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Marine Cadastre for Sarawak: Legal Analysis for Sustainable Ocean Governance

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Abstract— Sarawak's extensive marine resources hold substantial blue economic potential, yet their governance remains constrained by fragmented legal authority and the absence of enforceable mechanisms for recognizing and securing marine rights. Marine cadastre relates to the allocation of tenure rights in marine and inland water areas, its implementation at the state level remains largely unexplored. This paper provides a critical legal review assessing Sarawak's readiness to adopt this national framework. Doctrinal analysis of state and federal statutes reveals a paradox: Sarawak possesses unique institutional advantages via its integrated Land and Survey Department, Sarawak (DLSS), yet fundamental legal gaps hinder marine cadastre implementation. The Sarawak Land Code lacks provisions for marine parcel definition, creating jurisdictional ambiguities that obstruct sustainable ocean governance. The paper contends that legislative reform is imperative not merely to enhance administrative efficiency but also for aligning Sarawak's marine governance with the UN Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water). This study proposes targeted statutory amendments and pragmatic implementation pathways, offering a strategic blueprint to position Sarawak as a leading model for decentralized and sustainable marine governance in Malaysia.

Keywords— Legal Reform, Marine Cadastre, Marine Governance, Policy Framework, Sarawak, SDG 14

I. INTRODUCTION

The governance of marine spaces has emerged as a critical global priority, driven by increasing competition for marine resources and the urgent need for a sustainable blue economy [5], [18]. This challenge spans from national jurisdictions to areas beyond national jurisdiction, underscoring a universal need for structured spatial management to conserve marine biodiversity [21]. For coastal states and regions, establishing clear marine tenure systems is fundamental to achieving both economic development and environmental conservation objectives. Sarawak, with over 1,000 kilometers of coastline and rich marine ecosystems, stands at a crucial juncture in developing an integrated marine governance system that can balance development pressures with sustainability imperatives. However, existing spatial management remains fragmented, with unclear jurisdictional authority over marine spaces, particularly where land, sea, and inland water regimes converge [19].

The implementation of marine cadastre systems has gained international recognition as a foundational tool for effective marine spatial planning (MSP) and ecosystem-based management [7]. These systems operate within an international legal framework established by instruments like UNCLOS, which empowers coastal states to manage activities within their maritime zones [11]. In the Malaysian context, [2] have proposed a comprehensive national legal framework for marine cadastre, delineating authority between federal and state governments and highlighting the necessary amendments to land administration statutes. The need for such context-specific adaptation is highlighted by comparative studies, such as that of [3], which demonstrates how marine cadastre definitions and models must be tailored to a state's unique archipelagic or coastal characteristics.

However, the viability of this national framework depends significantly on its adaptation to the distinct socio-legal and institutional contexts of individual states. This paper positions Sarawak as a critical case study within this national and international discourse, examining how the state's specific legal instruments and its unique consolidated land administration authority, the DLSS, interact with the broader models. Furthermore, this study incorporates empirical data from stakeholder surveys to validate legal findings and identify practical implementation barriers, providing a comprehensive assessment that bridges theoretical frameworks and on-the-ground realities.

This paper aims to critically analyze Sarawak's current legislative framework for marine cadastre implementation, contextualized within Malaysia's national framework and supplemented by stakeholder perspectives. Through systematic analysis of state and federal statutes combined with stakeholder data, the study provides evidence-based recommendations to align Sarawak's governance framework with both national priorities and global sustainability commitments.

II. LITERATURE REVIEW: MARINE CADASTRE AND SUSTAINABLE GOVERNANCE

The effective governance of marine spaces is a growing global challenge, necessitating systems that can manage competing uses while ensuring long-term sustainability. This literature review establishes the theoretical foundation of marine cadastre as a critical governance tool, examines the specific framework proposed for Malaysia, and explores its vital connection to the United Nations Sustainable Development Goals (SDGs), thereby framing the research gap this paper addresses.

