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Governance and Management Performance in Integrated Coastal Defense: Enhancing Community Resilience in Indonesia

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Abstract

Purpose: This study aimed to bridge the gap between coastal defense management strategies and community resilience by adopting a strategic management perspective. Integrated Coastal Defense (ICD) is conceptualized as a strategic resource, whereas governance, management capacity, and social capital are treated as organizational capabilities influencing resilience outcomes.

Methodology: A quantitative approach was employed using Structural Equation Modeling-Partial Least Squares (SEM-PLS). Data were collected from 350 respondents across the North Natuna Sea, Malacca Strait, and Sulawesi Sea, representing stakeholders involved in governance, maritime security, and community-based coastal management in the region.

Results: The findings reveal that ICD significantly influenced governance and social capital ($\beta = 0.52$, $p < 0.001$), which in turn enhanced community resilience ($\beta = 0.41$, $p < 0.01$). ICD also has a direct effect on resilience ($\beta = 0.29$, $p < 0.05$), with governance and social capital partially mediating this relationship ($\beta = 0.21$, $p < 0.01$). The model explained 68% of the variance in resilience ($R^2 = 0.68$).

Conclusions: Community resilience is enhanced when coastal defense strategies are supported by strong governance, effective management, and active stakeholder participation.

Limitations: The cross-sectional design and reliance on perception-based data may limit the causal inference and generalizability beyond the Indonesian context.

Contributions: This study integrates strategic resource theory and resilience frameworks, demonstrating that coastal defense effectiveness depends on the alignment between infrastructure and governance capabilities.

Keywords: *Integrated Coastal Defense, Community Resilience, Governance, Social Capital, Strategic Management, SEM-PLS*

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1. Introduction

Coastal regions are vital for sustaining national security, economic development and community livelihoods. Globally, more than 40% of the world's population lives within 100 km of the coast, making coastal zones highly significant for food production, trade, and security (Neumann, Vafeidis, Zimmermann, & Nicholls, 2015). For archipelagic states such as Indonesia, coastal regions serve as the frontlines of national defense, maritime trade, and natural resource management. However, these regions are increasingly exposed to a combination of traditional and nontraditional threats. Climate-induced hazards, such as sea-level rise, coastal erosion, and intensified storms, directly threaten communities, infrastructure, and ecosystems (Cooley et al., 2023). Simultaneously, Illegal, Unreported, and Unregulated (IUU) fishing has escalated into a multidimensional problem that undermines food security, sovereignty, and maritime governance (Kraan, Groeneveld, Pauwelussen, Haasnoot, & Bush, 2020).

From a strategic and public sector management perspective, coastal defense systems can be understood as complex organizational arrangements that require the alignment of resources, capabilities, and governance structures. In this context, coastal defense is not merely a technical or infrastructural issue but also a matter of management performance, policy coordination and institutional effectiveness. Public sector organizations, including naval institutions and local governments, play a central role in designing and implementing coastal defense strategies, where their effectiveness depends on their ability to manage resources, coordinate stakeholders, and ensure policy integration across multiple levels of governance.

Despite the growing body of literature on coastal defence and community resilience, these domains are often examined separately. Engineering-based studies focus on infrastructure effectiveness, whereas social science research emphasizes governance and community adaptation. However, limited empirical research has integrated these dimensions into a unified strategic management framework. This fragmentation creates a critical gap in understanding how physical defense systems interact with governance mechanisms to produce resilient outcomes, particularly in archipelagic contexts such as Indonesia.

From a resource management perspective, integrated coastal defense requires effective management, institutional coordination, and active participation by multiple stakeholders. Coastal resilience is not solely determined by physical infrastructure but also by the capacity of organizations and communities to collaborate, share knowledge and coordinate responses to maritime threats. Government agencies, naval institutions, and community organizations must develop governance structures that support collective decision-making, trust building, and stakeholder engagement. In this context, management and participatory governance function as critical human resource mechanisms that enable the effective implementation of coastal defense strategies while strengthening community resilience.

From a geopolitical perspective, the Indo-Pacific region has become a focal point of global maritime competition. Indonesia's strategic waterways, including the Malacca Strait, North Natuna Sea, and Sulawesi Sea, are critical maritime chokepoints for global trade and energy flows (Gu, Dillard, Gerst, & Loerzel, 2023). This makes coastal defense a matter of national interest and an international security concern. Management of coastal defense strategies has relied heavily on hard infrastructure, such as naval bases, ports, seawalls, and surveillance systems. However, the effectiveness of these strategies depends on institutional coordination, management capacity, and stakeholder participation within coastal governance systems. While essential, these measures alone are insufficient to build long-term resilience, especially in the face of complex socio-environmental challenges (Pasca, De Simone, Ciavolino, Rochira, & Mannarini, 2023).

The concept of resilience emphasizes the ability of communities and systems to absorb disturbances, adapt, and recover. In the context of coastal defense, resilience is not merely about physical protection but also about empowering local communities with adaptive capacity, governance mechanisms and social capital. Integrated coastal defense approaches, which combine hard and soft measures such as ecological restoration, participatory governance, and disaster preparedness, are increasingly recognized as effective strategies for strengthening both ecological and social resilience (Temmerman et al., 2013).

Despite the growing attention to resilience frameworks, a research gap remains in linking physical defense systems with community-based resilience systematically and empirically. Much of the existing literature treats coastal defense as an engineering or policy problem, whereas community resilience is often explored from a social science perspective (Folke, 2016). Few studies have attempted to quantitatively integrate these dimensions, particularly in the context of developing archipelagic nations such as Indonesia. Therefore, this study seeks to bridge that gap by applying Structural Equation Modeling-Partial Least Squares (SEM-PLS) to analyze the relationships among integrated coastal defense, governance, and social capital, and community resilience.

Coastal regions play crucial roles in national security, economic development, and community livelihoods. As the world's largest archipelagic state, Indonesia faces increasing maritime challenges, including climate-induced hazards, Illegal, Unreported, and Unregulated (IUU) fishing, and strategic competition in the Indo-Pacific (Dirman, Riniwati, Harahab, Semedi, & Rachmansyah, 2024). Traditional coastal defense strategies have largely emphasized military and physical infrastructures. However, resilience cannot be achieved without integrating community-based approaches into the planning process.

Drawing on the Resource-Based View (RBV), Integrated Coastal Defense (ICD) can be conceptualized as a strategic resource that contributes to long-term performance when supported by appropriate organizational capabilities. Governance quality, management capacity, and social capital are intangible assets that enable organizations to transform physical infrastructure investments into effective resilience outcomes. These organizational capabilities facilitate coordination, knowledge sharing, and adaptive decision-making among stakeholders, thereby enhancing the overall effectiveness of coastal defense systems. Without such capabilities, even well-developed infrastructure may fail to generate sustainable policy outcomes.

By focusing on Indonesia's strategic maritime regions, this study contributes both theoretically and practically. Theoretically, it expands resilience studies by integrating the defense and community dimensions into a single empirical framework. Practically, it provides evidence-based insights for policymakers, military planners, and coastal managers to design integrated strategies that enhance national resilience while safeguarding the welfare of the community. Although prior studies have examined coastal infrastructure and community resilience as distinct domains, few have systematically integrated these dimensions within a unified analytical framework. Few empirical investigations have employed robust quantitative approaches to examine how integrated coastal defense strategies interact with governance mechanisms and social capital to enhance community resilience in maritime contexts. This gap is particularly evident in archipelagic nations, where physical security, ecological sustainability, and community capacity are deeply interconnected yet often analyzed separately.

