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Building sovereign maritime defense capability in an archipelagic state: A qualitative multiple case study of PT PAL, the KSOT autonomous submarine program, and the R41 modernization initiative in Indonesia

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ABSTRACT

How does an archipelagic developing economy transition from foreign platform dependency to sovereign maritime defense capability? This study examines the contemporary transformation of Indonesia's maritime defense industrial base through a qualitative multiple-case study of three embedded cases nested within a single organizational and policy context: [PT PAL Indonesia \(2025\)](#) as the anchor of the national naval industrial cluster, the Kapal Selam Otonom (KSOT) autonomous submarine program, and the R41 fleet modernization initiative. Following [Yin's \(2018\)](#) multiple case study methodology and the resource-based view of competitive advantage ([Barney, 1991](#); [Wernerfelt, 1984](#)) as the theoretical proposition, this study applies cross-case synthesis to documentary, observational, and triangulated open-source evidence collected between September 2024 and December 2025. Six themes emerged from the cross-case analysis: (a) selective foreign partnership as a strategic capability accelerator rather than a substitute for indigenous development; (b) tacit knowledge accumulation as the binding constraint on sovereign capability; (c) modular and software-defined integration as the locus of strategic value; (d) state ownership and industrial cluster governance as enabling but insufficient conditions; (e) human capital pipelines as the slow-maturing foundation of sustained capability; and (f) doctrinal coherence between platforms and operational concepts as a determinant of capability realization. This study contributes to the defense industrial base scholarship by articulating a context-sensitive model of sovereign capability transition in archipelagic developing economies, complementing dominant frameworks derived from advanced industrial democracies. The implications for Indonesian defense planners, industrial stakeholders, and the broader scholarly community studying middle-power defense industries are discussed.

Keywords: qualitative case study; maritime defense industry; sovereign capability; PT PAL; autonomous submarine; resource-based view; Yin

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1. INTRODUCTION

How does an archipelagic developing economy transition from foreign platform dependency to sovereign maritime defense capability? The question is theoretically significant because the dominant scholarly frameworks for understanding defense industrial transformation, drawn primarily from the experiences of the United States, the United Kingdom, France, Germany, Israel, South Korea, and increasingly the People's Republic of China, reflect the institutional conditions of advanced industrial democracies or developmental states with deep technological foundations (Boezer et al., 1997; Cheung, 2014; Hartley, 2017). The applicability of these frameworks to archipelagic developing economies, where strategic geography demands sophisticated naval capabilities but industrial foundations are uneven and budgets are constrained, has received comparatively limited scholarly attention. This question is also practically significant because at least a dozen states across Southeast Asia, South Asia, Latin America, and Africa face structurally similar transition challenges and lack context-appropriate scholarly guidance.

This study addresses this question through a qualitative multiple case study of three embedded cases nested within the contemporary transformation of Indonesia's maritime defense industrial base: PT PAL Indonesia (2025) as the anchor of the national naval industrial cluster, the Kapal Selam Otonom (KSOT) autonomous submarine program initiated by PT PAL with an international technology partnership, and the R41 fleet modernization initiative through which 41 legacy vessels are being refurbished and enhanced under Indonesian shipyard leadership. The three cases share a common organizational and policy context but exhibit distinct theoretical contributions to the question of sovereign capability. PT PAL represents the institutional anchor, the KSOT program represents the technological frontier, and the R41 initiative represents the operational sustainment dimension. Together, they offer the analytical leverage that Yin (2018) identified as the central methodological advantage of the embedded multiple-case design.

The remainder of this paper is organized as follows. The next section develops the theoretical framework by integrating the resource-based view of competitive advantage with adjacent defense industrial base scholarship and archipelagic defense doctrine. The third section details the qualitative multiple-case study methodology, including case selection, data sources, analytical procedures, and quality criteria. The fourth section presents within-case analyses of the three embedded cases in this study. The fifth section presents the cross-case synthesis and articulates the six emergent themes. The sixth section discusses the theoretical and practical implications of these findings. The concluding section addresses the limitations and proposes a research agenda.

