continuing importance of

local wisdom and customary law in sustainable fisheries governance in Aceh (Fikri et al., 2026), making it necessary to examine more closely the mechanisms through which such institutions operate. This matters because understanding the blue economy requires attention not only to resources and policy, but also to the perspectives and practices of actors who continuously negotiate conservation and resource utilization in everyday coastal life (Rusydy & Mansur, 2021).

The resulting research gap is therefore not simply a shortage of studies on Acehnese local wisdom. The deeper problem is the limited analytical integration of customary knowledge, community compliance, local institutions, multidimensional fisheries sustainability, and blue-economy innovation within a single socio-ecological framework. Blue-economy scholarship recognizes ecological, social, and economic dimensions while emphasizing creativity, resource efficiency, diversification, and environmentally responsible technologies (Fitria et al., 2020). Concurrently, fisheries sustainability can be assessed across ecological, economic, technological, social, and institutional dimensions through RAPFISH (Lloyd Chrispin et al., 2022), which provides a multidisciplinary basis for examining management effectiveness and sustainability (Charles, 2023). However, these dimensions alone do not explain how culturally embedded institutions shape community compliance, nor how such institutional capacities may enable—or constrain—the transition from customary resource governance toward an innovative and sustainable blue economy.

This study addresses the gap by connecting local wisdom and customary institutions with blue-economy governance through a socio-ecological perspective. Drawing on Ostrom's Socio-Ecological Systems (SES) framework, which emphasizes collective action and institutional arrangements in governing shared resources (Palomo & Hernández, 2019), the study treats *Hukum Adat Laot* and *Panglima Laot* not merely as cultural remnants, but as institutional mechanisms shaping community interactions with coastal common-pool resources. Its contribution lies in explaining how customary norms, institutional authority, community compliance, and multidimensional sustainability operate together rather than as isolated components. The article consequently argues that local wisdom can contribute to blue-economy transformation when cultural legitimacy and collective governance are connected to ecological sustainability, social participation, economic viability, technological adaptation, and institutional capacity (Putri & Ehsonov, 2024; Fikri et al., 2026).

The novelty of this study lies in its integrative analytical approach, which brings together local knowledge, *Hukum Adat Laot*, *Panglima Laot*, blue-economy dimensions, SES analysis, and RAPFISH-based sustainability assessment within a common framework to examine the conditions under which locally embedded governance may generate sustainable coastal innovation. Rather than assuming that customary practices are inherently sustainable, the study critically examines how their implementation and community compliance interact with ecological, economic, technological, social, and institutional conditions. This approach offers a more integrated understanding of how culturally embedded governance operates within a broader socio-ecological system and how its institutional strengths and limitations shape the transition toward sustainable coastal resource management.

Accordingly, this study aims to explain how local wisdom contributes to sustainable coastal resource management and the development of a blue economy in Banda Aceh. Specifically, it examines four interconnected domains: fishing prohibitions and myths, the implementation of *Hukum Adat Laot*, the functioning of local social institutions, and the sustainability status of capture fisheries. Through these domains, the study seeks to understand how culturally embedded practices and institutions interact with multidimensional sustainability conditions in shaping coastal resource governance.

B. Method

This study employed a convergent mixed-methods design to examine how local wisdom, customary institutions, and multidimensional fisheries sustainability interact in coastal resource management in Banda Aceh. Qualitative and quantitative data were collected in parallel and integrated during interpretation to provide complementary explanations of socio-cultural practices and sustainability conditions. The qualitative component used multiple case study design with purposive sampling to examine practices surrounding *Hukum Adat Laot*, the institutional role of *Panglima Laot*, community compliance, and the motives underlying individual and collective actions (Creswell & Creswell, 2017). The quantitative component used questionnaires and simple random sampling to assess ecological, economic, technological, social, and institutional dimensions of capture-fisheries sustainability. Banda Aceh was selected as the research setting because coastal community life is closely connected to Islamic values, customary institutions, and fisheries governance (Erda, 2019; Nur et al., 2020), within a significant coastal-community context in Aceh and Sumatra (Wilson & Linkie, 2012).