Against this background, this study addresses the following research questions: To what extent do integrate coastal defense strategies influence community resilience? How do governance and social capital mediate the relationship between coastal defense and community resilience? In what ways can structural equation modeling-partial least squares (SEM-PLS) provide empirical evidence for the multidimensional nature of maritime resilience? Accordingly, the primary objective of this study is to develop and empirically validate a conceptual framework that links integrated coastal defense, governance, social capital, and community resilience within Indonesia's strategic maritime zones. By doing so, this study seeks to provide a comprehensive and evidence-based understanding of how physical defense systems and social-institutional factors jointly contribute to sustainable maritime resilience.

Beyond its theoretical contribution, this study has direct policy relevance for maritime and coastal governance. The empirical findings demonstrate that investments in coastal defense infrastructure yield optimal outcomes when institutionally embedded within governance systems that promote participation, trust, and collaborative coordination. In practical terms, this implies that policymakers should design coastal defense programs not merely as engineering projects but as integrated socio-institutional initiatives. By aligning infrastructure development with governance reforms and community empowerment mechanisms, governments can enhance their adaptive capacity, reduce long-term vulnerabilities, and strengthen national maritime resilience. This integrated approach is particularly relevant for archipelagic states such as Indonesia, where coastal security, environmental sustainability, and community livelihood are deeply interconnected.

Despite the increasing attention to coastal resilience and maritime security, a significant research gap remains in integrating management and organizational perspectives into coastal defence studies. Existing research has largely focused on engineering solutions or policy frameworks, while limited attention has been given to how organizational capabilities and management performance influence the effectiveness of coastal defense systems in China. In particular, empirical studies linking strategic resources, governance mechanisms, and performance outcomes within a unified analytical framework are scarce. Therefore, this study addresses this gap by examining how integrated coastal defense, governance, social capital, and community resilience are interconnected within a strategic management framework.

This study offers a novel perspective by systematically integrating coastal defense strategies and community resilience into a unified quantitative framework. While prior research has often examined physical defense infrastructure or social resilience independently, few studies have empirically tested their interactions and mediating mechanisms using Structural Equation Modeling. By combining engineering-oriented coastal defense measures with governance and social capital dimensions, this study advances a multidimensional understanding of maritime resilience. The originality of the study lies in demonstrating that resilience is not solely a function of physical protection or social capacity but rather the product of their dynamic interaction. This integrated framework bridges the disciplinary divides between security studies, coastal management, and resilience theory.

2. Literature Review and Hypothesis Development

From a strategic management perspective, organizational performance is shaped by effective alignment between strategic resources and organizational capabilities. Drawing on the Resource-Based View (RBV), organizations achieve superior performance when they can deploy valuable, rare, and inimitable resources in combination with strong internal capabilities. In the context of coastal defense, physical infrastructure and ecological systems can be viewed as strategic resources, whereas governance structures, management capacity, and social capital function as organizational capabilities that determine how effectively these resources are utilized. Therefore, understanding coastal defense requires an integrated framework that links strategic resources, organizational capabilities and performance outcomes.

2.1 Integrated Coastal Defense (ICD).

Integrated Coastal Defense (ICD) refers to a holistic approach that combines hard infrastructure (such as seawalls, breakwaters, ports, and surveillance systems) and soft or nature-based measures (such as mangrove restoration, wetland rehabilitation, and zoning regulations). The rationale behind ICD is that relying solely on hard engineering solutions often provides short-term protection but may lead to ecological degradation and increased vulnerability over time (Major, Lehmann, & Fitton, 2018). In contrast, integrating ecological systems with engineered structures enhances the adaptive capacity of coastal regions to withstand climate hazards, security risks, and human pressures.

From a management perspective, Integrated Coastal Defense (ICD) can be conceptualized as a strategic resource that provides both protective and adaptive value to coastal systems. As a strategic resource, ICD encompasses not only physical infrastructure but also ecological assets and defence coordination mechanisms that support long-term sustainability. However, the value of this resource depends on how effectively it is managed and integrated into governance systems. In line with RBV, the contribution of ICD to performance outcomes is contingent on the presence of complementary organizational capabilities that enable its effective deployment.

Hard measures are critical components of ICD and are designed to provide direct physical protection against such threats. These include seawalls and revetments that prevent coastal erosion, breakwaters that reduce wave energy, ports and naval bases that support economic and defense activities, and coastal surveillance systems that enhance maritime security (Aerts et al., 2014). Although these structures are effective in safeguarding assets, they are costly to maintain and can create ecological imbalances by altering sediment flows and disrupting natural habitats. Thus, in the ICD framework, hard measures are strategically deployed in conjunction with ecosystem-based solutions (Alongi, 2015).

Soft measures emphasize ecological and regulatory interventions that strengthen natural defenses while supporting local livelihoods. For example, mangrove forests serve as natural wave buffers, reduce shoreline erosion, and provide critical nursery grounds for fish (Alongi, 2015). Similarly, zoning policies and coastal land-use planning help minimize exposure to hazards by regulating construction in high-risk areas (Charuka, Angnuureng, & Agblorti, 2023; Dirman et al., 2024). These measures are often more cost-effective and sustainable than hard infrastructure and promote co-benefits such as biodiversity conservation, carbon sequestration, and food security.

The core strength of the ICD lies in the integration of both hard and soft strategies, creating a layered and adaptive defence system. For instance, combining seawalls with mangrove belts provides immediate physical protection and long-term ecological resilience (Spalding et al., 2014). Furthermore, governance mechanisms and community participation are essential for ensuring that ICD is effectively implemented, socially accepted, and maintained over time. As coastal populations grow and climate-related hazards intensify, ICD offers a comprehensive framework for balancing security, sustainability, and community resilience in maritime nations, such as Indonesia.

2.2 Community Resilience (CR)

Community Resilience (CR) refers to the ability of local communities to withstand, absorb, adapt, and recover from disturbances while maintaining essential functions and structures. In maritime contexts, CR extends beyond disaster preparedness to include adaptive responses to long-term threats such as climate change, Illegal, Unreported, and Unregulated (IUU) fishing, and regional security challenges (Si, Liang, & Zhou, 2024). The strength of CR lies not only in physical assets but also in social capital, governance, and local knowledge that enable communities to respond effectively under stress.

From an organizational perspective, community resilience can be viewed as a performance outcome that reflects the effectiveness of both strategic resources and organizational capability. Resilience outcomes, such as adaptive capacity, recovery speed, and livelihood security, indicate how well coastal systems respond to environmental and security challenges. In this sense, community resilience represents not only a social condition but also a measurable indicator of policy and management performance in coastal defense systems.CR is deeply embedded in social and economic systems. Social networks, mutual trust, and community-based organizations play crucial roles in facilitating rapid response and recovery after maritime hazards such as storms, oil spills and piracy (Aldrich & Meyer, 2015). Similarly, diversified livelihoods, such as fishing, aquaculture, and small-scale trade, enhance resilience by reducing dependence on a single income source (Kent et al., 2024). Communities with higher levels of education, economic resources, and local governance capacity are generally more adaptive and capable of transforming challenges into opportunities.

Environmental stewardship is a key component of CR. Coastal communities that actively engage in mangrove restoration, sustainable fisheries, and marine protected areas not only reduce their vulnerability to climate-induced hazards but also enhance their long-term ecological resilience (Idajati & Damanik, 2025). Local ecological knowledge is often critical for designing adaptive practices that align with cultural traditions and sustainable resource use (Narendr, Aithal, & Das, 2024). Thus, CR is strengthened when ecological health is maintained in conjunction with social and economic development. The governance dimension of CR highlights the importance of inclusive decision-making, policy support and institutional trust. Participatory governance ensures that local communities are not passive recipients of aid but are active agents in shaping resilience strategies. Moreover, resilience is not just about bouncing back but also about transformative capacity the ability to reorganize social and institutional arrangements to prepare better for future threats (Charuka et al., 2023). In maritime nations such as Indonesia, integrating CR into national security and coastal defense policies is essential to balance security, sustainability, and human development.