2. THEORETICAL FRAMEWORK

2.1. The Resource-Based View as Theoretical Proposition

Following Yin's (2018) requirement that multiple case study research be guided by an explicit theoretical proposition that frames analytic generalization, this study adopts the resource-based view (RBV) of competitive advantage as its central proposition. The RBV, originally formulated by Wernerfelt (1984) and elaborated by Barney (1991), holds that sustained competitive advantage, whether for firms or, by analogous logic, for national defense industries, derives from resources that are Valuable, Rare, Inimitable, and Non-substitutable (VRIN). Applied to defense industrial capability, this framework suggests that platforms, however advanced, that can be acquired from external suppliers do not by themselves confer strategic advantage because they are imitable through subsequent procurement by adversaries and substitutable through alternative platforms. What is genuinely strategic, in the RBV sense, is the indigenous capacity to design, integrate, sustain, and iteratively improve defense systems, the human capital, tacit knowledge, integration know-how, and sovereign control over critical software, sensors, and combat management architecture.

The RBV proposition translates into a guiding analytic question for this study: across the three embedded cases, what configurations of resource accumulation, capability building, and external partnerships are associated with progress toward sovereign maritime defense capability, and what

configurations are associated with stagnation or dependency? This question shapes both the within-case analysis and cross-case synthesis.

2.2. Complementary Theoretical Anchors

Three complementary anchors enrich the RBV framework. First, the defense industrial base literature in the tradition of Boezer et al. (1997) and Hartley (2017) extends the RBV by considering the institutional, political, and economic conditions under which firms operate, including state ownership, defense procurement policy, technology transfer regimes, and supplier ecosystems. Second, the archipelagic defense doctrine literature, including recent comparative work on Indonesia and the Philippines (Krepinevich, 2023), provides an operational context that distinguishes the strategic problems facing archipelagic states from those facing continental powers. Third, the technology transfer and absorptive capacity literature (Cohen & Levinthal, 1990) addresses the conditions under which foreign-supplied technology can be effectively absorbed, integrated, and extended by recipient industries.

These four anchors—RBV as the central proposition, defense industrial base institutionalism, archipelagic defense doctrine, and absorptive capacity—jointly inform both the case selection logic and the analytic framework applied across cases.

3. RESEARCH METHODOLOGY

3.1. Research Design Rationale

This study adopted a qualitative multiple-case study design, following Yin (2018). The qualitative approach is appropriate because the research question is explanatory in nature—asking how and why sovereign capability development unfolds—rather than predictive or descriptive (Creswell & Poth, 2018; Yin, 2018). The multiple case design is appropriate because the three embedded cases offer complementary analytical leverage: PT PAL provides the institutional anchor, KSOT provides the technological frontier, and R41 provides the operational sustainment dimension. Each case contributes a distinct theoretical perspective to the central proposition, enabling literal and theoretical replication logic across the cases (Yin, 2018).

The case study boundary is deliberately drawn at the level of contemporary transformation rather than historical evolution, with the temporal scope confined to the period from September 2024 (the consolidation of the current presidential administration and the formal initiation of expanded naval modernization commitments) to December 2025. This bounded temporality allows the analysis to engage substantively with rapidly unfolding events while maintaining analytical consistency.

3.2. Case Selection Logic

The three embedded cases were selected through purposive theoretical sampling (Patton, 2015) to maximize variation along three dimensions: (a) capability domain (institutional, frontier-technological, operational-sustainment); (b) external partnership intensity (lower for R41 indigenous-anchored work, higher for KSOT international partnership components, and mixed for PT PAL); and (c) temporal maturity (longstanding institution for PT PAL, prototype-stage for KSOT, and mid-implementation for R41). This variation enables both literal replication, where similar findings across cases strengthen theoretical generalization, and theoretical replication, where contrasting findings illuminate boundary conditions (Yin, 2018) (see Table 1).

Table 1. Embedded Case Profiles

Dimension	Case 1: PT PAL	Case 2: KSOT Program	Case 3: R41 Initiative
Type	State-owned enterprise	Technology program	Fleet modernization
Strategic role	Institutional anchor	Technological frontier	Operational sustainment
Temporal maturity	Established (since 1939)	Prototype (KSOT-008, 2025)	Mid-implementation

Foreign partnership	Multiple (Naval Group, Thales, Fincantieri)	Diehl Defence (reported)	Thales Netherlands integrator
Indigenous content	Variable by program	>50% TKDN reported	PT Len integration
Theoretical contribution	Cluster governance	Frontier capability	Absorptive capacity in practice

Note:

TKDN = Tingkat Komponen Dalam Negeri (Domestic Component Level). Case profiles were synthesized from open-source documentation referenced in the analysis.