A. Theoretical Foundations of Marine Cadastre

The marine cadastre has evolved from a terrestrial extension into a sophisticated system for administering rights, restrictions, and responsibilities (RRRs) in marine spaces [13]. A fundamental distinction from land-based systems is the need to account for the dynamic and three-dimensional nature of marine spaces, which requires the separate delineation of rights in the water column, seabed, and subsoil [6]. As a cornerstone of Marine Spatial Planning (MSP), a marine cadastre provides the legal and technical infrastructure for implementing ecosystem-based management, a process crucial for minimizing user-conflicts and ensuring sustainable use [7]. The success of MSP and the cadastres that support them are underpinned by international law, particularly UNCLOS, which provides the jurisdictional foundation for coastal states to manage their maritime zones [11]. Reference [3] evaluated definitions from Australia, Canada, and the United States from Indonesia's perspective as an archipelagic state, highlighting that while technical standards from advanced systems provide a baseline, they must be adapted to local jurisdictional and geographical contexts. Studies of systems in countries like Australia and the Netherlands further demonstrate the critical importance of institutional coordination and robust legal frameworks, while also revealing common challenges such as jurisdictional complexities and technical limitations in boundary demarcation [16].

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B. *The Malaysian Framework*

In the Malaysian context, the work of [17] provides the foundational proposal for a national marine cadastre legal framework. Their research outlines a clear division of power, aligning with the Territorial Sea Act 2012, where State Authorities administer marine areas within three nautical miles and the Federal Government manages areas from 3 to 12 nautical miles. Sarawak's governance extends to 12 nautical miles under federal law, yet the state preserves their right to implement the Sarawak Land Code concurrently. Their framework also identifies the need to amend the National Land Code (NLC) 1965 for marine tenure, a challenge mirrored in Sarawak's Land Code. Their framework emphasizes a holistic approach, addressing technical, legal, and socio-economic dimensions, which provides an essential national benchmark against which Sarawak's specific readiness can be assessed.

C. *Marine Cadastre and Sustainable Development Goals*

A marine cadastre is increasingly seen not just as a technical tool, but as a critical enabler for sustainable development [5]. The United Nations' Sustainable Development Goal 14 (SDG 14): "Life Below Water" calls for the sustainable management and protection of marine and coastal ecosystems [17]. The principles of SDG 14, including the conservation of marine areas, apply not only within national jurisdictions but also inform the global conversation on protecting biodiversity in areas beyond national jurisdiction [21]. A marine cadastre provides the spatial and legal data infrastructure necessary to make specific SDG 14 targets such as regulating harvesting (14.4), conserving coastal areas (14.5), and providing access for small-scale fishers (14.b) enforceable and measurable.

By clearly delineating rights and responsibilities, a cadastre enables better monitoring, enforcement, and adaptive management [9]. Crucially, when designed with equity in mind, it can formally recognize and protect customary marine tenure, thereby safeguarding traditional fishing grounds, empowering local communities, and supporting both conservation and social equity objectives [5]. This positions the marine cadastre not just as an administrative system, but as a pivotal tool for operationalizing the integrated social, economic, and environmental aims of sustainable ocean governance.

III. METHODOLOGY

This study employs a mixed-methods approach, combining doctrinal legal analysis with an empirical stakeholder survey to assess Sarawak's readiness for a marine cadastre.

A. *Doctrinal Legal Analysis*

Doctrinal analysis was applied to primary legal sources. The process involved: (1) locating authoritative instruments, (2) interpreting provisions, (3) identifying contradictions, and (4) assessing consistency with international frameworks [8].

B. *Scope of Legal Texts Reviewed*

The legislative and regulatory documents reviewed include:

1) *Sarawak Land Code (Cap. 81, 1958)*
2) *Interpretation Ordinance 2005*
3) *Buildings Ordinance 1994 (Cap. 8)*
4) *Sarawak River Ordinance 1993*
5) *Malaysia Agreement 1963 (MA63)*
6) *Federal Constitution of Malaysia*
7) *Exclusive Economic Zone Act 1984*
8) *Continental Shelf Act 1966*
9) *Baselines of Maritime Zones Act 2006*
10) *United Nations Convention on the Law of the Sea (UNCLOS)*

C. *Analytical Dimensions*

The analysis focused on four dimensions:

1) *Marine Parcel Recognition: Legal provisions for defining marine spaces.*
2) *Jurisdictional Clarity: Delineation of state against federal authority.*
3) *Institutional Coordination: Mandates for agencies like DLSS, Department of Fisheries (DOF), and Natural Resources and Environment Board (NREB).*
4) *Comparative Benchmarking: Lessons from other jurisdictions like Australia and Indonesia [3], [6].*

D. *Mixed-Methods Approach: Integrating Doctrinal and Empirical Analysis*

A mixed-methods approach combined doctrinal analysis with an empirical stakeholder survey. The empirical component consisted of a structured questionnaire administered to 46 stakeholders in Sarawak between October 2024 and January 2025. The full list of survey questions is available in Appendix. The purposive sample included government agencies (n=18, 39.1%), private sector professionals (n=26, 56.5%), and other sectors (n=2, 4.4%). The questionnaire contained 22 items across five domains: conceptual understanding, perceived challenges, current implementation status, institutional readiness, and recommendations. Descriptive statistical analysis was performed to identify key patterns and validate legal findings.

IV. REVIEW OF LEGAL INSTRUMENTS RELEVANT TO MARINE CADASTRE IMPLEMENTATION

The implementation of a marine cadastre in Sarawak is hindered by a fragmented and inconsistent legal framework. While the state possesses institutional strengths, critical gaps in its laws prevent the formal recognition, registration, and management of marine spaces. This section examines key legal instruments to assess Sarawak's readiness

A. *The Sarawak Land Code (Cap. 81)*

The Sarawak Land Code (Cap. 81) serves as the cornerstone for land administration in the state by providing procedures for land alienation, title registration, and tenure security. While Part X of the Sarawak Land Code (Cap. 81) grants the State Planning Authority (SPA) the mandate to manage spatial planning and physical development, its practical application remains predominantly terrestrial. Unlike the adaptation proposed by [2] for the National Land Code, the code lacks explicit references to marine parcels or tidal zones, which creates a gap in the formal registration of rights in marine environments. However, because the code defines land to include the seabed and submerged areas, it provides a viable foundation for marine spatial planning. By introducing targeted amendments to the Sarawak Land Code, specifically within Part X, the state could officially expand its scope to regulate marine activities such as aquaculture and offshore renewable energy. These updates would establish the legal framework necessary for a modern marine cadastre system.

B. *Interpretation Ordinance 2005*

The Interpretation Ordinance 2005 serves as the definitive guide for statutory terms used across all Sarawak legislation. This ordinance is critical because the legal definitions of terms such as land, boundary, and territory dictate the state's ability to assert jurisdiction over marine environments. Currently, these terms lack marine-oriented definitions, which complicates the seamless extension of terrestrial laws to the

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seabed. To resolve this, the ordinance must be amended to include precise definitions for the water column, subsoil, and maritime boundaries. Clarifying these interpretations is a necessary step to integrate marine cadastre principles into Sarawak's legal corpus and provide the linguistic certainty required for rights registration.

C. Buildings Ordinance 1994 (Cap. 8)

The Buildings Ordinance, 1994, serves as the primary regulatory instrument for managing the physical dimensions of marine infrastructure by linking high-level land policy with practical structural oversight. This legislation is fundamental because Section 2 legally classifies marine assets, including jetties, piers, and subsea pipelines, as buildings. This classification mandates state supervision and strict adherence to structural safety standards for all offshore developments. Within a marine cadastre, the ordinance acts as a critical data source and enforcement tool. It requires the submission of precise site plans under Section 3 to define the geographical coordinates for 3D digital records and utilizes official completion permits to validate the active status of marine projects. Furthermore, Section 10 empowers authorities to identify and remove unauthorized offshore structures, ensuring the registry remains a definitive record of all physical assets in Sarawak's waters. To modernize this framework for marine governance, the ordinance must be updated to explicitly incorporate advanced offshore installations, mandate 3D digital modelling for submerged structures, and replace terrestrial limitations such as road access with defined navigation corridors. These updates will transform this land-based instrument into a robust legal mechanism capable of governing the complex spatial layers of the marine environment.

