

MONITORING MECHANISMS AND SUSTAINABILITY OF THE BLUE ECONOMY IN MOMBASA AND LAMU COUNTIES, KENYA

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ABSTRACT

Purpose of the Study: The study examined the influence of monitoring mechanisms on the sustainability of the blue economy in Mombasa and Lamu Counties, Kenya.

Problem Statement: Mismanagement of common marine resources continues to threaten the sustainability of the blue economy in Mombasa and Lamu Counties, undermining livelihoods, food security, and economic development. Despite existing governance frameworks, monitoring systems remain inadequate due to weak enforcement, limited institutional coordination, insufficient funding, and governance challenges, necessitating an assessment of their effectiveness in promoting sustainable resource management.

Methods: Anchored in Common-Pool Resources Theory, the study adopted a convergent parallel mixed-methods design. Data were collected from 330 respondents drawn from fishing communities, government institutions, NGOs, academia, and the private sector through semi-structured questionnaires and key informant interviews. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data were analyzed thematically.

Findings: The study found that monitoring mechanisms had a positive and statistically significant influence on the sustainability of the blue economy ($\beta = 0.170$, $p = 0.009$). Effective monitoring enhanced compliance, accountability, and marine resource conservation. However, the findings also revealed that monitoring systems were constrained by inadequate funding, weak institutional coordination, limited enforcement capacity, and perceptions of bias and corruption, reducing their overall effectiveness.

Conclusion: The study finds that robust and effective monitoring mechanisms are fundamental to improving governance, strengthening compliance with resource management regulations, and enhancing the long-term sustainability of Kenya's blue economy.

Recommendation: The study recommends strengthening monitoring systems by integrating digital monitoring technologies with local ecological knowledge, enhancing institutional and enforcement capacity, promoting transparency and accountability, and fostering inclusive stakeholder participation.

Keywords: *Monitoring mechanisms; Sustainability; Blue Economy*

INTRODUCTION

The sustainability of the blue economy in Mombasa and Lamu Counties can be understood through the lens of Common-Pool Resources (CPR) theory, which highlights the risks of overexploitation of shared marine resources, including fisheries and coastal ecosystems. Early perspectives emphasized the “tragedy of the commons,” in which unregulated access leads to depletion, whereas later work demonstrated that community-based governance, anchored in clear rules, monitoring, and collective decision-making, can promote sustainable resource use (Ostrom, 1990; Robert et al., 2021). This theoretical foundation underscores the importance of structured governance systems for managing Kenya’s blue economy.

Globally and regionally, the blue economy is a major driver of economic growth, contributing between USD 1.5-2.5 trillion annually and supporting millions of livelihoods, including about USD 296 billion and 49 million jobs in Africa. In Kenya, the sector holds significant potential, particularly in coastal counties such as Mombasa and Lamu, where fisheries alone could generate up to USD 5 billion annually. However, only about 7.5% of ocean resources are sustainably managed, reflecting persistent challenges such as overfishing, climate change, weak governance, and limited scientific capacity (OECD, 2016; Njiru et al., 2021).

Despite growing global emphasis on sustainable ocean governance, gaps remain in the effective application of key management mechanisms, particularly stakeholder engagement, monitoring systems, conflict resolution, awareness programs, and resource pooling, in Kenya’s coastal context. Existing studies emphasize that these mechanisms are critical for enhancing cooperation, accountability, and sustainability outcomes, yet their implementation remains fragmented and insufficiently understood in Mombasa and Lamu Counties. This study therefore addresses this gap by examining how these governance mechanisms influence the sustainability of Kenya’s coastal blue economy.

Problem Statement

The sustainability of the blue economy in Mombasa and Lamu Counties is increasingly constrained by the mismanagement of common marine resources, despite existing regulatory frameworks. Globally, over 34% of fish stocks are overexploited, while in Kenya, more than 30% of fish catches exceed sustainable levels, resulting in annual losses of over KES 3 billion due to illegal fishing (Costello et al., 2016; FAO, 2018).

Additionally, marine ecosystems are under pressure from over 8 million metric tons of plastic waste entering oceans annually and the escalating effects of climate change, including rising sea temperatures and ocean acidification (Jambeck et al., 2015; IPCC, 2019). These environmental pressures are compounded by weak institutional capacity, fragmented policies, and inadequate stakeholder involvement, which undermine effective governance and conservation efforts (Otieno, 2023; Thoya et al., 2022).

Empirical evidence from this study further reveals that key management mechanisms, such as stakeholder engagement, monitoring systems, conflict resolution, awareness programs, and resource pooling, do not have a statistically significant positive effect on sustainability, highlighting systemic governance gaps. This aligns with broader findings that highlight inequitable access to resources, prioritization of economic gains over environmental sustainability, and marginalization of local communities (Cisneros-Montemayor et al., 2021; Okafor-Yarwood et al., 2020; Cinner et al., 2012). Collectively, these findings underscore the urgent need for integrated, participatory, and institutionally strengthened approaches to improve sustainability outcomes in Kenya's coastal blue economy.