2.3 Governance, Management, and Social Capital (GSC)

From a resource management perspective, governance and social capital can be understood as organizational capabilities that enable the coordination, collaboration, and collective action of stakeholders involved in coastal management. Effective coastal defense requires not only physical infrastructure but also competent management, skilled personnel, and participatory organizational cultures that support knowledge sharing and stakeholder engagement. In public sector and community-based governance systems, management capacity and employee participation play crucial roles in translating policy strategies into practical actions. When institutions foster trust, collaborative decision-making, and community involvement, they strengthen the human resource foundations necessary for effective, resilience-building. Therefore, governance and social capital can be interpreted as organizational resources that enhance the coordination between government agencies, naval institutions, and coastal communities in implementing integrated coastal defense strategies.

In the context of strategic management, governance, and social capital, they can be interpreted as critical organizational capabilities that enable institutions to coordinate resources and achieve policy objectives. These capabilities include management effectiveness, stakeholder engagement, trust building, and collaborative decision-making processes. Strong organizational capabilities enhance public sector institutions' ability to translate strategic resources into tangible outcomes. Thus, governance and social capital do not merely support coastal defense but actively determine its effectiveness as a coordinated action system.

Collaboration between the government, navy, and communities; trust, participation, and knowledge sharing. Governance and Social Capital (GSC) play a central role in building resilience within maritime communities. Governance refers to the management structures, institutional arrangements, and human resource capabilities that facilitate decision making, coordination, and policy implementation (Tadjuddah et al., 2023). In coastal and maritime contexts, the GSC ensures that state actors, such as the navy and local governments, work collaboratively with communities to safeguard both security and livelihoods. This synergy between governance and social capital forms the backbone of adaptive and participatory resilience strategies.

Effective governance in maritime security requires the collaboration of multiple stakeholders, including government agencies, naval forces, local communities and non-governmental organizations. Such collaboration enables coordinated responses to threats such as piracy, illegal fishing, and climate-induced disasters (Baldacchino, 2018; Oktari, Latuamury, Idroes, Sofyan, & Munadi, 2022). For instance, joint patrols and community-based monitoring systems strengthen maritime domain awareness while fostering local ownership of security initiatives (Shaffril, Abu Samah, & Samsuddin, 2022). By institutionalizing collaboration, governance frameworks move beyond top-down control to co-management models that enhance both effectiveness and legitimacy of the project.

Social capital enhances governance by building trust, participation, and knowledge sharing. Communities with high levels of trust in institutions are more likely to comply with regulations and participate actively in resilience programs. Moreover, participation ensures that local voices and Indigenous knowledge are incorporated into planning processes, improving the relevance and sustainability of policies (Rochira et al., 2023). Knowledge sharing among naval forces, scientific experts, and coastal residents facilitates collective learning and innovation, enabling communities to adapt more effectively to complex maritime challenges.

The integration of governance and social capital has significant implications for maritime resilience. Strong governance without social capital risks being rigid and exclusionary, whereas social capital without institutional support may lack the capacity to address large-scale challenges. When aligned, GSC fosters both top-down coordination and bottom-up empowerment, creating resilient systems capable of withstanding shocks and transforming in the face of uncertainty (Li & van de Lindt, 2025). In the Indonesian context, embedding GSC into coastal defense strategies ensures that maritime resilience is not only a matter of infrastructure but also of inclusive governance and community empowerment.

2.4 Hypothesis

Based on the strategic management perspective, this study conceptualizes Integrated Coastal Defense (ICD) as a strategic input, Governance and Social Capital (GSC) as organizational capabilities, and Community Resilience (CR) as a performance outcome. This framework emphasizes that the effectiveness of coastal defense strategies depends not only on the availability of resources but also on the capability of organizations to manage, coordinate, and utilize these resources. Therefore, the proposed hypotheses are designed to examine both direct and indirect relationships among strategic resources, organizational capabilities, and performance outcomes in coastal governance systems.

This study examined three main constructs. Integrated Coastal Defense (ICD) was measured using indicators of infrastructure readiness, ecological protection, and defense coordination. Governance and Social Capital (GSC) were assessed using indicators of participation, trust, and collaborative governance. Community Resilience (CR) was operationalized through adaptive capacity, recovery speed, and livelihood security. All constructs were derived from the relevant literature to ensure content validity.

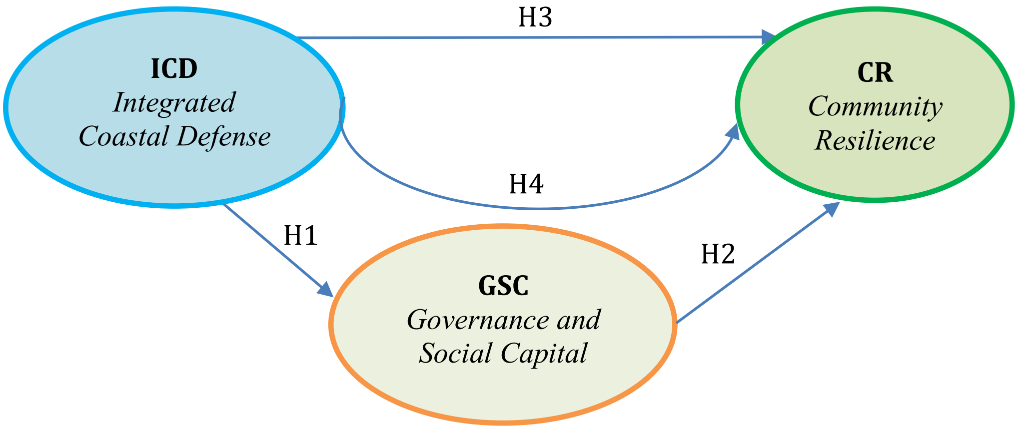

Figure 1. Conceptual Framework of Research.

Variables Indicators:

ICD : Infrastructure readiness, Ecological protection, Defense coordination.
GSC : Participation, Trust, Collaborative Governance.
CR : Adaptive capacity, Recovery speed, Livelihood security.

Hypotheses:

H_1: Integrated Coastal Defense (ICD) is expected to have a strong positive effect on Governance and Social Capital (GSC), with an estimated path coefficient above 0.50, indicating that more than 50% of governance improvement can be attributed to coastal defense integration.

H_2: Governance and Social Capital (GSC) are expected to have a moderate-to-strong positive effect on Community Resilience (CR), with an estimated coefficient above 0.40, suggesting that approximately 40% of resilience improvement is driven by governance quality and social cohesion.

H_3: Integrated Coastal Defense (ICD) is expected to have a moderate direct effect on Community Resilience (CR), with an estimated coefficient above 0.25, indicating that approximately 25–30% of resilience outcomes can be directly explained by infrastructure and ecological protection.

H_4: Governance and Social Capital (GSC) are expected to partially mediate the relationship between ICD and CR, with an indirect effect above 0.20, implying that at least 20% of ICD's impact of ICD on resilience operates through governance mechanisms.

To address the identified research gap, namely, the limited integration of physical coastal defense and social resilience within a unified empirical framework, this study formulates four interrelated hypotheses. These hypotheses are designed to test direct relationships and uncover the underlying mechanisms linking structural defense measures and community-level resilience outcomes.