The study involved 74 respondents, comprising 56 men and 18 women, representing actors directly or institutionally connected to coastal resource management. They included 14 fishermen, three *Toke Boat* (boat owners/financiers), three *Toke Bangku* (fish auction intermediaries), three *Pawang Laot* (lead fishing captains), one *Panglima Laot* each at provincial, municipal, and *Lhok* levels, two heads of marine and fisheries agencies, three village heads, six Islamic religious leaders, three social workers, three fisheries extension workers, 18 women collecting *tirom* (small oysters/bivalves), and 13 coastal community members. The respondent groups and the information targeted from each group are presented in Table 1.

Table 1. Composition of Respondents and Targeted Information

No.	Respondents	Targeted Information
1.	<i>Panglima Laot</i> of Aceh Province	General information on <i>Hukum Adat Laot</i> , local wisdom, and its institutional structure.
2.	<i>Panglima Laot</i> of Banda Aceh City	Information on <i>Hukum Adat Laot</i> , local wisdom, and the institutional structure at the municipal level.
3.	<i>Panglima Laot Lhok</i>	Information on the implementation of <i>Hukum Adat Laot</i> and local wisdom at the <i>Lhok</i> level.
4.	Fishermen, <i>Toke Boat</i> , <i>Toke Bangku</i> , <i>Pawang Laot</i> , and <i>tirom</i> collectors	Information on their understanding of <i>Hukum Adat Laot</i> and local wisdom, and their acceptance to customary law in everyday coastal practices.
5.	<i>Geuchik Gampong</i> (village heads) and coastal community members	Information on changes in social behavior and community practices.
6.	Islamic religious leaders	Information on the relationship between religious norms and the behavior of coastal communities.
7.	Social facilitators and fisheries extension workers	Information on efforts to strengthen <i>Hukum Adat Laot</i> and local wisdom, their relationship with state law, and community capacity development.
8.	Head of the Marine and Fisheries Service of Aceh Province	Information on provincial policies concerning local wisdom-based coastal resource management.
9.	Head of the Marine and Fisheries Service of Banda Aceh City	Information on municipal policies concerning local wisdom-based coastal and marine resource management.

Primary data were collected through field observations, in-depth interviews, and questionnaires. Observations were conducted at key coastal sites, including fishing-boat docks and fish-landing sites, while interviews explored participants' experiences and understandings of *Hukum Adat Laot*, *Panglima Laot*, community practices, compliance, and coastal-resource policies. Secondary data were gathered from relevant academic publications and regulatory documents.

Qualitative data were analyzed through content analysis of interview transcripts, *Hukum Adat Laot* provisions, and coastal-resource regulations. Following Miles, Huberman, and Saldaña's analytical framework, the process involved data condensation, data display, verification, and conclusion drawing (Lester et al., 2020). The data were organized around recurrent themes concerning prohibitions and myths, the implementation of *Hukum Adat Laot*, the institutional role of *Panglima Laot*, and fisheries sustainability. Interpretations were triangulated across observations and interviews to ensure coherence among sources. Quantitative data were analyzed using RAPFISH (Rapid Appraisal for Fisheries) through multidimensional scaling (MDS) to assess sustainability across ecological, economic, technological, social, and institutional dimensions. The assessment incorporated dimension-specific attributes related to fisheries resources, livelihoods, fishing technology, community capacity, institutional recognition, law enforcement, and fisheries violations in accordance with the Code of Conduct for Responsible Fisheries.

Ethical clearance was obtained before fieldwork through the PhD Program in Social Science Education, Graduate School, Universitas Syiah Kuala (USK), following review by the supervisory committee and the Graduate School's Quality Control Management team. Fieldwork proceeded after the required research permissions were secured from relevant regional authorities and stakeholders. Ethical protocols guided participant involvement, informed consent, and the handling of data collected during observations, interviews, and questionnaires.

C. Results and Discussion

The presentation of results focuses on several key aspects of the blue economy in sustainable coastal resource management that are strongly shaped by local wisdoms: taboos and myths surrounding fishing, the application of *Hukum Adat Laot*, the institutional functioning of *Panglima Laot*, and the sustainability status of capture fisheries. Ultimately, the study reveals that the driving forces caused by the blue economy implementation lead to positive outcomes and innovations, particularly when coastal resource management integrates local wisdom as a vital component.