LITERATURE REVIEW

Theoretical Review

Common-Pool Resources (CPR) Theory explains the sustainability of the blue economy in Mombasa and Lamu Counties by focusing on shared marine resources such as fisheries, mangroves, and coastal waters, which are difficult to regulate and prone to overuse. Early work by Garrett Hardin (1968) warned that unrestricted access leads to resource depletion, while Elinor Ostrom (1990) demonstrated that sustainable management is achievable through collective action and well-structured local institutions. Ostrom's design principles, particularly monitoring, clearly defined rules, and graduated sanctions, highlight the importance of effective governance systems in ensuring compliance and preventing overexploitation (Ostrom, Gardner & Walker, 1994; Ostrom, 2009).

Regarding monitoring mechanisms, CPR theory emphasizes that continuous, transparent, and participatory monitoring is essential to sustaining common-pool marine resources. Empirical evidence shows that adaptive and polycentric governance systems improve accountability and resource outcomes in marine contexts (Palomo & Hernández-Flores, 2019). For Mombasa and Lamu Counties, effective monitoring, supported by institutions and integrated with local knowledge, enhances compliance, reduces illegal exploitation,

and strengthens collective responsibility. Therefore, CPR theory underscores that strengthening monitoring systems is central to improving governance effectiveness and achieving long-term sustainability of the blue economy.

Empirical Review

Sustainability of Kenya's Blue Economy.

Rasowo et al. (2020) evaluated the blue economy as a driver of economic growth and development in Kenya. Among the many secondary sources used by the researchers were academic journals, UN reports, policy documents, and grey literature. Insufficient integration, coordination, and coherence among government entities were identified as one of the major limitations and strengths of the Kenyan blue economy sector in their study. To fully realize the developmental potential of the blue economy, policy alignment and institutional synchronization are vital, and this study points to a considerable gap in both areas. The report underscores the importance of improving institutional collaboration and policy integration so that the sector can exert its influence and grow.

Thoya et al. (2022) have considered the impact of port expansions on small-scale fishermen in Tanzania's Bagamoyo and Kenya's Lamu. Despite the negative impacts, such as pollution and ocean grabbing, the study, through perception surveys, focus groups, and participatory mapping methods, highlights the fishermen's reliance on nearshore habitats. To ensure sustainability and fairness, it insists on marine spatial planning and policies that consider the needs of small-scale East African fishermen, fostering collaboration among port development, maritime governance, and fishers. The study reveals that establishing such frameworks is paramount.

Monitoring Mechanisms and Sustainability of Kenya's Blue Economy

Eisenbarth and his team (2021) examined the impact of community forestry on forest consumption across 110 Ugandan localities. In addition, the study examined regions monitored by satellite and ground data, as well as those that were not. The findings indicated that, even though community monitoring could not stop forest use stemming from the aforementioned four sources of information, it was effective in changing the pattern of use in areas not under watch, especially those neighboring the communities. This underscores the critical need for intervention in resolving the denudation issue.

Makwaka and Muna (2022) conducted a study on monitoring the sea, specifically focusing on organizational structure, professional staff, technology use, and collaboration in information sharing. Data from 294 respondents across seven marine businesses indicated that organizational structure significantly affected the speed and accuracy of decision-making. Additionally, sharing information was described as an influential factor, alongside staff competency, and it was found that the effectiveness of surveillance could be improved by enhancing the indicated areas. The government is therefore advised to adopt the study's recommendation and establish a policy framework and procedures to coordinate monitoring activities across agencies in the maritime sector.

Wafula (2021) evaluated the maritime protected areas (MPAs) in Kenya and the ecological monitoring programs of the Kenya Wildlife Service (KWS). This research scrutinized and evaluated the monitoring framework in depth, drawing on contributions from renowned research institutions, universities, and the local populace. Important data were gathered through semi-structured surveys during the participation of key stakeholders. The findings revealed a very high level of contentment with the existing monitoring system. However, the areas of finance, stakeholder participation, human resources, policies, and data sharing were identified for improvement through recommendations.

Conceptual Framework

The relationship involving the two types of variables in the study is outlined in the framework. In this research, the independent variable is monitoring mechanisms, while the sustainability of Kenya's blue economy is the dependent variable. Figure 1 illustrates the study's conceptual framework.