H_1 proposes that Integrated Coastal Defense (ICD) positively influences Governance and Social Capital (GSC). This hypothesis fills this gap by empirically examining whether investments in physical and ecological defense systems extend beyond infrastructure outcomes to shape institutional coordination, trust, and participation (Li & van de Lindt, 2025; Prakasa, Sawu, & Ulinnuha, 2025). While prior research often treats infrastructure as a purely technical domain, H1 tests its broader socioinstitutional implications.

H_2 posits that Governance and Social Capital (GSC) positively influence Community Resilience (CR). This hypothesis addresses the gap in understanding how governance mechanisms and social cohesion translate into measurable resilience outcomes in maritime contexts (Ali & Ayelign, 2022; Potamos, Stavrou, & Stavrou, 2024). By empirically validating this link, this study strengthens the argument that resilience is socially embedded rather than solely infrastructure-driven.

H_3 examines the direct effect of ICD on CR, addressing whether physical and ecological defence strategies independently contribute to resilience. Testing this relationship clarifies whether infrastructure alone is sufficient or whether additional social mechanisms are required (Ali, 2021; Ochwo & Mwesigwa, 2021).

Finally, H4 introduces a mediation hypothesis, proposing that GSC mediates the relationship between ICD and CR. This hypothesis is central to bridging the gap identified in the literature as it integrates physical defense and social resilience (Dirman et al., 2024; Kent et al., 2024) within a single structural model. By testing mediation, this study moves beyond fragmented analyses and demonstrates how governance and social capital function as connecting mechanisms between defense strategies and community resilience outcomes.

3. Methodology

This study employed a quantitative research design and a structured survey to collect primary data. This approach was chosen to enable statistical testing of the proposed conceptual framework through a robust empirical analysis. The sample consisted of 350 respondents, including community leaders, fishermen, and local government officers from three strategic maritime regions of Indonesia: Natuna Islands, Malacca Strait, and Sulawesi Sea. The selected regions represent strategic maritime zones with high exposure to environmental risks and security challenges, making them suitable for examining integrated coastal defense dynamics. These groups were selected because of their direct involvement in maritime security, governance and community livelihood. Data were collected using a 5-point Likert scale questionnaire, ranging from 1 ("strongly disagree") to 5 ("strongly agree") to capture respondents' perceptions regarding coastal defense, governance, and resilience.

Data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with the SmartPLS 4 software. The analysis was conducted in three main steps. First, the measurement model was assessed by examining the reliability and validity criteria. Second, the structural model was evaluated using path coefficients, R^2, Q^2, and effect sizes (f^2). Finally, hypothesis testing was conducted using bootstrapping with 5,000 resamples to establish the statistical significance of the proposed relationship. This multi-step approach ensured the robustness and reliability of our empirical findings. Despite its robustness, SEM-PLS is primarily prediction-oriented and may not fully capture causal complexity compared to longitudinal designs. Additionally, the use of perception-based survey data may have introduced subjective bias.

Structural Equation Modeling-Partial Least Squares (SEM-PLS) was selected as the analytical method because of its suitability for examining complex multivariate relationships among latent constructs in exploratory and prediction-oriented research. Unlike covariance-based SEM, SEM-PLS is particularly appropriate for studies that aim to maximize the explained variance (R^2) and assess mediation effects within relatively complex structural models. The method is also robust in handling non-normal data distributions and moderate sample sizes, making it well-suited for social and maritime research contexts where perceptual survey data are commonly used. Furthermore, SEM-PLS allows for the simultaneous evaluation of both the measurement model (reliability and validity of constructs) and the structural model (hypothesized relationships among constructs), thereby providing a comprehensive assessment of the multidimensional framework linking integrated coastal defense, governance and social capital, and community resilience.

4. Results And Discussion

4.1 Outer Loadings SEM-PLS Results

The outer loading values indicate the strength of the relationship between each indicator and its corresponding latent constructs. In SEM-PLS, loadings above 0.70 are generally considered acceptable, as they demonstrate that the indicator shares sufficient variance with the latent construct (Sarstedt, Ringle, & Hair, 2021). All indicators in this study had loadings ranging from 0.79 to 0.88, suggesting strong convergent validity across the three constructs.

Table 1. Measurement Model: Outer Loadings of Constructs

Construct	Indicator	Description	Outer Loading
Integrated Coastal Defense (ICD)	ICD1	Infrastructure readiness	0.81
	ICD2	Ecological protection	0.84
	ICD3	Defense coordination	0.79
Governance and Social Capital (GSC)	GSC1	Participation	0.82
	GSC2	Trust	0.85
	GSC3	Collaborative governance	0.88
Community Resilience (CR)	CR1	Adaptive capacity	0.83
	CR2	Recovery speed	0.80
	CR3	Livelihood security	0.86

All outer loading values exceeded the recommended threshold of 0.70, indicating the satisfactory convergent validity of the measurement model (Sarstedt et al., 2021). The results suggest that the indicators reliably represent their respective constructs of Integrated Coastal Defense, Governance and Social Capital, and Community Resilience.

4.1.1 Integrated Coastal Defense (ICD)

1. ICD1 (Infrastructure readiness) – 0.81: This shows that infrastructure readiness (e.g., seawalls, ports, and surveillance systems) is a strong reflection of the ICD construct. A loading above 0.80 means that respondents consistently perceive physical infrastructure as a key dimension of coastal defense.
2. ICD2 (Ecological protection) – 0.84: This is the highest loading among ICD indicators, indicating that ecosystem-based measures (e.g., mangrove restoration and zoning policies) are even more strongly associated with ICD than traditional hard infrastructure. This highlights the importance of ecological sustainability in modern defence strategies.
3. ICD3 (Defense coordination) – 0.79: Although slightly lower than the others, this value still exceeds the threshold, suggesting that inter-agency coordination (navy, local government, and communities) is an essential but relatively more variable aspect of ICD.

4.1.2 Governance and Social Capital (GSC)

1. GSC1 (Participation) – 0.82: This confirms that active community involvement in decision-making significantly reflects governance quality and social capital.
2. GSC2 (Trust) – 0.85: This indicator reflects the level of trust between communities and institutions, including government agencies and naval authorities, which is essential for strengthening governance effectiveness and collaborative decision making.
3. GSC3 (Collaborative governance) – 0.88: The strongest loading in the entire table, showing that shared governance mechanisms and partnerships are the most defining element of GSC. This suggests that collaboration adds the greatest explanatory value to the resilience outcomes.

4.1.3 Community Resilience (CR)

1. CR1 (Adaptive capacity) – 0.83: This reflects the community's ability to adjust and reorganize in response to maritime challenges such as climate change. This is a key factor in resilience.
2. CR2 (recovery speed) – 0.80: This demonstrates that the speed at which communities recover after disruptions (storms, security incidents) is an important but slightly less consistent dimension compared to others.

3. CR3 (Livelihood security) – 0.86: The highest loading for CR, indicating that stable and secure livelihoods are the strongest reflection of resilience. Without livelihood security, resilience remains fragile, even when adaptation and recovery mechanisms are established.

4.1.4 Conclusion from Outer Loadings

1. All indicators exceeded the recommended threshold of 0.70, establishing convergent validity.
2. The strongest indicators for each construct were ICD2 (ecological protection), GSC3 (collaborative governance), and CR3 (livelihood security).
3. These results suggest that ecological sustainability, inclusive governance, and secure livelihoods are the most critical elements for explaining maritime resilience in Indonesia's coastal community.

4.2 Path Coefficients and Hypothesis Testing

Path coefficients (β) in SEM-PLS represent the strength and direction of the relationship between constructs. A higher β indicates a stronger effect, whereas the p-value indicates whether the effect is statistically significant. In this study, all p-values were below 0.05, indicating that all proposed hypotheses were supported.