1. Results

The findings reveal that local wisdom in Banda Aceh operates through customary fishing practices, the implementation of *Hukum Adat Laot*, and the institutional role of

Panglima Laot. These practices coexist with uneven conditions of capture-fisheries sustainability, characterized by substantial disparities across ecological, economic, technological, social, and institutional dimensions.

a. Taboos and Myths in Fishing Activities

Interview and observational data show that fishing practices in the coastal communities of Banda Aceh remain closely tied to religious beliefs, inherited traditions, and collectively recognized prohibitions. One of the most visible practices is *Kenduri Laot*, a communal ceremony involving prayer, *dhikr* (remembrance of God), and a shared feast. Informants described the ceremony as an inherited coastal tradition as well as a religious and social occasion through which fishermen express gratitude to Allah and strengthen social cohesion and solidarity within the community. However, the interviews revealed differing perspectives regarding the perceived consequences of observing or omitting this tradition:

The ceremony begins with a prayer and dhikr, followed by a meal with the guests and other invitees. If the Kenduri Laot tradition is not performed, that is fine, and it will not bring bad luck or misfortune in the future. (Informant A, Mosque Imam, 2025).

As a fisherman, I highly respect Kenduri Laot, during which we as fishermen do not engage in fishing activities (meulaot) because we fear disasters or bad luck occurring on that day, though not all fishermen think the same as I do. (Informant B, Fisherman, 2025).

The contrasting perspectives also reveal how religious interpretations and inherited cultural beliefs coexist within the everyday experiences of coastal communities. While the mosque imam emphasized that the performance of *Kenduri Laot* should not be understood as a determinant of future misfortune, the fisherman's account reflected a more cautious attitude toward violating customary practices. In this context, the temporary suspension of fishing activities (*meulaot*) represents an important aspect of communal observance, although the reasons for respecting this prohibition may differ among individuals. These differences indicate that participation in *Kenduri Laot* does not necessarily imply a uniform understanding of its religious significance or its perceived consequences. Rather, the tradition continues to be observed within a community where religious convictions, customary expectations, and personal interpretations intersect.

These findings highlight the persistence of *Kenduri Laot* as a communal tradition despite differences in how its observance is interpreted. The contrasting accounts suggest that respect for customary practices may be maintained for different reasons, ranging from religious and social considerations to concerns about potential misfortune. Field observations during preparations for the ceremony further documented the temporary suspension of fishing activities, providing additional evidence of how this tradition continues to shape the collective practices of coastal communities, as illustrated in Figure 1.



Figure 1. Cessation of fishing activities during preparations for the *Kenduri Laot* ceremony

The cessation of fishing activities was also associated with *Uroe Pantang Meulaot*, or designated days on which fishing is customary prohibited. Observational and interview data indicated that fishermen consistently refrained from going to sea during these periods. The practice was collectively associated with *Kenduri Laot*, community solidarity, and compliance with rules maintained through *Hukum Adat Laot* and supervised by *Panglima Laot*. The findings therefore show that fishing prohibitions operate through an intersection of religious understanding, inherited cultural beliefs, communal norms, and customary regulation, even if community members do not necessarily attach identical meanings to these practices.

b. The Application of Hukum Adat Laot

The findings identified *Uroe Pantang Meulaot* as one of the most visible manifestations of *Hukum Adat Laot* in everyday fishing practices. The prohibited fishing periods reported by participants included Friday (one day), Eid al-Fitr (three days), Eid al-Adha (three days), Indonesian Independence Day on August 17 (one day), the December 26 tsunami commemoration (one day), the mourning period following the death of a

community member (one day), the Prophet Muhammad's birthday (one day), and *Kenduri Laot* (three days). Participants described compliance with these closed periods as an established community norm, noting that violations carry enforceable customary sanctions.

Interview data further revealed that restrictions on fishing activities on certain days did not necessarily result in the complete cessation of fisheries-related work. Instead, fishermen used these periods, particularly Fridays, to carry out maintenance activities and prepare their fishing gear. These accounts indicate that adherence to such restrictions was associated with collective responsibility, customary expectations, and concerns about the social consequences of violating established community norms.

On Fridays, the crew and I work together to repair fishing gear, such as mending damaged nets, cleaning and painting the boat, servicing the engine, and preparing our equipment. We do these things out of a shared responsibility to ensure the smooth operation of fishing trips, and it has become a tradition in the community, embracing local wisdom that has become custom. (Informant C, Toke Boat, 2025).

As a fisherman, I do not carry out meulaot activities during the Uroe Pantang Melaot, because it would bring disgrace upon us and our families if we violated it, beyond the formal sanctions, where fishing activities are suspended and the boat and equipment are confiscated. (Informant D, Fisherman, 2025).