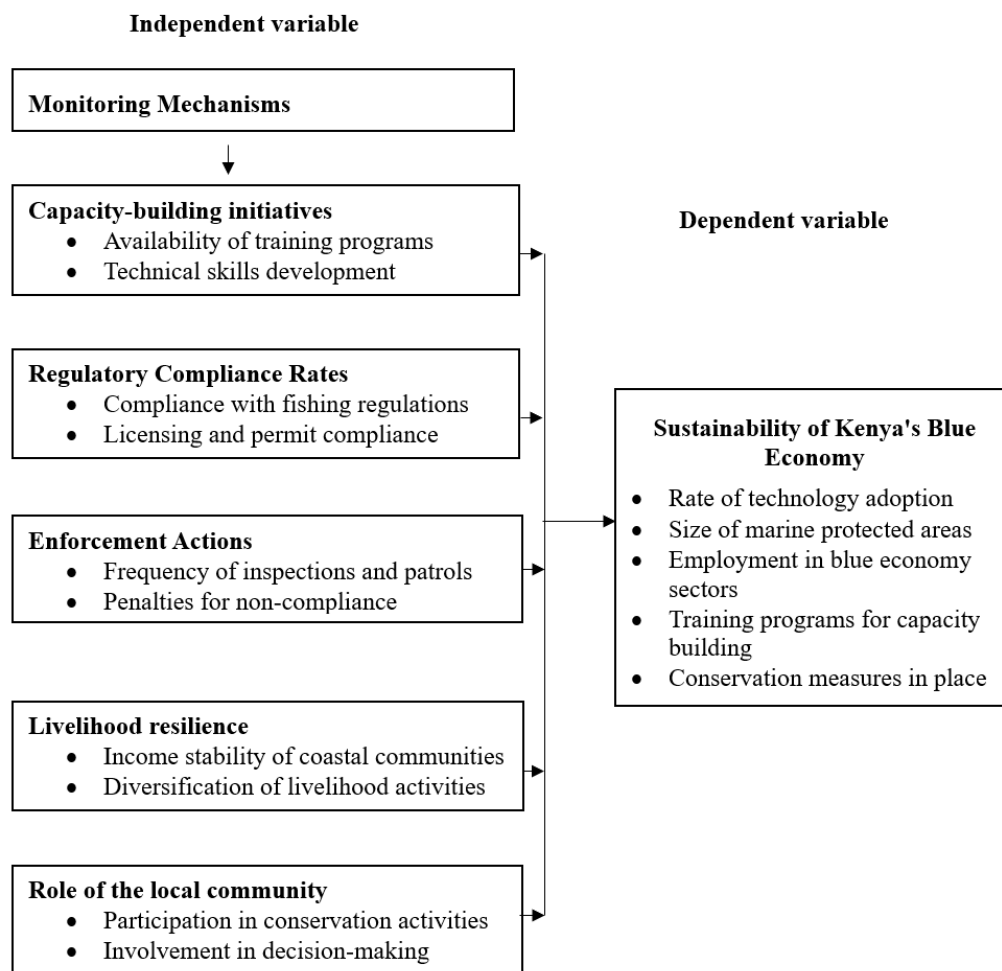


Figure 1: Conceptual Framework

METHODOLOGY

The study adopted a pragmatic research philosophy and employed a convergent parallel mixed-methods design, enabling the simultaneous collection and analysis of quantitative and qualitative data to enhance validity and depth of understanding. The research was conducted in Mombasa and Lamu Counties, targeting 1,881 stakeholders across government agencies, local communities, NGOs, and private-sector actors, from whom a sample of 330 respondents was drawn using purposive and simple random sampling.

Data were collected using semi-structured questionnaires and interview guides, with a pilot study to assess validity and reliability (Cronbach's $\alpha \geq 0.7$). Quantitative data were analyzed using SPSS (version 26) through descriptive statistics, correlation, and regression analysis, while qualitative data were examined using thematic analysis. Diagnostic tests such as VIF, Breusch–Pagan, and Durbin–Watson were conducted to ensure model

robustness. Ethical standards were upheld through informed consent, confidentiality, and research authorization from relevant bodies.

RESULTS AND DISCUSSION

Descriptive statistics for Sustainability of Kenya's blue economy

The study aims to understand how respondents perceived the sustainability of Kenya's blue economy. It focused on the link between economic growth and marine conservation. Participants shared their opinions on whether the financial benefits from marine resources outweighed conservation needs, whether there were sufficient resources to support conservation efforts, and how tourism contributed to coastal livelihoods.

Respondents also shared their perceptions of environmental issues, such as plastic waste and the lack of community involvement in cleanup activities. They highlighted governance issues, including the need for strong laws to reduce pollution and the impact of community participation on compliance with maritime rules. These questions offered valuable insights into how stakeholders viewed the trade-offs, challenges, and opportunities in managing marine resources sustainably in Mombasa and Lamu counties.

Table 1: Descriptive Statistics on Sustainability of Kenya's Blue Economy

Statement	N	Maximum	Mean(M)	Std. Dev
Making money from the marine resources is seen as more important than protecting them.	307	5	3.77	1.326
I believe Kenya can grow its blue economy by balancing the need to make money with conservation.	307	5	3.96	1.050
Sometimes, financial resources to support the conservation of marine resources are not enough.	307	5	3.93	1.165
I feel the blue economy should focus on bringing more tourism money to coastal areas.	307	5	3.99	1.130
I feel that plastic waste is still a big problem along our coast	307	5	4.08	1.096

Few people in my community take part in activities like beach cleanups to protect the ocean	307	5	3.90	1.196
I believe having strict laws and regulations can prevent pollution in our coastal areas.	307	5	4.17	1.054
Sometimes, failure to involve local communities in decision-making reduces compliance with maritime laws.	307	5	4.10	1.083
Valid N (listwise)	307			