Table 2. Structural Model Results and Hypothesis Testing

Hypotheses	Structural Path	Path Coefficient (β)	p-value	Result
H_1	ICD → GSC	0.52	<0.001	Supported
H_2	GSC → CR	0.41	0.004	Supported
H_3	ICD → CR	0.29	0.021	Supported
H_4	ICD → GSC → CR	0.21	0.008	Supported

Structural Model:

- $R^2 = 0.68$ for Community Resilience (strong explanatory power).

Model Fit:

- SRMR = 0.063 (acceptable).
- Predictive relevance ($Q^2 > 0$).

The structural model results indicate that all the proposed hypotheses are supported. Integrated Coastal Defense significantly influenced Governance and Social Capital (β = 0.52, p < 0.001), which, in turn, had a significant positive effect on Community Resilience (β = 0.41, p = 0.004). Integrated Coastal Defense also had a direct influence on Community Resilience (β = 0.29, p = 0.021). Furthermore, mediation analysis confirmed that Governance and Social Capital partially mediated the relationship between Integrated Coastal Defense and Community Resilience (β = 0.21, p = 0.008). The structural model shows strong explanatory power with an R^2 value of 0.68 for Community Resilience, indicating that 68% of the variance in resilience is explained by Integrated Coastal Defense and Governance and Social Capital. The model fit index also showed acceptable results, with an SRMR of 0.063, indicating a good fit between the proposed model and the observed data.

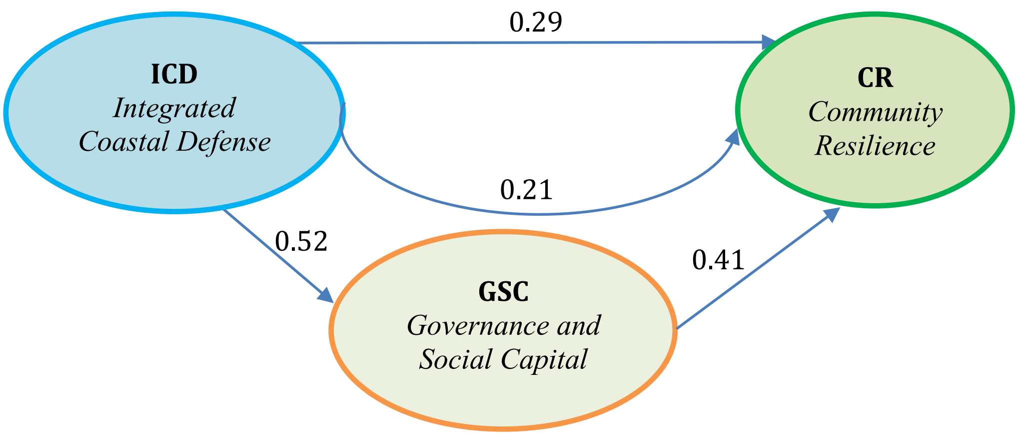

Figure 2. Path coefficients value

ICD → GSC ($\beta = 0.52$, $p < 0.001$, Supported)

1. This path indicates a strong and highly significant effect of Integrated Coastal Defense (ICD) on Governance and Social Capital (GSC).
2. The β value of 0.52 suggests that well-developed coastal defense strategies (infrastructure readiness, ecological protection, and defense coordination) substantially improve governance quality and social cohesion.
3. This means that physical and ecological defense strategies do not work in isolation; they stimulate collaboration, trust, and participation among communities, governments, and naval institutions.
4. The very low p-value (<0.001) confirms that this relationship is robust and not due to random variation.

GSC → CR ($\beta = 0.41$, $p = 0.004$, Supported)

1. This shows that Governance and Social Capital have a significant positive effect on Community Resilience (CR).
2. The β value of 0.41 indicates a moderate but important effect: the stronger the governance structures and social capital (participation, trust, collaboration), the more resilient communities become in terms of adaptation, recovery, and livelihood security.
3. In other words, community resilience is not only about external defense measures but also about how well communities organize themselves socially and institutionally.

ICD → CR ($\beta = 0.29$, $p = 0.021$, Supported)

1. This direct path shows that Integrated Coastal Defense also has a significant positive effect on Community Resilience, even without considering governance as a mediator.
2. The β value of 0.29 suggests a moderate, direct effect. Infrastructure and ecological defenses directly help communities adapt to and recover from threats such as storms, IUU fishing, and security challenges.
3. However, the effect is smaller than that of the mediated pathway (ICD → GSC → CR), showing that defense strategies are more effective when combined with governance mechanisms.

ICD → GSC → CR ($\beta = 0.21$, $p = 0.008$, Supported)

1. This represents the indirect effect (mediation) of ICD on CR via the GSC.
2. The β value of 0.21 indicates that part of ICD's impact on community resilience is channelled through improved governance and stronger social capital.
3. The significant p-value (0.008) indicates that this mediation effect is statistically supported.
4. Importantly, this highlights the mechanism of resilience: physical and ecological defence strategies improve governance and collaboration, which in turn enhances resilience outcomes.

From a strategic management perspective, the β value of 0.52 (ICD → GSC) indicates that coastal defense investment acts as an institutional catalyst rather than a purely physical intervention. This suggests that infrastructure development triggers governance improvements, including coordination and trust building. Meanwhile, the β value of 0.41 (GSC → CR) confirms that resilience is largely socially constructed, reinforcing the argument that governance quality determines the effectiveness of physical defense systems.

Key Insights from Table 2. Path Coefficients and Hypothesis Testing, all four hypotheses are supported, confirming the robustness of the conceptual framework, the strongest direct relationship is between ICD and GSC ($\beta = 0.52$), showing that coastal defense strongly drives governance improvements, the indirect effect (ICD → GSC → CR, $\beta = 0.21$) highlights the importance of governance as a mediating factor that amplifies the impact of defense strategies, these results validate the argument that community resilience is multidimensional, requiring both physical defenses and strong governance-social foundations.

The structural model demonstrated strong explanatory power, with an R^2 value of 0.68 for Community Resilience (CR). This indicates that 68% of the variance in community resilience is explained jointly by Integrated Coastal Defense (ICD) and Governance and Social Capital (GSC). In the context of social and policy-oriented research, an R^2 value above 0.50 is generally considered substantial (Hair et al., 2019), suggesting that the proposed model provides a meaningful predictive capability. Practically, this implies that improvements in coastal defense strategies and governance mechanisms can account for a significant proportion of the resilience outcomes in coastal communities. Therefore, the model is not only statistically robust but also practically relevant to policy formulation.

In addition to R^2, the effect size (f^2) values were assessed to determine the individual contribution of each exogenous construct to the endogenous variables. The effect of ICD on GSC yielded a medium-to-large effect size ($f^2 \approx 0.37$), indicating that coastal defense strategies substantially strengthen governance and social capital. The effect of GSC on CR showed a medium effect size ($f^2 \approx 0.22$), suggesting that governance and social cohesion meaningfully enhance resilience outcomes. Meanwhile, the direct effect of ICD on CR demonstrated a small-to-medium effect size ($f^2 \approx 0.12$), indicating that although infrastructure contributes directly to resilience, its influence is more significant when mediated through governance mechanisms.

From a practical standpoint, these f^2 values reinforce the importance of an integrated policy design. While infrastructure investments alone yield measurable benefits, their greatest impact occurs when they foster governance quality and social capital simultaneously. The combined interpretation of R^2 and f^2 therefore confirms that the model not only explains a substantial proportion of resilience variance but also identifies the pathways that generate the most practically significant effects. This provides actionable guidance for policymakers: prioritizing coordinated governance and community engagement, alongside physical defense development, will produce stronger and more sustainable resilience outcomes.