The data also revealed that *Hukum Adat Laot* extends well beyond the regulation of fishing schedules. Participants reported strict prohibitions against fishing practices deemed environmentally destructive, including bombing, poisoning, chemical anesthetizing, and electrofishing. Customary rules were also described as restricting the clearing of coastal vegetation, such as mangroves, casuarina, ketapang (sea almond), and pandanus, as well as prohibiting the extraction of coral reefs and the harvesting of protected marine fauna and flora. Furthermore, participants reported that any items or wreckage found drifting at sea must be surrendered to *Panglima Laot* before being transferred to state authorities. These findings illustrate the comprehensive scope of coastal activities regulated through customary law in the study area.

The coastal communities of Banda Aceh City safeguard our coastal resources by managing them in accordance with local customs and traditions. For us, safeguarding these resources means safeguarding our livelihoods. (Informant E, Panglima Laot, 2025).

The interview accounts indicate that compliance with *Hukum Adat Laot* is reflected not only in the cessation of fishing during *Uroe Pantang Meulaot* but also in the alternative productive activities undertaken by fishermen during these closed periods.

Rather than going to sea, fishermen utilized this time to repair boats, service engines, mend nets, and organize other gear. This pattern was corroborated by fieldwork observations, providing empirical evidence that the prohibition on fishing does not suspend all livelihood-related activities; rather, it redirects labor toward vessel maintenance and trip preparation. Figure 2 documents fishermen undertaking boat-repair activities during *Uroe Pantang Meulaot*.



Figure 2. Fishermen repairing boats during Uroe Pantang Meulaot

As illustrated in Figure 2, fishermen utilized *Uroe Pantang Meulaot* to conduct boat repairs, corroborating interview accounts that prohibited fishing days serve as designated maintenance periods. Across the interviews and field observations, compliance with *Hukum Adat Laot* manifested in both behavioral and normative forms: fishermen refrained from going to sea on designated days, engaged in secondary fisheries-related upkeep, and recognized customary sanctions for non-compliance. These findings demonstrate that *Hukum Adat Laot* operates as an active, living component of everyday coastal practice rather than merely a formal or symbolic customary code.

c. Functioning of the Local Customary Institution (*Panglima Laot*)

Interview data identified *Panglima Laot* as the primary customary institution governing the implementation of *Hukum Adat Laot* across the studied coastal communities. Participants described its core functions as regulating fishing activities, maintaining customary order, adjudicating violations, and coordinating coastal resource management. The data also highlighted regular institutional coordination between *Panglima Laot* and

statutory authorities, particularly the Marine Affairs and Fisheries Service (Dinas Kelautan dan Perikanan), regarding fishing technology standards, statutory regulations, gear compliance, and integrated coastal zone management.

Participants further described coordination with maritime authorities in matters extending beyond the immediate capacity of customary institutions. These accounts included navigation and fishing-area information, weather-related guidance, and the referral of serious violations to the appropriate authorities. At the community level, *Panglima Laot* was also described as receiving reports concerning violations of customary rules. Informants associated the absence of reported disputes during the period described in the interviews with community observance of *Hukum Adat Laot*. This claim is retained as the informant's account rather than treated as independent evidence of complete community compliance.

In this year, the Panglima Laot Institution has not received any reports of complaints or disputes, this means that coastal communities and fishermen comply with the rules of Hukum Adat Laot. (Informant D, Panglima Laot Lhok, 2025).

To carry out the annual Khanduri Laut activity agenda, the community is enthusiastic in supporting the Panglima Laot Institution; usually a fee of Rp. 200.000 / boat is quoted, which is mostly used by fishermen and depends on the size of the boat, if the type of boat is 30 GT, it will be charged Rp. 400.000 /boat. (Informant E, Panglima Laot Provinsi, 2025).

The second account provides evidence of community participation in activities coordinated through *Panglima Laot*. Financial contributions to *Khanduri Laot* were reported to vary according to boat size, indicating an organized mechanism of participation in the customary activities. Taken together, the interview findings identify regulatory, coordinating, reporting, and community-mobilization functions associated with *Panglima Laot*. Figure 3 presents the institutional identity of *Panglima Laot Aceh*.