The data presented in Table 1 ($M = 3.77$, $SD = 1.326$) confirm the view that economic benefits are the main goal, while environmental protection is the least prioritized area. A participant in the study stated that, “*Profit will always be the top concern for most users of the ocean, which results in practices that are harmful to the environment, for example, overfishing and pollution*” (R002). The dispute between conservation and people's livelihoods is the key problem in managing marine resources. The ‘tragedy of the commons’ theory by Hardin (1968), to some extent, explains the situation. If people continue to think about ‘me, myself, and I’ regarding the resource, i.e., if they think it is their right to take out as much as they can use, the fisheries soon get depleted. The respondents pointed out that overfishing, destruction of the marine ecosystem caused by the use of harmful gear, and a lack of strict regulations are factors that contribute to the depletion of fisheries. Nonetheless, contrary to Hardin’s original proposition that resource collapse is inevitable, the data indicate that alternative practices are often a direct consequence of poverty, unemployment, and limited access to technology. In these situations, overexploitation is no longer the result of neglect but rather a survival strategy. This perception, in fact, challenges the notion that local people will always be opponents of conservation. Rather, it demonstrates how economic challenges limit ecological options. Kohler and Brondízio (2017) warn that conservation efforts that do not address these challenges will face backlash from local people. Jamil et al. (2024) and Roberts (2021) maintain that the formulation of policies for the blue economy must interweave economic, ecological, and social goals. Likewise, Du (2024) proposes that if fishing practices are selective and ethical, they will not only satisfy present needs but also support long-term sustainability, provided they are affordable and accessible to underprivileged communities.

Positively, the findings ($M = 3.96$, $SD = 1.050$) indicate that the majority of respondents consider economic growth and environmental protection to be mutually supportive. One of the respondents stated, *“Some, like in Kiunga, conduct shift fishing. This allows fish to reproduce, seagrass to grow back, and coral reefs to recover.”* (R002). Traditional techniques such as rotational fishing, seasonal closures, and breeding zone preservation reveal local conservation systems that support Ostrom's view of commons management. These are situations where communities can develop management methods that are sustainable without external influence. However, the formal government often neglects these systems, favoring external models at the expense of local knowledge. Ali and Sulistiyono (2025) point out that well-managed marine resources can be a great source of national welfare. Meanwhile, Bennett et al. (2019) argue that ecological targets should be set with fairness and equity in mind. Marine spatial planning tools (Renaldo et al., 2024) are positioned to offer a solution to the coexistence of conflicting needs, but their credibility hinges on incorporating community views rather than ignoring them.

Insufficient funding and limited technical resources ($M = 3.93$, $SD = 1.165$) are another key barrier. The lack of modern fishing gear, storage facilities, and safety equipment makes it hard to increase output while also denying access to sustainable practices. This lack of funding is a major problem that negatively affects the entire ecosystem. Communities sometimes have no choice but to resort to unsustainable practices because the alternatives are too expensive. Moreover, conservation projects that rely on unstable government funding or external donations often lead local communities to depend on donors rather than build their resilience. The case studies from Ghana and the Philippines show that governance failures and unstable funding critically undermine fisheries management (Okyere et al., 2023). Parker et al. (2024) and Bohorquez et al. (2023) are other researchers who have concluded that problems with localities' capacity to manage their resources negatively affect marine protected areas (MPAs), even when they are supported by the community. These trends indicate that the conservation challenges are equally political, economic, and ecological. The ongoing underfunding of coastal management clearly indicates the low priority given to fishing communities in the overall development agenda. Unless there are resource reallocations and institutional supports, conservation might intensify inequalities rather than eliminate them.

Tourism ($M = 3.99$, $SD = 1.130$) is identified as a primary component of the blue economy, offering money, jobs, and involvement in conservation activities in return, but the findings also indicate that these advantages are not equally distributed, and the local inhabitants are the ones without a say in the decision-making process and are relegated to low-paid, seasonal jobs. Such a situation acts as a barrier to the possibility of tourism being a sustainable development plan, as it reinforces social and economic inequalities. Evans et al. (2023) underscore the importance of giving coastal communities a role in governance structures, while case studies from Indonesia and Yogyakarta (Irhamni & Astuti, 2024; Airawati et al., 2023) reveal that tourism can fulfill both ecological and social objectives when communities are true partners. On the other hand, exclusionary practices may convert tourism into an avenue for the elite and outsiders to seize resources. Rasowo et al. (2020) support implementing strategies such as participatory planning, education, and transparent data sharing among stakeholders as the most effective means of tackling these challenges. These revelations make it clear that tourism can only be a partner in sustainability if the division of benefits, responsibilities, and decision-making power is fair.

Plastic pollution has emerged as one of the most pressing problems ($M = 4.08$, $SD = 1.096$). Respondents pointed to the negative effects on ecosystems, human health, and local economies. It comes from various sources, including household waste, tourism, fishing, and boating, but the persistence of the issue indicates governance failures rather than individual carelessness. Poor waste collection systems, ineffective enforcement, and a lack of public education increase pollution levels and force communities to improper disposal as their only option. Studies comparing Ghana, Peru, and even developed countries like the UK (Mensah, 2021; Guidino et al., 2023; Olatunji et al., 2022) have shown that inadequate infrastructure and weak enforcement are problems everywhere, not just in certain places. Awareness has been raised through similar initiatives such as the plastic dhow and community clean-ups, but respondents still saw them as scattered and insufficient. In the absence of system-wide changes in waste management and law enforcement, these efforts are but minor compared to the size of the problem. Plastic pollution control still needs to be prioritized at the governance, infrastructure, and accountability levels, rather than relying on isolated volunteer efforts.