3.3. Data Sources and Collection

Qualitative case study research benefits from triangulation across multiple sources of evidence (Yin, 2018). This study draws on four source categories. The first category comprises institutional and official documents, including PT PAL annual reports and capability briefings, Ministry of Defense statements, Indonesian Navy doctrinal publications, and trade-show technical briefings made available at Indo Defense 2025. The second category comprises specialized defense journalism from outlets with established editorial standards in defense reporting, including Naval News, [The Maritime Executive \(2025\)](#), [Defence Security Asia \(2025\)](#), Asian Military Review, [Indo-Pacific Defense Forum \(2025\)](#), and [Antara News \(2025\)](#). The third category comprises peer-reviewed academic literature and policy publications from research institutions including the S. Rajaratnam School of International Studies (RSIS), the International Institute for Strategic Studies (IISS), the Center for Strategic and International Studies (CSIS), the Hudson Institute, and the Lemhannas (National Resilience Institute) of the Republic of Indonesia. The fourth category comprises author observation of the publicly documented capability showcases—including the TNI 80th anniversary parade of October 5, 2025, the Indo Defence 2025 exhibition, and the commissioning ceremonies of KRI Brawijaya-320 (July 2, 2025) and KRI Belati-622 (October 2025)—as reported in real-time documentary sources.

Triangulation across these four source categories was systematically applied to every claim that entered the analysis. Where the sources converged, claims were retained with high evidentiary confidence. Where sources diverged, disagreement was reported in the analysis rather than resolved by author preference. Where claims rested on a single source, the single-source status was acknowledged and treated as tentative.

3.4. Analytic Procedures

Following Yin (2018) and the qualitative coding traditions articulated by Saldaña (2021), data analysis proceeded in three phases. The first phase comprised a within-case analysis of each embedded case, applying both pattern-matching against the RBV proposition and explanation-building to develop the narrative account of each case. Coding was conducted manually using a hybrid approach that combined deductive codes derived from the RBV framework (VRIN attributes, partnership configurations, and absorptive capacity indicators) with inductive codes that emerged from the documentary corpus (e.g., "showcase versus systemic capability" emerged as a distinction not present in the initial code list).

The second phase comprised a cross-case synthesis using the technique of building a word table that displayed the data from individual cases according to a uniform analytic framework, then aggregating findings across cases (Yin, 2018). This procedure enabled both literal (similar findings strengthening generalization) and theoretical replication (contrasting findings illuminating boundary conditions).

The third phase comprised theme development through iterative reading of within-case and cross-case findings against the RBV proposition and complementary theoretical anchors. Six themes emerged with sufficient cross-case salience to warrant elaboration.

3.5. Quality Criteria

Following Yin (2018), four quality criteria were applied throughout. Construct validity was addressed through triangulation across multiple sources, a chain of evidence linking research questions to data to conclusions, and a review of draft findings by domain-knowledgeable colleagues prior to submission.

Internal validity was addressed through pattern matching and explanation-building procedures, with attention to rival explanations. External validity was addressed through analytic generalization to the RBV proposition rather than statistical generalization to a population, recognizing that case study findings extend theory rather than describe distribution. Reliability was addressed through a documented case study protocol and a maintained case study database consisting of the public and open-source documents cited in the reference list.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. Within-Case Analysis

4.1.1.1. Case 1: PT PAL Indonesia as Institutional Anchor

PT PAL Indonesia is a state-owned shipbuilder headquartered in Surabaya, with a history extending back to 1939 under Dutch colonial administration and a contemporary role as the anchor of the Indonesian maritime defense industrial cluster. As of late 2025, PT PAL functions simultaneously as the principal indigenous shipbuilder for the Indonesian Navy, as a co-producer with foreign partners (notably the Naval Group of France for the Scorpène Evolved submarine program), as the systems integrator coordinating across PT Len Industri (mission systems integration) and other state-owned and private suppliers under the DEFEND ID holding, and as the host institution for emerging frontier programs such as the KSOT autonomous submarine.