D. Sarawak River Ordinance 1993

The Sarawak Rivers Ordinance 1993, governs inland waterways, focusing on river navigation, environmental protection, and riverbank development. While this legislation provides a solid governance structure for rivers, its applicability to estuarine and foreshore areas requires clarification. Given the expansive network of river deltas in Sarawak that transition into coastal zones, the ordinance must be revised to include regulatory mechanisms for these overlapping areas. For a marine cadastre, this ordinance is essential for managing near-shore parcels and ensuring that the transition between riverine and marine jurisdictions is spatially defined. Updates should focus on extending the authority of the Sarawak Rivers Board to assist in the delineation of maritime tenure within deltaic environments.

E. Malaysia Agreement 1963 (MA63)

The Malaysia Agreement 1963 is the fundamental constitutional document that grants Sarawak specialized autonomy over land, immigration, and fiscal matters. It provides the legal basis for the state's distinct jurisdiction over its territory and resources, distinguishing it from the governance model used in Peninsular Malaysia. Although MA63 confirms Sarawak's authority over land-based governance, its specific application to the continental shelf and maritime spaces is a point of legal significance. A precise interpretation of MA63, in alignment with historical boundaries and international law, supports the state's claim to manage resources up to the continental shelf. A collaborative state-federal legal review is required to formalize these boundaries within the marine cadastre to prevent jurisdictional overlaps.

F. Federal Constitution of Malaysia

The Federal Constitution of Malaysia establishes the division of legislative powers between the federal and state governments. Under the Ninth Schedule, land matters are vested in the State List, whereas maritime zones, navigation, and fisheries are categorized under the Federal List. This division creates a significant governance gap in coastal zones where land-based and marine activities intersect. For a marine cadastre to function at the state level, the framework must navigate this constitutional split. Coordination with federal counterparts is necessary to ensure that state-led reforms in marine tenure registration do not conflict with federal jurisdiction over national maritime security and fisheries.

G. Exclusive Economic Zone (EEZ) Act 1984

The Exclusive Economic Zone Act 1984 establishes Malaysia's sovereign rights over the EEZ for the purposes of resource extraction, fishing, and scientific research. While this Act is a primary instrument for national maritime management, it centralizes control at the federal level and lacks provisions for state-led spatial governance. In a marine cadastre context, this Act represents the outer limit of national jurisdiction. The state framework must be designed to complement the EEZ Act by focusing on the registration of specific commercial rights, such as aquaculture or carbon storage, that may fall within the broader federal maritime zones.

H. Continental Shelf Act 1966

The Continental Shelf Act 1966 grants the federal government exclusive rights to explore and exploit the seabed and subsoil within the continental shelf. This legislation is a major factor in the management of offshore oil and gas resources. However, the Act does not provide legal mechanisms for the administrative parcelling or registration of marine spaces at the state level. To support a marine cadastre, there is a clear need for a negotiated framework between state and federal authorities. This would allow Sarawak to exercise its administrative rights over the seabed while remaining consistent with the federal government's role in managing national energy resources.

I. Baselines of Maritime Zones Act 2006

The Baselines of Maritime Zones Act 2006 defines the geographical baselines from which the territorial sea, contiguous zone, and EEZ are measured. This Act is foundational for setting the spatial limits within which a marine cadastre can operate. It provides the technical references needed to define the foreshore and nearshore zones under state administration. For the cadastre to be accurate, it must adopt the precise coordinates and baseline methodology established under this Act. This ensures that the state's marine parcels are spatially aligned with national and international maritime boundary standards.

J. United Nations Convention on the Law of the Sea (UNCLOS)

The United Nations Convention on the Law of the Sea serves as the primary international legal authority for maritime rights and responsibilities. It establishes the global rules for defining maritime zones and confirms the sovereign rights of coastal states over their territorial seas. While UNCLOS does not provide the specific technical steps for building a cadastre, its principles for maritime spatial planning and sustainable resource use are fundamental to any modern system. Sarawak must align its marine cadastre policies and boundary protocols with UNCLOS to ensure that the state's framework is legally recognized and valid on an international level.

V. FINDING AND DISCUSSION

This section synthesizes the doctrinal legal analysis with institutional and governance realities in Sarawak to assess the readiness for marine cadastre implementation. The review of legal instruments reveals key strengths in state autonomy and administrative structure, but also exposes legislative gaps, jurisdictional ambiguities, and operational constraints that may hinder implementation without strategic reform.