Participation in conservation activities, such as cleanups, was rated rather low ($M = 3.90$, $SD = 1.196$). This limited participation should be interpreted as a consequence of structural exclusion, rather than an expression of apathy. When conservation activities are managed

by hotels, NGOs, or other external organizations and the community is not consulted, neighborhood groups tend to perceive caring for the environment as the outsiders' duty. Peer et al. (2022) and Morris et al. (2024) observe that top-down approaches reduce community trust and long-term compliance. Ward et al. (2018) and Osore et al. (2022) argue that logistical difficulties and power imbalances result in the marginalization of less fortunate groups. This exclusion not only undermines the legitimacy of conservation but also negatively influences its effectiveness and sustainability. Such findings are an argument in favor of grassroots approaches that prioritize community engagement in the design, implementation, and monitoring of such initiatives, ensuring that conservation efforts are in sync with local needs and capacities.

The support for stricter environmental laws and regulations was very strong ($M = 4.17$, $SD = 1.054$). People are acknowledging the importance of these laws. The interviewees were demanding very strict regulations and strict enforcement, but at the same time, they were talking about punishment to deter. On the surface, the argument appears to be simple: more laws, more sustainability. But the interviews indicate a very complicated situation. Participants said that weak and inconsistent enforcement, not the lack of laws, was the real problem. The issue is made more difficult by political interference at times. One of the respondents said, *"foreign trawlers continue to overfish because of the enforcement interferences"* (R011). Another pointed out, *"the observers are mostly compromised because they depend on the very people they are monitoring"* (R005). There is a contradiction: communities demand stricter laws, yet realize that if there is corruption, selective enforcement, and a lack of political will, laws cannot help. Community perspectives add another dimension. Some people support imposing harsher penalties, while others claim that punishments that disregard community participation will only alienate locals and reduce compliance. The question is not whether laws are necessary, but whether Kenya's governance system is strong enough to make regulations effective. Stricter laws can only prove to be symbolic rather than transformative if the issues of corruption, a weak monitoring system, and a lack of genuine community involvement are not tackled. Kerubo et al. (2021) argue that localized measures increase compliance. Raha et al. (2021) emphasize the role of public engagement in developing effective frameworks. Similarly, Sarwar et al. (2021) and Willis et al. (2022) show that regulatory systems succeed only when institutions earn trust and demonstrate resilience. In weak governance situations, tough laws become gestures rather than tools for meaningful change.

The exclusion of communities from decision-making processes is considered a major reason for noncompliance with maritime laws, as noted by the respondents ($M = 4.10$, $SD = 1.083$). A number of people expressed dissatisfaction with governance structures that do not take into account local opinions. They pointed out that the Beach Management Units (BMUs) do not work as they should. Yes, policymakers say the participatory structures are in place, but communities tend to see them as either merely symbolic or controlled by special interests. Trust and compliance are dwindling due to this perception. The interviews provided insight into several obstacles. One participant said, *“BMUs are supposed to give ownership, but they are not consistent in their response. The lack of training is intentional to prevent locals from getting knowledge”* (R002). Another participant noted, *“There is very little participation in stakeholder discussions; young people and women are not invited”* (R012). Such statements imply that participation daily favors the elites or the politically connected, while many local people remain shut out of the decision-making process. The irony is clear. Norms intended to be benevolent are applied intrusively and become a source of conflict when the community lacks real ownership. Ostrom's (1990) theory of collective action emphasizes that co-designing and trust are the only ways for rules to succeed. Thoya et al. (2022) also caution that ignoring small-scale fishers is tantamount to killing both livelihoods and regulatory compliance. Empirical data from various studies support this view. Francolini et al. (2023), Nugraha (2023), and Buana and Barlian (2023) show that participatory governance strengthens legitimacy and compliance. In the same vein, Clark and Humphreys (2020) pointed out that inclusive decision-making is a prerequisite for sustainable marine management in the long run. Thus, the entire body of evidence suggests that the government of Kenya cannot, however, rely solely on sanctions and strict regulation as means of conducting effective maritime governance. Community participation, by contrast, is a decisive factor in shaping the practice of legal frameworks.

The sustainability of the blue economy in Kenya is not merely a technical issue of conservation practices or regulations; it is a political problem shaped by fairness, trust, and legitimacy. Economic hardship, underfunding, exclusionary governance, and poor enforcement are always prevailing, rendering well-meaning initiatives unsuccessful. Addressing these challenges requires developing solutions that involve the community rather than top-down approaches, that acknowledge community knowledge, that share decision-making power, and that provide the infrastructure support for sustainable practice.

It is only in this manner that marine conservation can promote both ecological health and social justice.

Descriptive statistics for Monitoring Mechanisms and Sustainability of Kenya's Blue Economy

Effective monitoring is essential for ensuring regulatory compliance, promoting accountability, and protecting the long-term sustainability of marine resources. In this study, respondents shared their views on how monitoring mechanisms affect the sustainability of Kenya's blue economy. The study explored several factors, including how often the government inspects fishing areas, whether marine rules are applied fairly, and if there are enough financial resources for enforcement. Respondents also considered the importance of combining traditional knowledge with modern technology, the role of community members in reporting illegal activities, and the limited use of modern monitoring tools such as drones and satellites. The study also examined whether there are sufficient training opportunities for people to participate in marine monitoring.