Figure 3. Institution of Panglima Laot Aceh

(Image source: <http://www.panglimalaotaceh.org/wewenang-tugas-dan-fungsi/>)

Across these accounts, *Panglima Laot* emerged as an institution through which customary rules were operationalized in fishing activities and community relations. Its reported functions included supervision of *Hukum Adat Laot*, coordination with fishermen and relevant governmental actors, reception of community reports, and organization of customary activities. These institutional findings provide qualitative evidence concerning the functioning of customary governance that can subsequently be examined alongside the institutional and other dimensions measured through RAPFISH.

d. Sustainability Status of Capture Fisheries (RAPFISH)

The quantitative component assessed capture-fisheries sustainability across the five dimensions specified in the Methods: ecological, economic, technological, social, and institutional. The RAPFISH analysis produced different sustainability scores across these dimensions. The ecological dimension obtained 77.2%, the economic dimension 50.3%, the technological dimension 27.1%, the social dimension 79.5%, and the institutional dimension 90.2%. The institutional dimension therefore recorded the highest score, whereas the technological dimension recorded the lowest. The complete multidimensional pattern is presented in Figure 4.

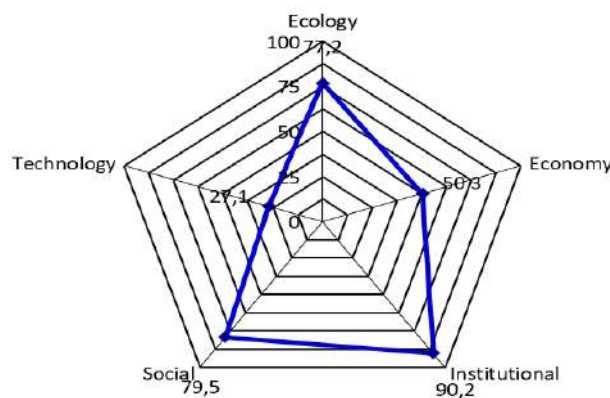


Figure 4. Sustainability Diagram of Fishery Capture

The RAPFISH profile shows an uneven sustainability pattern across the five dimensions. Institutional sustainability reached 90.2%, followed by the social dimension at 79.5% and ecological dimension at 77.2%. By contrast, the economic dimension reached 50.3%, while the technological dimension recorded only 27.1%. Figure 4 therefore displays comparatively strong institutional, social, and ecological dimensions alongside substantially

weaker economic and technological conditions. This multidimensional difference constitutes a central quantitative finding of the study.

The technological dimension was the weakest component of the sustainability profile, with a score of 27.1%. Data collected in the study indicated limited technological involvement in fishing activities and continuing reliance on *Pawang Laot* for fishing knowledge and weather forecasting. By contrast, the institutional dimension recorded the highest score at 90.2%, consistent with the qualitative findings showing the continuing operation of *Panglima Laot* and community recognition of *Hukum Adat Laot*. These results reveal a marked contrast between strong customary institutional capacity and comparatively weak technological conditions in the sustainability profile of capture fisheries in Banda Aceh.

2. Discussion

The findings demonstrate that local wisdom in Banda Aceh functions not merely as inherited cultural knowledge, but as an operative governance mechanism through which fishing behavior, resource use, social obligations, and institutional relationships are organized. The persistence of *Uroe Pantang Meulaot*, *Kenduri Laot*, *Hukum Adat Laot*, and *Panglima Laot* indicates that customary governance remains embedded in everyday interactions between coastal communities and marine resources. This finding supports the view that local wisdom becomes consequential when cultural knowledge is translated into collective practices and institutional arrangements rather than retained only as symbolic heritage (Keliat et al., 2021). In the Acehnese context, its significance is reinforced by the formal recognition of customary marine governance, particularly the continuing institutional position of *Panglima Laot* in fisheries management (Rahmah et al., 2021; Susetyo et al., 2023).

The findings concerning fishing prohibitions and *Kenduri Laot* further show that community compliance cannot be explained solely through formal regulation. Religious understandings, inherited beliefs, social expectations, and customary obligations coexist in shaping fishing behavior. Importantly, participants did not interpret these traditions uniformly, particularly regarding beliefs about misfortune associated with non-observance. This variation suggests that the regulatory capacity of local wisdom does not depend on complete agreement about supernatural meanings. Rather, shared practices can remain socially binding even when their underlying

interpretations differ. This finding extends the understanding of local wisdom as an adaptive relationship between communities and their environments (Abd Majid et al., 2022; Taufiq et al., 2025) by showing that cultural continuity can operate through behavioral consensus despite interpretive diversity. It also cautions against romanticizing local wisdom as a culturally homogeneous system of belief.