A. Legal Gaps in Marine Parcel Recognition and Tenure Registration

The absence of formal recognition for marine parcels in the Sarawak Land Code represents a fundamental legal gap, confirming the national-level diagnosis by [2]. Currently, the Sarawak Land Code is highly effective in managing terrestrial tenure but lacks provisions for registering submerged lands, tidal zones, or seabed areas. This legal gap prevents Sarawak from formally issuing titles or leases for marine areas, thus limiting control over nearshore development, aquaculture expansion, and marine infrastructure planning. Without an enabling legal clause, any attempt to assert tenure over marine parcels could face administrative resistance or legal invalidation. These gaps emphasize the necessity of

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legislative amendments to facilitate marine parcel registration under state authority. This finding is strongly validated by stakeholder perceptions, where 72.2% of respondents were uncertain or unaware of any existing marine cadastre framework in Sarawak. Furthermore, legal constraints were identified as the primary challenge by both government (38.9%) and private sector (50%) stakeholders, confirming that the absence of a marine parcel definition is a fundamental operational barrier that directly impedes progress toward SDG Target 14.5 on marine conservation.

B. Institutional Strength: The Role of DLSS in Integrated Marine Governance

Department of Land and Survey Sarawak's pre-existing integration of land administration, survey and mapping, planning, and valuation offers a more efficient pathway to integrated land-sea governance. This creates a governance structure conducive to marine cadastre development, as the institutional expertise and spatial infrastructure are already consolidated within one department. If marine governance responsibilities are expanded within DLSS, Sarawak could achieve seamless integration of land-sea administration, a model consistent with international practices such as those seen in the Netherlands and Australia. However, stakeholder data reveals significant implementation challenges, with 94.4% of government respondents indicating their agencies were "less prepared" or "not prepared" for implementation. This suggests that institutional structure alone is insufficient without enhanced coordination and capacity building, as evidenced by 27.8% of government stakeholders describing inter-agency coordination as "poor."

C. Jurisdictional Overlaps with Federal Authorities

Despite Sarawak's constitutional autonomy under MA63, jurisdiction over maritime zones is still contested due to overlapping mandates between state and federal authorities. While the EEZ Act 1984 and Continental Shelf Act 1966 grant federal control over offshore waters, ambiguity persists in nearshore and foreshore zones. This jurisdictional ambiguity has led to inefficiencies, where approvals for marine development are delayed or contested between state and federal bodies. In practical terms, this has resulted in fragmented licensing, uncertain investor confidence, and unregulated coastal occupation. Legal clarification whether through constitutional interpretation, Memorandum of Understandings (MOUs), or amendments are critical to prevent administrative conflict and enable operational rollout of marine cadastre initiatives.

D. Absence of Delineation Standards for Marine Boundaries

Terrestrial cadastral practices in Sarawak are well-established through geodetic and legal surveying protocols. However, no equivalent standard exists for marine boundaries, making it difficult to spatially define or enforce marine tenure rights. In the absence of such protocols, issues such as overlapping aquaculture licenses, unregulated marine development, and boundary disputes arise. Adopting marine-specific demarcation methodologies which possibly adapted from UNCLOS baseline principles and vertical zoning concepts would allow Sarawak to establish spatial clarity for marine parcels. The development of these standards should be led by DLSS, considering its statutory surveying authority.

E. Fragmented Coordination Between Marine-Related Agencies

The current governance of marine areas involves multiple state departments and agencies such as the Natural Resources and Environment Board (NREB), Department of Fisheries (DOF), Marine Department Malaysia, and the State Planning Unit. However, there is no formal platform that facilitates coordination or data sharing among these bodies. This results in duplication of efforts, policy misalignment, and inconsistent enforcement. The creation of a multi-agency coordination unit, possibly under the leadership of DLSS would centralize marine spatial data, unify licensing decisions, and ensure that tenure rights are consistent across agencies.