Table 2: Descriptive Statistics on the Monitoring Mechanisms

Statement	N	Max	Mean(M)	Std. Dev
Sometimes, government officials fail to visit fishing areas to check if rules are being followed.	307	5	3.84	1.229
I feel marine rules are not applied equally to all ocean users.	307	5	3.93	1.232
Money to enforce maritime rules is not enough.	307	5	3.90	1.201
Joining traditional knowledge with modern technology can improve how we manage marine resources.	307	5	4.04	1.108
Some people in my community help monitor any illegal activities in the ocean and report them.	307	5	3.69	1.306

Modern ways, like use of drones or satellites have not been adopted well to monitor marine resources.	307	5	3.98	1.222
I have not received training on how to monitor the marine environment.	307	5	3.76	1.331
Valid N (listwise)	307			

The data presented in Table 2 indicate significant weaknesses in the enforcement of maritime rules. The findings also point to a more profound problem concerning governance and institutions. The great majority of respondents reported that government staff very rarely visit the fishing areas to check whether the regulations are being adhered to ($M=3.84$, $SD=1.229$). Such a point of view emerged in the interviews, when some participants mentioned negligence and corruption in the authority sectors. One of the interviewees stated, *“Bad leadership is the main issue that does not allow for proactiveness and strict enforcement of laws”* (R007). The congruence of different datasets reinforces the idea that enforcement is not merely weak but ultimately flawed. When regulations are in place without periodic scrutiny, communities regard them as such, leading to increased mistrust and non-compliance. The patrols are irregular, especially at remote landing sites. Such irregularity causes a split in enforcement, allowing illegal fishing and unregistered landings to thrive. Not only does this situation weaken accountability, but it also fosters a culture of impunity that questions the authority of governance. Some respondents recounted instances of Coast Guard personnel abusing their power, resulting in a loss of trust and a reluctance to work with the state. Weak and inconsistent enforcement is seen as a structural problem that cuts off state institutions from the realities of coastal communities. These findings relate to Itembu et al. (2023), who found that weak monitoring in Namibia led to illegal practices and harmed conservation efforts. Similarly, Bova et al. (2022) identified comparable issues in South Africa’s recreational fisheries. Rohé et al. (2017) argued that without reliable and trusted enforcement, community-based management becomes merely symbolic and ineffective.

The biased perception of enforcement is a major issue. The respondents' opinions indicated that maritime laws were inconsistently enforced. There were different reasons, especially corruption, political connections, or economic power, behind the non-enforcement of some groups. The average agreement score of 3.93 ($SD = 1.232$) indicates that selective enforcement is a common problem rather than a rare occurrence. The communities reported

that the small-scale fishermen had to endure harsh penalties and frequent monitoring, while the connected persons or the wealthy elite got away with their wrongdoings. One respondent said, *“Some local leaders keep supporting their community members even if they are using illegal fishing gear”* (R010). The irony of enforcing the law on the one hand and providing informal protection to the “friends” on the other points to systemic inequalities: small-scale fishers face regulations, while the connected ones are free to operate. The data imply that the difference in enforcing rules is as damaging to the credibility of marine governance as the absence of enforcement. This scenario generates bitterness, disengagement, and even resistance or sabotage against the conservation efforts. In such conditions, enforcement loses both its effectiveness and legitimacy. The results support Pomeroy et al. (2015) and Rohe et al. (2017), who point out that justice and fairness are necessary for effective compliance. Elliott et al. (2023) also mention that fair and consistent governance is crucial for the sustainable management of resources. The case of Kenya illustrates that enforcement systems perceived as unjust will likely perpetuate inequality and ultimately lead to poor conservation outcomes.

Resource constraints appeared very pronounced and clear. The respondents agreed that the enforcement agencies suffer from a lack of funds, equipment, and skilled personnel ($M=3.90$, $SD=1.201$). Moreover, practical obstacles such as fuel shortages, insufficient patrol boats, and inadequate training adversely affected monitoring along the entire length of Kenya's coastline. The findings clearly indicated that although community monitoring initiatives were carried out with considerable resourcefulness, they still encountered mounting logistical issues. The argument is that the locals are not mere and passive recipients of governance; they are already active agents who are taking charge. Still, their efforts remain scattered and unsupported. This scenario brings out the importance of institutional frameworks that can formalize community monitoring and even reward it, instead of leaving it to chance. The challenges experienced are in line with the findings from Ditria et al. (2022), who associated underfunding with poor data collection and, consequently, policy failures, and Failler et al. (2020), who pinpointed resource shortages as a principal reason for the failure of marine protected areas in West Africa. Smit et al. (2022) similarly highlighted weak institutional capacity in developing nations as a factor limiting the implementation of coastal monitoring mechanisms. In Kenya, these weaknesses imply that monitoring will remain fragmented unless continuous investment is made.

Despite these challenges, the combination of traditional ecological knowledge (TEK) with formal monitoring systems proved promising for improving enforcement. The respondents were strongly supportive of this approach ($M = 4.04$, $SD = 1.108$). Fishermen have been recognized as the best sources of information on ecosystem changes, illegal activities, and even fish migration patterns. To support the participants' consensus, one participant stated, *"They already know how to keep the ocean safe. If empowered, they can change the unsustainable ways of doing things"* (R009). The correspondence of the data sets enhances the argument that hybrid governance, which is based on traditional ecological knowledge and modern tools, is a way to connect legitimacy with effectiveness. The Kiunga community-managed Marine Protected Area, supported by WWF, is an example of co-management that brings together the native people's knowledge and technical skills. The researchers, such as Mulalap et al. (2020) and Stenekes et al. (2020), highlighted the potential of TEK to provide specific insights and early warnings about ecological stress. Nonetheless, the use of TEK comes with risks. Kuhn and Duerden (2021) and Jakes (2024) warned that these processes must be culturally sensitive and that participation must be fair; otherwise, they may push indigenous people's voices to the margins.