The implementation of *Hukum Adat Laot* provides stronger evidence of how cultural norms become resource-governance practices. Prohibited fishing days temporarily restrict extraction while allowing fishermen to redirect their activities toward repairing boats, engines, nets, and other equipment. Customary rules also prohibit destructive fishing practices and activities that threaten mangroves, coral reefs, and protected species. These practices indicate that customary regulation simultaneously structures resource access and constrain environmentally harmful behavior. Similar research has identified local wisdom as an important mechanism for sustainable capture fisheries (Elbaar & Limantara, 2019), while ecosystem-based fisheries studies emphasize that sustainable management requires the integration of ecological conditions and human behavior (Sari et al., 2022; Rachman et al., 2025). The present findings add an institutional dimension by showing that environmental restraint is embedded in socially recognized rules and routine community practices rather than operating only through externally imposed conservation measures.

Compliance with *Hukum Adat Laot* is also sustained through a combination of moral legitimacy, social accountability, and customary sanctions. Previous research records sanctions including confiscation of catches and temporary restrictions on fishing for violations of customary rules (Rahmah et al., 2021). However, the present findings suggest that enforcement should not be reduced to punishment alone. Fishermen's observance of prohibited days, participation in customary activities, and recognition of community expectations indicate that compliance is also socially internalized. This distinction is important because sustainable governance based exclusively on coercive enforcement may weaken when monitoring is absent, whereas socially legitimate rules can influence behavior through collective expectations. Local wisdom therefore functions as both a normative and regulatory institution, connecting moral responsibility with resource-management practices. This interpretation is consistent with studies emphasizing the importance of integrating ecological and human-community dimensions in coastal governance (Powell et al., 2019).

The institutional role of *Panglima Laot* strengthens this governance arrangement by connecting customary rules with organized authority. The findings show that *Panglima Laot* performs regulatory, coordinating, reporting, and community-mobilization functions while interacting with governmental and maritime actors. This position is consistent with its historical transformation from traditional maritime leadership into a formally recognized customary institution (Utama et al., 2020). Previous studies similarly demonstrate its role in ecosystem-based fisheries management in Aceh (Miswar et al., 2019; Rahmah et al., 2021). The present study nevertheless moves beyond describing institutional existence by showing how *Panglima Laot* operates as an intermediary between community norms, fishing practices, and formal governance structures. Rather than replacing state institutions, customary authority appears to complement them in areas where local legitimacy, everyday monitoring, and community participation are particularly important.

Viewed through the Socio-Ecological Systems perspective, this interaction is particularly significant because sustainable common-pool resource governance depends on relationships among resource conditions, users, rules, and institutional arrangements rather than on ecological resources alone (Palomo & Hernández-Flores, 2019). *Hukum Adat Laot* establishes locally recognized rules of resource use, while *Panglima Laot* provides an institutional mechanism through which those rules are coordinated and maintained. The findings therefore support an interpretation of Acehnese customary governance as part of a socio-ecological arrangement in which cultural legitimacy and institutional authority mediate interactions between fishing communities and marine resources. This also helps explain why the institutional and social dimensions achieved relatively high RAPFISH scores. The contribution of local wisdom lies not simply in preserving tradition, but in embedding resource-management norms within social relationships and locally legitimate institutions.

The RAPFISH results, however, complicate any assumption that strong customary institutions automatically produce comprehensive fisheries sustainability. Institutional sustainability reached 90.2%, social sustainability 79.5%, and ecological sustainability 77.2%, whereas economic sustainability reached only 50.3% and technological sustainability 27.1%. This divergence is one of the study's most consequential findings. It indicates that institutional legitimacy and social cohesion can coexist with substantial weaknesses in technological capacity and more moderate

economic conditions. Multidimensional fisheries assessment is valuable precisely because sustainability cannot be inferred from a single strong dimension (Lloyd Chrispin et al., 2022; Charles, 2023). Thus, the high institutional score should not be interpreted as evidence that the coastal system as a whole has already achieved sustainable blue-economy transformation.