F. Missed Socio-Economic and Community Opportunities

The lack of a structured marine cadastre system not only impacts governance efficiency but also undermines the socio-economic potential of Sarawak's marine spaces. Without registered marine parcels, traditional coastal communities may face displacement from commercial aquaculture or port development without legal recourse. Similarly, marine-based industries operate with legal uncertainty, deterring sustainable investment. By formalizing marine tenure and spatial rights, Sarawak can ensure equitable access, protect customary marine use, and unlock new economic opportunities in eco-tourism, marine farming, and seabed leasing, thus, aligning marine governance with broader social and developmental goals.

G. Stakeholder Perspectives: Empirical Validation of Implementation Barriers

The stakeholder survey provides critical empirical validation that the legal gaps identified through doctrinal analysis represent only one dimension of a more complex implementation challenge. The data reveals a triad of interconnected barriers: a profound knowledge deficit, a clear consensus on necessary interventions, and a self-reinforcing cycle of legal, technical, and coordination challenges that must be addressed concurrently.The most immediate barrier is a fundamental lack of awareness and expertise. Survey results reveal substantial conceptual unfamiliarity with marine cadastre principles across all sectors. Among government stakeholders, who would be the primary implementers, 77.8% reported being "unfamiliar" with the concept, and a mere 5.6% had ever participated in a related project. This knowledge deficit extends to the governing international legal framework, with 61.1% of government respondents acknowledging they lack an understanding of UNCLOS implications. This indicates that legislative reform alone would be insufficient, as the institutional expertise required to enact and manage a marine cadastre is currently absent.Beyond knowledge gaps, stakeholders identified a clear hierarchy of operational challenges. As shown in Table 1, legal and technical constraints are seen as equally significant and primary obstacles.

TABLE I: STAKEHOLDER PERCEPTION OF KEY IMPLEMENTATION CHALLENGES

Challenge Category	Stakeholder		Overall (%)
	Government (%)	Private Sector (%)	
Legal and Regulatory Constraints	38.9	50.0	45.7
Technical Capacity Gaps (Technology, Data and Workforce)	55.6	38.5	45.7
Institutional Coordination Issues	27.8	15.4	20.0
Public Awareness and Political Challenges	22.2	19.2	20.4

*Note: Percentages exceed 100% as respondents could select multiple challenges

When asked to identify the main barriers, legal and regulatory constraints were selected by 45.7% of all respondents, powerfully corroborating the doctrinal finding of a critical legal vacuum. However, an identical percentage (45.7%) highlighted technical capacity gaps, encompassing a lack of technology, data, and a skilled workforce. A further 20% of stakeholders cited institutional coordination issues, suggesting that siloed operations could undermine a unified system. The distribution of these concerns also varied tellingly between sectors. The private sector expressed greater concern over legal constraints (50%) compared to government respondents (38.9%), potentially reflecting investor anxieties, while government stakeholders were more acutely aware of their own internal capacity limitations (55.6% highlighted technical gaps against 38.5% in the private sector).

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This collective diagnosis directly has led to a strong consensus on the necessary path forward. Stakeholders demonstrated unambiguous priorities for intervention, with unanimous (100%) agreement among geospatial experts on the need for new technologies and overwhelming (85.7%) support for international collaboration across all expert groups. This provides robust empirical support for the technical and knowledge-transfer components of the proposed strategy.

H. *Insights from Comparative Benchmarking*

A review of marine cadastre implementation in other jurisdictions offers valuable lessons for Sarawak. The foundational development of the marine cadastre concept in Australia provides a highly relevant case study. As [6] established in their seminal work, the Australian approach was built on extending the principles of the existing land administration system to marine spaces, emphasizing the need to define complex, multi-dimensional property rights in the marine environment. This model of leveraging and adapting terrestrial cadastral frameworks resonates strongly with Sarawak's potential to utilize the integrated Department of Land and Survey Sarawak, rather than creating an entirely new agency from scratch.Furthermore, the Australian experience, along with initiatives in Canada, highlights the critical importance of addressing legal gaps as a first step. Their progress was predicated on clear legislative frameworks that defined marine parcels and rights, a fundamental step that Sarawak has yet to undertake. Conversely, the challenges faced in Indonesia, an archipelagic state with similar complexities, underscore the universal difficulties of inter-agency coordination and data harmonization [3]. These international experiences collectively validate the phased strategy proposed for Sarawak, confirming that legislative reform must precede full technical implementation and that building upon existing institutional strength is a recognized best practice. Furthermore, the persistent challenge of coordination seen across different jurisdictions underscores that Sarawak's situation is not unique but part of a broader governance phenomenon that requires deliberate institutional design to overcome [12].