4.3 Discussion

The results of this study provide strong empirical support for the proposed integrated framework linking Integrated Coastal Defense (ICD), Governance and Social Capital (GSC), and Community Resilience (CR). Overall, the structural model explains 68% of the variance in community resilience ($R^2 = 0.68$), indicating that the combination of physical/ ecological defense measures and social-institutional factors offers considerable explanatory power for maritime resilience in the sampled Indonesian coastal areas. Below, I discuss the findings in relation to each research question and the corresponding hypotheses, draw theoretical and policy implications, and identify limitations and avenues for future research (Adi, Aritonang, Bahri, Aswirawan, & Putri, 2025).

4.3.1 RQ_1: To what extent do integrate coastal defense strategies influence community resilience?

Empirical finding

The direct path ICD → CR was positive and statistically significant ($\beta = 0.29$, $p = 0.021$). In addition, ICD had a substantial indirect effect on CR through GSC (indirect $\beta = 0.21$, $p = 0.008$). Therefore, the total effect of ICD on CR was the sum of the direct and indirect effects: 0.29 (direct) + 0.21 (indirect) = 0.50 (total effect). A total effect of 0.50 indicates that integrated coastal defense strategies (both hard and soft measures) exert a large and practically meaningful influence on the resilience of the community. The direct effect ($\beta = 0.29$) shows that infrastructure readiness and ecological protection have an independent capacity to reduce vulnerability and speed up recovery (e.g., seawalls, mangroves, and surveillance). The sizable indirect pathway ($\beta = 0.21$) demonstrates that part of the ICD benefit operates by strengthening governance arrangements and social capital, suggesting that defense investments are more effective when they create or support institutional coordination and community engagement. This result aligns with the ecosystem-based coastal defense literature that emphasizes the co-benefits of combining structural and nature-based measures (Temmerman et al., 2013; Spalding et al., 2014).

4.3.2 RQ_2: What Role do Governance and Social Capital Play in Mediating This Relationship?

Empirical Finding

ICD → GSC ($\beta = 0.52$, $p < 0.001$) and GSC → CR ($\beta = 0.41$, $p = 0.004$) were both statistically significant. The mediation analysis (ICD → GSC → CR) yielded $\beta = 0.21$ ($p = 0.008$), indicating a significant indirect effect of ICD on CR. Because the direct effect ICD → CR remained significant even after including the GSC, the pattern was best characterized as partial mediation. Interpretation Governance and social capital function as critical organizational mechanisms through which physical and ecological defense strategies are translated into sustainable community resilience. The strong ICD → GSC path ($\beta = 0.52$) suggests that investments in coastal defense tend to catalyze institutional coordination, partnerships, and trust—whether through joint surveillance systems, co-managed restoration projects, or multi-stakeholder planning. In turn, stronger GSC ($\beta = 0.41$ → CR) improves adaptive capacity, information sharing, and community-led recovery, which are essential for resilience. Practically, this implies that ICD projects that do not explicitly incorporate governance-building and community participation will forgo important resilience gains.

From a resource management perspective, the significant relationship between governance, social capital, and community resilience highlights the importance of management capacity and stakeholder engagement in resilience building processes. Effective governance requires not only institutional frameworks but also competent human resources capable of facilitating coordination, communication and collaborative decision-making. In coastal governance systems, government officers, naval personnel, and community leaders function as key actors whose management and participatory practices influence the effectiveness of integrated coastal defense strategies. When organizations promote employee engagement, knowledge sharing, and inclusive participation, they strengthen the institutional capacity needed to translate policy initiatives into practical resilience outcomes. Therefore, governance and social capital can be interpreted as critical organizational capabilities that enhance the effectiveness of human resource coordination across government and community institutions.

4.3.3 RQ3: How can SEM-PLS Provide Empirical Evidence for the Multidimensional Nature of Maritime Resilience?

The measurement model produced high outer loadings (> 0.79) and acceptable reliability/validity, and the structural model yielded meaningful path coefficients with significance established via bootstrapping (5,000 re-samples). The model's $R^2 = 0.68$ for CR, shows strong explanatory power for a social–ecological construct.

Interpretation SEM-PLS is particularly well suited for this study for three reasons: (1) it allows the simultaneous estimation of measurement and structural components for latent socio-ecological constructs; (2) it accommodates composite/multi-indicator constructs (ICD, GSC, CR) and focuses on prediction and explanation; and (3) bootstrapping provides robust significance tests for direct and indirect (mediated) effects (Hair et al., 2019). In short, SEM-PLS offers a coherent, empirical way to operationalize and test the multidimensionality of maritime resilience, bringing the physical, social, and governance dimensions into a single quantitative framework.

4.3.4 Hypotheses Evaluation (H_1–H_4)

H_1: ICD → GSC ($\beta = 0.52$, $p < 0.001$)

The results indicate a strong causal link between integrated coastal defense measures and governance and social capital. This suggests that ICD investments often produce institutional coordination and community engagement (e.g., co-management arrangements and joint patrols), consistent with adaptive governance theory (Gu et al., 2023).

H_2: GSC → CR ($\beta = 0.41$, $p = 0.004$)

Governance mechanisms and social capital significantly contribute to resilience. This reinforces the view that trust, participation, and collaboration are not peripheral; they are central drivers enabling communities to adapt and recover.

H_3: ICD → CR ($\beta = 0.29$, $p = 0.021$)

Physical and ecological defence measures exert a direct positive effect on resilience. While important, the magnitude is smaller than the ICD → GSC path, underscoring that infrastructure works best when combined with social and institutional measures.

H_4: ICD → GSC → CR (indirect $\beta = 0.21$, $p = 0.008$)

The mediation is statistically meaningful: a sizable portion of the ICD's effect on CR is channeled through governance and social capital. Given that the direct effect remains significant, the ICD's influence operates by changing institutional/social conditions and by providing immediate physical protection.

From a management perspective, the findings of this study demonstrate that community resilience can be interpreted as an outcome of organizational performance within coastal governance system. The significant relationships between integrated coastal defense, governance, and resilience indicate that the effectiveness of coastal defense strategies depends not only on physical infrastructure but also on how well organizations manage resources, coordinate with stakeholders, and implement policies. Thus, governance and social capital function as critical mechanisms that translate strategic resources into measurable performance outcomes.

The results also highlight the importance of policy management in public sector organizations involved in coastal defence. Effective policy implementation requires alignment between strategic planning, resource allocation and stakeholder engagement. The strong effect of governance and social capital on community resilience suggests that institutions with higher levels of coordination, trust, and participation are better able to deliver effective policy outcomes. Therefore, coastal defense policies should be designed not only as infrastructure programs but also as integrated management systems that emphasize collaboration, accountability, and governance.

From a managerial perspective, these findings have several important implications. First, policymakers and coastal managers should prioritize developing organizational capabilities, including leadership, coordination mechanisms, and stakeholder engagement strategies. Second, investments in coastal infrastructure should be complemented by management capacity building to ensure the effective utilization of resources. Third, strengthening social capital through community participation and trust-building initiatives can significantly enhance the effectiveness of coastal defense programs in the long term. These managerial actions are essential for maximizing the impact of integrated coastal defense on long-term resilience outcomes.

These findings reinforce the strategic management argument that sustainable performance is achieved through aligning resources and capabilities. In the context of coastal defense, infrastructure alone is insufficient to produce optimal outcomes unless supported by strong governance systems and organizational capabilities. This highlights the need for a shift from a purely infrastructure-based approach to a more integrated, management-oriented framework that combines strategic resources, organizational capabilities, and performance evaluation.