The particularly low technological score reveals a critical boundary to what customary governance can accomplish independently. Reliance on *Pawang Laot* for fishing knowledge and weather forecasting demonstrates the continuing importance of experiential and locally embedded knowledge, but it also indicates limited technological incorporation into fisheries activities. The appropriate policy response is not to displace local knowledge with technology, but to develop forms of technological adaptation that complement existing institutional capacities. This distinction is crucial because blue-economy transformation requires innovation without marginalizing the actors whose knowledge sustains local resource governance. Research on Indigenous and local knowledge similarly emphasizes the value of bringing different knowledge systems into fisheries governance without subordinating one to another (Reid et al., 2021). In Banda Aceh, technological development should therefore strengthen rather than erode the legitimacy and adaptive capacities already embedded in customary institutions.

The moderate economic score of 50.3% further demonstrates that institutional and ecological strengths do not automatically translate into stronger economic outcomes for coastal communities. This finding challenges an overly linear understanding of the blue economy in which sustainable resource management is assumed to generate prosperity by itself. Fisheries productivity and community welfare depend on broader economic capacities, including access to productive resources and opportunities for value creation, as demonstrated in research on Aceh's fisheries sector (Abd Majid et al., 2022). Consequently, the blue economy should not be framed merely as increased exploitation of marine economic potential. In this context, its development requires an alignment between ecological protection, institutional legitimacy, technological capacity, and economically meaningful opportunities for coastal communities. Without such alignment, blue-economy development risks becoming disconnected from the social institutions that actually govern resource use.

This multidimensional imbalance also reframes the innovation possibilities identified by the study. Digital monitoring, renewable marine energy, circular use of fisheries waste,

sustainable aquaculture, digital markets, marine-based products, ecotourism, and coastal education may offer potential pathways for strengthening blue-economy development, but they should not be presented as outcomes already produced by the communities studied. Rather, they represent possible directions whose feasibility depends on local technological capacity, economic accessibility, ecological suitability, and community participation. Integrated marine governance research demonstrates that multidimensional problems require institutional arrangements capable of coordinating diverse actors and forms of knowledge (Haapasaari et al., 2021). Accordingly, innovation in Banda Aceh should be understood as institutionally embedded adaptation, not simply the introduction of new technologies into an existing coastal economy.

The broader theoretical contribution of these findings lies in repositioning local wisdom from a cultural variable to an institutional component of blue-economy governance. The findings suggest that local wisdom contributes to sustainability when cultural norms are translated into enforceable practices, supported by legitimate institutions, and connected to ecological and social conditions. At the same time, the RAPFISH results demonstrate that cultural and institutional strength alone cannot resolve technological and economic weaknesses. These qualify approaches that treat local wisdom as inherently sufficient for sustainable resource management. Instead, the study proposes a relational understanding in which customary governance provides institutional and social foundations that must interact with technological adaptation, economic viability, and ecological protection. Such an interpretation is consistent with integrated governance approaches that emphasize coordination across multiple dimensions of marine-resource management (Haapasaari et al., 2021).

The coexistence of customary authority and formal governmental institutions also provides insight into polycentric coastal governance. Rather than claiming that *Hukum Adat Laot* produces a separate “positive law,” the findings indicate that customary marine rules derive additional institutional authority from their recognition within Aceh’s formal legal and governance framework. This creates an arrangement in which community-based authority and governmental structures operate at different but interacting levels. Such institutional complementarity resembles broader arguments that ocean governance increasingly requires coordination among multiple centers of authority rather than exclusive dependence on centralized management (Mahon & Fanning, 2019). The Banda Aceh case therefore demonstrates how formally recognized customary institutions can

contribute local legitimacy and community-level coordination within a wider governance system, while still requiring interaction with state institutions for regulatory, technological, and resource-management functions beyond their customary jurisdiction.

The Banda Aceh case offers broader insights into a challenge faced by many coastal societies: how locally rooted institutions can remain relevant as fisheries governance increasingly encounters pressures for ecological sustainability, technological adaptation, and economic transformation (Haapasaari et al., 2021; Keliat et al., 2021). In Aceh, *Hukum Adat Laot* provides community-based rules governing marine resource use, while *Panglima Laot* represents a customary institution through which these rules are maintained and connected with formal governance (Rahmah et al., 2021; Susetyo et al., 2023). Their significance beyond the Acehnese context lies not in the possibility of replicating these institutions elsewhere, but in what their functioning reveals about the role of cultural legitimacy, collective authority, and local knowledge in governing coastal resources (Reid et al., 2021; Keliat et al., 2021). Similar concerns are central to debates on community-based coastal management and polycentric marine governance, where coordination between communities and multiple institutional actors remains critical (Powell et al., 2019; Mahon & Fanning, 2019).