VI. RECOMMENDATIONS

The findings from both the legal analysis and the stakeholder survey point to a clear, phased pathway for implementing a marine cadastre in Sarawak. A sequential approach is recommended, beginning with the urgent task of closing legal gaps, followed by building the necessary institutional capacity, and culminating in a fully operational system that balances economic development with social equity and environmental sustainability.

A. *Phase One: Laying the Legal Foundation*

The first and most critical step is to create legal space for a marine cadastre to exist. The analysis confirms that the current Sarawak Land Code operates exclusively for land, creating a legal vacuum for marine areas. This fundamental barrier is widely recognized by practitioners, with 45.7% of all stakeholders identifying legal constraints as the primary challenge. Therefore, immediate priority must be given to amending the Sarawak Land Code to formally establish a new category of property, such as a “marine cadastral unit.” Simultaneously, the Interpretation Ordinance 2005 requires updating to ensure that definitions of terms like “land” and “boundary” legally encompass marine and coastal spaces. Without these foundational amendments, any attempt to administer marine spaces will lack statutory legitimacy and remain vulnerable to legal challenges, stalling progress before it can begin.

B. *Phase Two: Building Institutional Readiness and Coordination*

Once the legal framework is initiated, the focus must shift to the significant capacity gaps within the very institutions that will implement the system. The stakeholder data reveals a complete readiness problem, with 94.4% of government respondents reporting their agencies were less than prepared. To address this, the institutional strength of the DLSS should be formally expanded to encompass marine administration, rather than creating a new and separate body. This leverages an existing, integrated structure. A dedicated unit within DLSS should be established and empowered to lead this transition. This unit’s immediate task would be to launch comprehensive capacity-building programs to address the technical skills gap, a concern highlighted by 45.7% of stakeholders. Furthermore, to tackle the coordination issues noted by 27.8% of government respondents, a high-level steering committee chaired by DLSS should be formed. This committee would be responsible for integrating data and aligning policies across all relevant state and federal agencies. This approach aligns with established principles of polycentric ocean governance, which emphasize the need for integrated and coordinating mechanisms to manage complex, multi-jurisdictional marine spaces effectively [12].

C. *Phase Three: Operationalizing a Sustainable and Equitable System*

The final phase involves activating the technical and governance components of the system, ensuring it delivers on its promise of sustainable ocean governance. This stage is guided by clear stakeholder consensus: the unanimous (100%) agreement among geospatial experts on the need for new technologies like drones and advanced mapping systems dictates that robust technical standards for marine boundary demarcation must be developed. This technical capability must then be directed toward achieving higher goals. The system should be designed to formally recognize and map customary marine tenure, protecting the rights of coastal communities and directly contributing to the achievement of UN Sustainable Development Goal 14. This aligns the marine cadastre with global sustainability targets. Alongside this, the clear legal framework and spatial data will enable the development of a transparent marine leasing policy, which can unlock economic potential in sectors like aquaculture and tourism. This approach ensures that economic development is pursued in a manner that is both socially equitable and environmentally responsible, fulfilling the broader purpose of the marine cadastre.