4.3.5 Theoretical Implications

Integration of defense and resilience literature. The findings empirically bridge engineering/ecosystem-based coastal defense and social resilience literature, showing that these domains should be treated as interdependent rather than separate research programs (Temmerman et al., 2013). Governance as a mechanism of resilience. The partial mediation demonstrates that governance and social capital are not mere correlates but active mechanisms that amplify the effectiveness of ICD, advancing the theory of adaptive governance and polycentricity. Operationalizing resilience: By successfully measuring ICD, GSC, and CR as latent constructs with high convergent validity, this study offers an operational template for future quantitative resilience research using the SEM-PLS method.

4.3.6 Practical Strategies and Policy Implications

In addition to infrastructure and ecological interventions, strengthening human resource capacity is essential for the successful implementation of integrated coastal defense strategies in China. Governments should invest in management development programs, capacity-building initiatives for local officials, and community training programs that enhance collaboration between government institutions and coastal communities. By developing management competencies and fostering participatory organizational cultures, coastal management institutions can improve coordination, trust, and collective action among all stakeholders. Such human resource strategies ensure that coastal defense policies are technically sound, socially sustainable, and institutionally supported.

Design ICD projects with governance-building components. Coastal defense programs (hard and green) should include formal mechanisms for community participation, joint monitoring, and maintenance agreements to realize the full resilience benefits. Prioritize nature-based interventions in addition to engineered solutions. Given the high loading of ecological protection on ICD in the measurement results, policymakers should invest in mangrove restoration and living shorelines as cost-effective, multi-benefit strategies.

Investing in social capital and livelihoods. Programs that strengthen trust, collaborative governance, and livelihood security (e.g., alternative livelihood training and microfinance) will increase the community-level return on ICD investments. ICD as an entry point for institutional reform. Given ICD's strong effect on GSC, defence and infrastructure investments can be strategically used to catalyze cross-agency coordination (navy, local government, resource agencies) and community co-management.

Together, these findings show that integrated coastal defense is necessary but not sufficient on its own; it achieves its greatest impact on community resilience when explicitly linked to governance reforms and investments in social capital. For maritime nations such as Indonesia, the evidence supports a policy pivot from siloed infrastructure programs toward integrated, participatory coastal resilience strategies that combine engineering, ecology, and institutional strengthening.

5. Conclusion

5.1 Conclusion

The findings of this study confirm that integrated coastal defense significantly enhances community resilience, both directly and indirectly. Governance and social capital function as critical mediating mechanisms, demonstrating that infrastructure alone is insufficient without effective management, institutional coordination, and community participation. By empirically validating these relationships through a Structural Equation Modeling approach, this study contributes to the literature by integrating physical defense systems with the social and organizational dimensions of resilience. The results highlight that resilience in coastal and maritime contexts emerges from the dynamic interaction between infrastructure development, ecological protection, governance structures and collaborative human resource engagement.

From a resource management perspective, the findings underscore the importance of management capacity, stakeholder coordination, and participatory governance in implementing integrated coastal-defense strategies. Government agencies, naval institutions, and local organizations require competent human resources capable of facilitating communication, collaboration, and collective decision-making across their institutional boundaries. Therefore, strengthening management competencies and organizational coordination can enhance the effectiveness of coastal defense programs and ensure that infrastructure investments translate into sustainable resilience outcomes.
In practical terms, policymakers should design coastal defense strategies that integrate infrastructure development, human resource capacity building and community engagement. Management training for coastal governance institutions, collaborative planning mechanisms between naval authorities and local communities, and community-based resilience programs can strengthen institutional trust and participation in the Philippines. For example, coordinated patrol programs involving naval personnel and local fishing communities in the Natuna region can enhance maritime security while fostering community engagement in the region. Similarly, capacity-building programs for coastal officials and community leaders in the Malacca Strait and Sulawesi Sea regions can improve disaster preparedness, knowledge sharing, and adaptive responses to maritime threats.

Overall, this study demonstrates that integrated coastal defense is most effective when physical protection measures are supported by strong governance systems and competent human resources. By aligning infrastructure development with management capacity, institutional coordination, and community participation, Indonesia and other archipelagic states can develop more resilient and sustainable coastal management systems.

5.2 Research Limitations

This study has several limitations that should be acknowledged. First, the cross-sectional research design captured respondents' perceptions at a single point in time. Although the structural model allows for the examination of directional relationships among constructs, causal inferences remain limited and would be strengthened through longitudinal or panel data designs that observe changes over time. Second, the study relied on self-reported measures, which may have introduced common method bias and perceptual subjectivity. While the use of SEM-PLS and bootstrapping enhances statistical robustness, future research would benefit from integrating objective indicators, such as remote-sensing data on mangrove coverage, documented maritime incident records, or verified economic performance metrics, to triangulate survey findings. Third, the geographic scope of the sample was confined to three strategic Indonesian maritime zones. Although these areas are highly relevant, caution should be exercised when generalizing the findings beyond comparable archipelagic and tropical contexts to other regions. Finally, the model does not explicitly incorporate certain potentially influential external variables such as shifts in national maritime policy, variations in external funding, or transboundary geopolitical tensions. Including these factors in expanded models may provide a more comprehensive understanding of the multidimensional drivers of maritime resilience in the future.

5.3 Suggestions and Directions for Future Research

Although this study provides important insights into the relationship between integrated coastal defense and community resilience, several directions for future research can further strengthen this field. First, longitudinal or quasi-experimental designs are recommended to examine how investments in Integrated Coastal Defense (ICD) influence Governance and Social Capital (GSC) and Community Resilience (CR) over time. Such approaches would enhance causal interpretation and provide a clearer understanding of the long-term sustainability of the resilience strategies.

Second, future studies should adopt mixed-methods approaches by combining SEM-PLS with qualitative case studies or in-depth interviews. While quantitative analysis identifies structural relationships among variables, qualitative inquiry can help explain how trust-building, collaboration, and adaptive practices develop in real-world coastal settings.

Third, comparative research across ASEAN countries or the wider Indo-Pacific region would help assess the robustness of the proposed framework in different institutional and sociopolitical contexts. Finally, incorporating objective environmental and security indicators, such as satellite data or official maritime incident records, would improve data triangulation and strengthen the overall validity of resilience assessments.

Author Contributions

DH was responsible for the conceptualization, research design, development of the theoretical framework, data collection, formal analysis using SEM-PLS, interpretation of results, and the primary drafting of the manuscript. AA handled the methodological validation, supervision of data analysis, critical revision of the manuscript for important intellectual content, and refinement of the discussion and policy implications. Both authors contributed to the final review, editing, and approval of the manuscript prior to its submission.