This perspective is particularly important for blue-economy transitions in developing coastal regions, where technological modernization and economic diversification may advance more rapidly than the institutional capacity of local communities to participate in them. The Banda Aceh findings reveal the opposite but equally important condition: strong institutional, social, and ecological dimensions coexist with weak technological and moderate economic performance. This imbalance shows that culturally embedded governance can provide a strong social and institutional foundation for sustainability but cannot substitute for technological capacity and viable economic opportunities. The experience of Banda Aceh therefore contributes to wider discussions on small-scale fisheries, local and Indigenous knowledge, and blue-economy governance by demonstrating the need to connect technological and economic transformation with institutions that coastal communities already recognize as legitimate.

This study nevertheless has several limitations that delimit the interpretation of its findings. The research is concentrated on coastal communities in Banda Aceh, and the institutional characteristics of *Hukum Adat Laot* and *Panglima Laot* are strongly embedded in Aceh's particular legal, religious, and socio-cultural context; the findings therefore

should not be generalized directly to coastal communities with different institutional arrangements. The cross-sectional design also captures practices and sustainability conditions within a specific period rather than changes over time. Although the mixed-methods design combines qualitative evidence with multidimensional RAPFISH assessment, the study does not establish causal relationships between customary governance and the sustainability scores. Moreover, the low technological score identifies an important weakness but does not by itself determine which technological interventions would be locally feasible or effective. These limitations should frame the scope of the study's theoretical and practical claims.

D. Conclusion

This study demonstrates that local wisdom in Banda Aceh functions as an institutional and social foundation for sustainable coastal resource governance rather than merely as inherited cultural practice. *Hukum Adat Laot* regulates fishing behavior and resource use, while *Panglima Laot* provides locally legitimate authority through which customary rules are maintained, coordinated, and connected with formal governance. The RAPFISH assessment, however, reveals an uneven sustainability profile: strong institutional (90.2%), social (79.5%), and ecological (77.2%) dimensions coexist with moderate economic sustainability (50.3%) and particularly weak technological sustainability (27.1%). These findings indicate that strong customary institutions and community compliance can support sustainable resource governance, but they are not sufficient by themselves to produce a balanced blue-economy transformation.

The study therefore contributes to blue-economy and socio-ecological governance scholarship by positioning local wisdom as an institutional component of sustainability rather than treating it primarily as cultural heritage. The Banda Aceh case shows that culturally legitimate institutions can provide important foundations for collective action, environmental responsibility, and community participation, while technological and economic capacities remain critical for broader transformation. Practically, this means that coastal development should not bypass or replace established local institutions in the pursuit of modernization. Instead, technological adaptation and economic development need to be connected with customary governance, community knowledge, and locally recognized authority so that blue-economy initiatives strengthen rather than weaken the social and institutional foundations through which coastal resources are already governed.

Future research should address these limitations through comparative studies across coastal communities with different institutional and cultural settings and longitudinal designs that capture changes in customary governance and sustainability over time. Further studies should also examine the relationship between customary governance and specific sustainability outcomes, particularly the feasibility and social acceptance of technological and economic interventions within locally grounded coastal governance. Ultimately, sustainable coastal transformation does not require choosing between local wisdom and modernization but connecting them. The Banda Aceh case demonstrates that locally legitimate institutions can provide a strong foundation for marine governance, but their contribution to a blue economy depends on integration with ecological protection, technological adaptation, and viable economic opportunities. Sustainable blue-economy development should therefore build upon, rather than bypass, the institutions, knowledge, and collective practices already embedded within coastal communities.

Declaration of Competing Interest

The authors declare that they have no financial, professional, or personal conflicts of interest that could have influenced the design, conduct, interpretation, or reporting of this study.

Declaration of Generative AI

Generative AI tools were used during the manuscript revision process to assist with language refinement, academic clarity, coherence, and organization of the text. The authors critically reviewed and revised all AI-assisted content and retained full responsibility for the accuracy, interpretation, arguments, citations, and final content of the manuscript. Generative AI was not used to generate research data, fabricate evidence, conduct the empirical analysis, or replace the authors' scholarly judgment.

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