VII. CONCLUSION

Sarawak stands at a pivotal moment in advancing its marine governance framework through the implementation of a marine cadastre system. This paper has extended beyond a purely doctrinal review by integrating empirical stakeholder data, providing a comprehensive assessment of the state's legal readiness and practical preparedness. The analysis confirms that while Sarawak benefits from a consolidated land administration structure under DLSS and constitutional autonomy under the Malaysia Agreement 1963 (MA63), the current legislative environment, particularly the Sarawak Land Code, does not yet provide the legal foundation necessary to register, delineate, and manage marine parcels effectively [20], [22].The findings demonstrate a critical paradox. The analysis demonstrates the absence of marine-specific tenure recognition in the Sarawak Land Code, the lack of standardized marine boundary demarcation methods, and jurisdictional ambiguities in nearshore areas. Without reform, these issues risk stalling investment, compromising community rights, and hindering sustainable development [10] a finding powerfully validated by stakeholders, with 45.7% of practitioners identifying legal constraints as the primary barrier. Sarawak, with the right legal amendments and institutional coordination, has the capacity to establish a fit-for-purpose marine cadastre system. The central role of DLSS provides an administrative advantage for integrating land and sea governance under a unified authority [22], [23]. However, the institutional advantage of DLSS is currently offset by a significant readiness gap, with 94.4% of government respondents reporting that their agencies were unprepared for the transition to marine administration. This underscores that legislative reform must be coupled with targeted capacity-building.

The stakeholder data reveals that the challenges are multidimensional. The profound knowledge gap, where 77.8% of government stakeholders were unfamiliar with marine cadastre concepts, indicates that legal reform alone is insufficient. The strong consensus on

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interventions including unanimous (100%) expert agreement on technology needs which provides a clear mandate for the phased implementation strategy proposed in this study. This approach ensures that marine cadastre development in Sarawak is not only legally sound but also operationally viable and aligned with sustainable development objectives [1], [4], [15].

In conclusion, this paper offers an evidence-based foundation for policy engagement, legislative drafting, and institutional capacity building. It reinforces the urgent need for coordinated reform that aligns legal instruments, technical practices, and community interests [14]. By addressing both the legal gaps and the empirically validated implementation barriers, Sarawak can truly assert its jurisdiction, promote sustainable blue growth, and safeguard the rights and well-being of its coastal and marine communities.

APPENDIX

Introduction: You are invited to participate in academic research on implementing a marine cadastre system in Sarawak. This questionnaire takes 15-20 minutes. Your responses are confidential and voluntary.

Section 1: Respondent Profile
Primary Sector: [ ] Government [ ] Private [ ] Academia/Research [ ] NGO/Community [ ] Other: _____
Field of Expertise: [ ] Geospatial Sciences [ ] Law [ ] Marine Studies [ ] Environmental Studies [ ] Other: _____

Section 2: Conceptual Understanding
4. Familiarity with "Marine Cadastre":
[ ] Very [ ] Somewhat [ ] Unfamiliar [ ] Never heard
5. Understanding of UNCLOS implications:
[ ] High [ ] Moderate [ ] Low [ ] None
6. Involved in marine spatial planning projects?
[ ] Yes [ ] No

Section 3: Perceived Challenges
7. Main Barriers (select up to 3):
[ ] Legal/Regulatory Constraints
[ ] Technical Capacity Gaps
[ ] Institutional Coordination Issues
[ ] Lack of Funding/Resources
[ ] Lack of Political Will/Public Awareness
[ ] State-Federal Jurisdictional Ambiguities
[ ] Other: _____
8. Rate challenge severity (1=Not Severe, 5=Extremely Severe):
a) No legal definition for marine parcels
[1] [2] [3] [4] [5]
b) No technical standards for boundaries
[1] [2] [3] [4] [5]
c) Poor inter-agency coordination
[1] [2] [3] [4] [5]
d) Insufficient marine data
[1] [2] [3] [4] [5]

Section 4: Current Status & Institutional Readiness
9. Current marine rights registration system?
[ ] Yes, comprehensive [ ] Yes, but fragmented [ ] No system
10. Current inter-agency coordination level?
[ ] Excellent [ ] Good [ ] Fair [ ] Poor [ ] Non-existent
11. Your agency's readiness for marine cadastre?
[ ] Very Prepared [ ] Somewhat [ ] Less Prepared [ ] Not Prepared

Section 5: Recommendations
12. Preferred lead institution:
[ ] DLSS [ ] New dedicated department [ ] Multi-agency committee [ ] Other: _____
13. Priority actions (1=Highest, 5=Lowest):
[ ] Amend Sarawak Land Code
[ ] Develop technical standards
[ ] Establish coordination platform
[ ] Conduct capacity building
[ ] Launch pilot projects
14. Most important step for sustainable ocean governance:
_____
_____
15. Additional comments/suggestions:
_____
_____

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