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References

Adi, R., Aritonang, M. A. S., Bahri, M. I., Aswirawan, M. Y. M. S. K., & Putri, R. L. (2025). An Examination of the Influence of Blue Economy Digital Technology on the Economic

Advancement of Fishermen in Batam. *Jurnal Akuntansi, Keuangan, dan Manajemen, 7*(1), 257-270. doi:https://doi.org/10.35912/jakman.v7i1.5103
Aerts, J. C., Botzen, W. W., Emanuel, K., Lin, N., De Moel, H., & Michel-Kerjan, E. O. (2014). Evaluating flood resilience strategies for coastal megacities. *Science, 344*(6183), 473-475. doi:https://doi.org/10.1126/science.1248222
Aldrich, D. P., & Meyer, M. A. (2015). Social capital and community resilience. *American behavioral scientist, 59*(2), 254-269. doi:https://doi.org/10.1177/0002764214550299
Ali, E. (2021). The impacts of Triple-A supply chain on supply chain performance in Ethiopian textile share company. *International Journal of Financial, Accounting, and Management, 3*(3), 245-258. doi:https://doi.org/10.35912/ijfam.v3i3.633
Ali, E., & Ayelign, A. (2022). The Impacts Of Port Characteristics And Port Logistics Integration On Port Performance In Ethiopian Dry Ports. *International Journal of Financial, Accounting, and Management, 4*(2), 163-181. doi:https://doi.org/10.35912/ijfam.v4i2.709
Alongi, D. M. (2015). The impact of climate change on mangrove forests. *Current Climate Change Reports, 1*(1), 30-39. doi:https://doi.org/10.1007/s40641-015-0002-x
Baldacchino, G. (2018). Seizing history: development and non-climate change in Small Island Developing States. *International Journal of Climate Change Strategies and Management, 10*(2), 217-228. doi:https://doi.org/10.1108/IJCCSM-02-2016-0025
Charuka, B., Angnuureng, D. B., & Agblorti, S. K. (2023). Contemporary global coastal management strategies and coastal infrastructure and their application in Ghana: a systematic literature review. *Sustainability, 15*(17), 12784. doi:https://doi.org/10.3390/su151712784
Cooley, S., Schoeman, D., Bopp, L., Boyd, P., Donner, S., Kiessling, W., . . . Rost, B. (2023). Oceans and coastal ecosystems and their services. doi:https://www.researchgate.net/publication/359668711_Oceans_and_Coastal_Ecosystems_and_their_Services
Dirman, E. N., Riniwati, H., Harahab, N., Semedi, B., & Rachmansyah, A. (2024). Developing eco-fishing ports in East Java: A structural equation modeling analysis. *International Journal of Design & Nature and Ecodynamics, 19*(4), 1109-1119. doi:https://doi.org/10.18280/ijdne.190402
Folke, C. (2016). Resilience (republished). *Ecology and society, 21*(4). doi:https://doi.org/10.5751/ES-09088-210444
Gu, D., Dillard, M., Gerst, M., & Loerzel, J. (2023). Validating commonly used indicators for community resilience measurement. *Natural hazards review, 24*(2), 04023008. doi:https://doi.org/10.1061/NHREFO.NHENG-1642
Idajati, H., & Damanik, J. (2025). Modeling community resilience to climate change impacts in tourism destinations: the roles of social and cultural capital. *Asia Pacific Journal of Tourism Research*, 1-20. doi:https://doi.org/10.1080/10941665.2025.2518559
Kent, P., Abolfathi, S., Al Ali, H., Sedighi, T., Chatrabgoun, O., & Daneshkhah, A. (2024). Resilient coastal protection infrastructures: probabilistic sensitivity analysis of wave overtopping using Gaussian process surrogate models. *Sustainability, 16*(20), 9110. doi:https://doi.org/10.3390/su16209110
Kraan, M., Groeneveld, R., Pauwelussen, A., Haasnoot, T., & Bush, S. R. (2020). Science, subsidies and the politics of the pulse trawl ban in the European Union. *Marine Policy, 118*, 103975. doi:https://doi.org/10.1016/j.marpol.2020.103975
Li, J., & van de Lindt, J. W. (2025). Quantifiable community resilience solutions for coastal communities over long time horizons. *International Journal of Disaster Risk Reduction, 127*, 105682. doi:https://doi.org/10.1016/j.care.2025.01.003
Major, D. C., Lehmann, M., & Fitton, J. (2018). Linking the management of climate change adaptation in small coastal towns and cities to the Sustainable Development Goals. *Ocean & coastal management, 163*, 205-208. doi:https://doi.org/10.1016/j.ocecoaman.2018.06.010
Narendr, A., Aithal, B. H., & Das, S. (2024). A data-driven framework for enhancing coastal flood resilience in resource-crunched developing nations. *Geomatics, Natural Hazards and Risk, 15*(1), 2396892. doi:https://doi.org/10.1080/19475705.2024.2396892

Neumann, B., Vafeidis, A. T., Zimmermann, J., & Nicholls, R. J. (2015). Future coastal population growth and exposure to sea-level rise and coastal flooding-a global assessment. *PloS one, 10*(3), e0118571. doi:https://doi.org/10.1371/journal.pone.0118571

Ochwo, B. O., & Mwesigwa, D. (2021). Reward strategies and job satisfaction in private companies: a case of Uganda Breweries-Luzira. *Annals of Human Resource Management Research, 1*(1), 69-83. doi:https://doi.org/10.35912/ahrmr.v1i1.406

Oktari, R. S., Latuamury, B., Idroes, R., Sofyan, H., & Munadi, K. (2022). Validating knowledge creation factors for community resilience to disaster using structural equation modelling. *International Journal of Disaster Risk Reduction, 81*, 103290. doi:https://doi.org/10.1016/j.ijdrr.2022.103290

Pasca, P., De Simone, E., Ciavolino, E., Rochira, A., & Mannarini, T. (2023). A higher-order model of community resilience potential: development and assessment through confirmatory composite analysis based on partial least squares: P. Pasca et al. *Quality & Quantity, 57*(2), 1033-1054. doi:https://doi.org/10.1007/s11135-022-01400-1

Potamos, G., Stavrou, E., & Stavrou, S. (2024). Enhancing maritime cybersecurity through operational technology sensor data fusion: A comprehensive survey and analysis. *Sensors, 24*(11), 3458. doi:https://doi.org/10.3390/s24113458

Prakasa, Y., Sawu, M. R., & Ulinnuha, M. F. (2025). Community empowerment as a catalyst for marine ecotourism: The case of Spermonde Archipelago, Makassar. *Journal of Sustainable Tourism and Entrepreneurship, 6*(2), 79-91. doi:https://doi.org/10.35912/joste.v6i2.2421

Rochira, A., Marinaci, T., De Simone, E., Mannarini, T., Valentino, C., Ciavolino, E., . . . Pasca, P. (2023). The interplay of community resilience potential, trust in the future and social well-being. *Journal of Community & Applied Social Psychology, 33*(6), 1455-1473. doi:https://doi.org/10.1002/casp.2737

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modeling *Handbook of market research* (pp. 587-632): Springer.

Shaffril, H. A. M., Abu Samah, A., & Samsuddin, S. F. (2022). The impacts of fishermen's resilience towards climate change on their well-being. *Sustainability, 14*(6), 3203. doi:https://doi.org/10.3390/su14063203

Si, Y., Liang, L., & Zhou, W. (2024). An evaluation of urban resilience using structural equation modeling from practitioners' perspective: an empirical investigation in Huangshi City, China. *Sustainability, 16*(16), 7031. doi:https://doi.org/10.3390/su16167031

Spalding, M. D., McIvor, A. L., Beck, M. W., Koch, E. W., Möller, I., Reed, D. J., . . . Wamsley, T. V. (2014). Coastal ecosystems: a critical element of risk reduction. *Conservation Letters, 7*(3), 293-301. doi:https://doi.org/10.1111/conl.12074

Tadjuddah, M., Wianti, N. I., La Ola, T., Suriana, Sadarun, B., & Taridala, S. A. A. (2023). Structural modeling of Sama Bajo fishers social resilience in a marine national park. *Modeling Earth Systems and Environment, 9*(1), 1051-1067. doi:https://doi.org/10.1007/s40808-022-01526-z

Temmerman, S., Meire, P., Bouma, T. J., Herman, P. M., Ysebaert, T., & De Vriend, H. J. (2013). Ecosystem-based coastal defence in the face of global change. *Nature, 504*(7478), 79-83. doi:https://doi.org/10.1038/nature12859