Community-driven monitoring initiatives add another dimension to governance. The respondents did not doubt the importance of stakeholders at the very bottom, such as those working in fisheries, hotels, and tour operations, as well as BMU members, in reporting illegal practices and enforcing compliance. Those activities, with a mean score of 3.69 ($SD = 1.306$), are regarded as not only legitimate but also effective, particularly in regions without government support. The research results revealed that some locals were already reporting illegal activities and highlighted the need for shared responsibility. *"People should be united at work for the common good"* (R003) was one participant's statement, while another explained, *"There should be enough personnel from the community to support monitoring well"* (R006). These results entail that there is public involvement, but it is informal and unacknowledged. It is said that if this existing commitment is to be built upon through organized, incentivized monitoring programs, the local vigilance could become the institutional strength. Earlier studies have emphasized their significance, with Danielsen et al. (2014, 2021) and Oviedo & Bursztyn (2017) demonstrating that community-based monitoring is cost-effective in resource-limited settings. Alfandri et al. (2024) argued that genuine community engagement is indispensable to the realization of blue economy strategies. However, these initiatives also struggle due to a lack of funding,

technical assistance, and institutional support. Without formal institutional frameworks, the contributions of these initiatives will go unnoticed or will be unsustainable.

The capacity of technology is tremendous but still largely unexploited. The majority of the respondents believed that the aforementioned tools, drones, satellite tracking, and Vessel Monitoring Systems (VMS), were seldom used in the management of marine resources in Kenya ($M=3.98$, $SD=1.222$). The pilot projects are in place, but their activities are scattered and disorganized, and they lack proper management. The qualitative feedback expressed a call for investment in implementing a centralized monitoring system, data sharing, and more frequent training for local officials. Studies done in other parts of the world highlight the potential of new technological applications; for example, Abouldahab (2022) examined the efficiency of VMS in cutting down illegal fishing, Adnan and Hasana (2023) talked about the use of big data in facilitating fisheries management, and Estes et al. (2022) encouraged the use of remote sensing tools more widely. However, as Manyilizu (2023) points out, Kenya and the rest of the Western Indian Ocean region are distant from the adoption of such technologies, thereby illuminating the broader problem of the disconnect between science and policy.

The inadequate training in maritime monitoring has much the same problem with enforcement, as operators are not trained to the level required by the situation. The survey respondents reported limited knowledge of marine laws, coastal habitats, and monitoring tools ($M=3.76$, $SD=1.331$). The majority of the community cited the lack of training schemes as a key reason for weak community participation and institutional performance. The same was indicated by Mamun and Natcher (2023) and Almeida et al. (2025), who found that insufficient training was the primary reason this type of monitoring did not work in the first place. Ekau et al. (2025) and Kelly (2022) support regional training platforms and capacity-building programs to make institutions more resilient. Such programs in Kenya could help address the lack of knowledge and align community engagement with state enforcement goals, which in turn would lead to more inclusive and effective governance.

The results indicate that Kenya's monitoring mechanism has faced critical shortcomings. This includes inconsistent enforcement of laws, applying rules only to specific cases, insufficient funds, and poor use of existing ecological knowledge and technology. Therefore, these problems make compliance more difficult and, at the same time, put resource sustainability at risk. Institutional Theory emphasizes the role of legitimacy, trust,

and well-organized governance. On the other hand, CPR Theory emphasizes the importance of participatory, adaptable, and inclusive monitoring to prevent resource depletion. It is time to change the punitive enforcement approach that has dominated the compliance struggle. The implementation of collaborative systems that integrate government oversight, community participation, traditional knowledge, technological tools, and training will be the way forward. These transformations will be instrumental in establishing trustworthy, efficient, and long-lasting monitoring in the Kenyan blue economy.

Correlation between Monitoring Mechanisms and Sustainability of Kenya's Blue Economy

The study conducted a correlation analysis to assess the association between monitoring mechanisms and the sustainability of Kenya's blue economy. The findings are presented in Table 3.

Table 3: Correlation Between Monitoring Mechanisms and Sustainability of Kenya's Blue Economy

		Sustainability of Monitoring Kenya's Blue Economy Mechanisms	
Sustainability of Kenya's Blue Economy	Pearson Correlation	1	.821**
	Sig. (2-tailed)		.000
	N	307	307
Monitoring Mechanisms	Pearson Correlation	.821**	1
	Sig. (2-tailed)	.000	
	N	307	307

****.** Correlation is significant at the 0.01 level (2-tailed).

The connection between the monitoring mechanisms and the sustainability of Kenya's blue economy is demonstrated in Table 3. A strong positive and statistically significant relationship was found by the analysis ($r=0.821$, $p<0.01$), which means that the implementation of an effective monitoring mechanism is highly related to improved sustainability results. This connection makes it clear that proper monitoring and inspection systems, the deployment of fair rules, and sufficient institutional resources are vital to the continued health of marine ecosystems. Therefore, monitoring becomes the foundation of sustainable marine governance.

The results of the current study corroborate Ostrom's (1990) principles for managing the commons, which highlighted the use of monitoring as a means to avoid resource overexploitation. Monitoring resource consumption is a common practice in preservation through sharing that even empirical studies support. For example, one study shows that joint monitoring by the community and NGOs is a factor that helps maintain cooperation and compliance over time (Gjertsen et al., 2016). Moreover, the involvement of users in monitoring and planning for resource conservation has also been found to be effective, as it fosters a willingness to report violations and enhances accountability through social ties (Alexander et al., 2018). The large-scale experimental evidence is even more conclusive, showing that monitoring, whether local or externally initiated, always results in a cutback in resource extraction and an improvement in knowledge and user satisfaction (Slough et al., 2021).

Technological and participatory strategies have been effective in different contexts. Using local environmental knowledge has been a viable solution in no-data areas. For example, fish counting by the local community in Amazonian fisheries led to an increase in the arapaima population from 2,500 to more than 20,000, demonstrating the effectiveness of participatory monitoring (Castello, 2023). The deployment of remote camera systems has been the cheapest way of monitoring the so-called recreational fisheries, which make up 12% of the world's catch and are very often difficult to control (Lancaster et al., 2017). Training 400 fishers in Mexico to conduct more than 12,000 transects not only provided scientific data but also fostered a sense of stewardship and responsibility among the people using the resources (Fulton et al., 2018). The rigorous enforcement of user rights on the fisheries in the territories led to the creation of the same conservation effect as the no-fishing marine protected zone, and it was found that highly regulated access is the best

policy compared to free access areas in terms of species richness, biomass, and density (Gelcich et al., 2012).

These outcomes carry significant weight for Kenya. Making the monitoring of the Kenya Coast Guard Service, Kenya Fisheries, the Kenya Maritime Authority, and Beach Management Units more efficient is then essential for consistent compliance. Also, equipping them with advanced technologies such as vessel-tracking systems, drones, and satellite surveillance would further enhance their efficiency and transparency. Local communities should also be empowered through participatory monitoring programs, as these not only offer additional monitoring but also create a sense of shared responsibility for the marine environment. While a correlation does not imply causation, the strength of this relationship indicates that monitoring is a major driver of sustainability in Kenya's blue economy, supporting both ecological resilience and effective governance.

Regression Analysis

Table 4 presents the regression results examining the effect of monitoring mechanisms on the sustainability of Kenya's blue economy in Mombasa and Lamu Counties.

Table 4: Coefficients^a

Model		Unstandardized		Standardized	t	Sig.
		Coefficients		Coefficients		
		B	Std. Error	Beta		
1	(Constant)	3.822	.906		4.218	.000
	Monitoring Mechanisms	.170	.065	.163	2.616	.009

a. Dependent Variable: Sustainability of Kenya's Blue Economy

The findings indicate that monitoring mechanisms has a positive and statistically significant influence on sustainability ($\beta = 0.170$, $p = 0.009$), suggesting that improved monitoring mechanisms enhance sustainability of the blue economy sector.

CONCLUSION

The findings demonstrate that monitoring mechanisms have a positive and statistically significant influence on the sustainability of the blue economy in Mombasa and Lamu Counties, underscoring their critical role in promoting responsible resource use and environmental conservation. However, despite this positive contribution, existing

monitoring mechanisms remain largely ineffective due to inadequate funding, weak institutional capacity, and perceptions of corruption and bias, which collectively undermine their credibility and effectiveness. These limitations not only compromise enforcement of regulations but also place conservation initiatives at considerable risk. While there is notable community support for incorporating indigenous and local knowledge into monitoring processes, the absence of structured institutional support, capacity building, and technical training continues to constrain meaningful collaboration. Therefore, strengthening monitoring frameworks through adequate resourcing, transparency, capacity enhancement, and integration of community-based knowledge systems is essential for improving accountability, fostering trust, and ensuring the long-term sustainability of the blue economy in Kenya's coastal regions.

RECOMMENDATIONS

Integration of Technology with Traditional Knowledge: Modern instruments such as drones, satellite tracking, and digital reporting systems can enhance marine monitoring, but they should be a supporting element rather than a replacement for traditional ecological knowledge. Local fishermen have a profound understanding of their particular habitats, which is often unlike what technology can offer. A national framework should be established to document, validate, and merge this knowledge with marine decision-making. Funding options, such as grants, subsidies, and shared-use facilities, along with technical training, are essential for communities to become proficient with modern tools. This combination of approaches leads to improved monitoring systems and, at the same time, builds trust and legitimacy in the process.

Clear and Coordinated Institutional Roles: Governance is weakened and made inefficient by fragmentation and overlapping responsibilities. Policy and legal modifications should clarify the roles and authorities of each within government agencies, Beach Management Units, NGOs, and the private sector. The establishment of coordination platforms for joint planning, open collaboration, and sharing resources will effectively reduce duplication and increase efficiency. Monitoring systems with annual reviews, measurable indicators, and independent evaluations must be created. Moreover, formal conflict management systems, such as arbitration committees and escalation pathways, must be established to ensure the swift resolution of disputes.

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