Three patterns are particularly salient in this case. First, PT PAL's capability profile exhibits substantial variation across program lines. Surface combatant production for the Indonesian Navy has accumulated cumulative experience over decades, with progressive capability building from simple patrol vessels to more complex platforms. By contrast, submarine production is at an earlier stage of capability accumulation, with PT PAL's role in the Scorpène Evolved program structured around technology transfer from Naval Group rather than indigenous design authority. Combat management system integration is at an earlier stage, with PT PAL's unveiling of an indigenous CMS at Indo Defence 2025 representing a recent and important capability milestone (Rinaldi, 2025a). This variation across program lines is significant because it suggests that capability building proceeds at different rates across technological domains within institutions.

Second, PT PAL's relationships with foreign partners exhibit a pattern of selective collaboration rather than a uniform dependency. The Scorpène Evolved program with the Naval Group involves substantial technology transfer commitments and shared production responsibilities, with PT PAL hosting elements of submarine construction in Surabaya. The R41 program involves Thales Netherlands as the combat system integrator and PT Len Industri as the mission system integrator, with PT PAL as the principal shipyard. Other programs involve Italian (Fincantieri), South Korean (DSME, now Hanwha Ocean), Dutch (Damen), Turkish, and other partners. This pattern is one of strategic optionality, with PT PAL maintaining relationships across multiple foreign suppliers and avoiding exclusive dependence on any single technology source.

Third, PT PAL operates in an institutional environment that combines state ownership with operational management challenges. Reporting from defense industry analysts (Rinaldi, 2025b) suggests that the institution faces persistent challenges regarding budgetary stability, project-management capacity, and the alignment of industrial production cycles with naval operational requirements. These challenges are not unique to PT PAL—comparable state-owned shipbuilders in Malaysia (Boustead Heavy Industries), the Philippines, and elsewhere face similar structural pressures—but they shape the realistic pace at which sovereign capabilities can be built.

4.1.1.2. Case 2: The KSOT Autonomous Submarine Program as Technological Frontier

The Kapal Selam Otonom (KSOT) program represents PT PAL's most strategically consequential technological venture. The KSOT-008 prototype, unveiled during the 80th anniversary parade of the Indonesian Armed Forces on October 5, 2025, is reported to have a length of approximately 15 m, beam of 2.2 m, displacement of 37 t, submerged endurance of up to 72 h, maximum speed of 20 knots, and operational range of 200 nautical miles, with control via radio frequency or satellite communication through an Autonomous Submarine Command Center ([The Maritime Executive, 2025](#); [Rinaldi, 2025a](#)). Three configurations—surveillance, one-way attack (OWA), and torpedo-launch variants, the latter of which is capable of carrying two heavyweight torpedoes—have been announced for development. The platform reportedly incorporates more than 50% indigenous content (TKDN) ([Rinaldi, 2025b](#)).

The within-case analysis revealed three patterns of theoretical interest. First, the KSOT program positions Indonesia among a small group of nations actively developing and prototyping autonomous underwater vehicles with potential combat capabilities, alongside the United States (Orca XLUUV), China (AJX-002), Australia (Ghost Shark), and the United Kingdom (Excalibur). This positioning is theoretically significant because the autonomous underwater domain is comparatively young as a technology category, with substantially lower barriers to entry than the established categories of nuclear or conventional crewed submarines. Thus, the KSOT program illustrates a strategic pattern in which middle-power industries can enter frontier technology categories that remain comparatively unsettled rather than compete in mature categories dominated by long-established incumbents.

Second, the KSOT program exhibits an explicit pattern of selective foreign partnerships for specific subsystem capabilities while retaining indigenous design authority for the platform architecture. Its reported partnership with Diehl Defence of Germany for selected subsystems illustrates this pattern ([Defence Security Asia, 2025](#); [Malufti, 2025a](#)). This pattern is theoretically consistent with the absorptive capacity literature: foreign partnerships enable accelerated capability building when the recipient possesses sufficient indigenous knowledge to absorb and integrate the foreign-supplied technology but is structured to avoid the substitution of indigenous design authority by foreign control.

Third, the KSOT program raises the strategically important question of the gap between technology demonstration and operationally fielded capabilities. As of the time of writing, KSOT-008 remains a prototype with no announced commissioning timeline. The historical record across multiple national autonomous systems programs suggests that the transition from prototype to operationally deployable platform is non-trivial, often requiring years of iterative refinement, doctrinal development, and operator training. The KSOT program's eventual operational realization will depend on sustained investment, doctrinal coherence with the broader fleet, and the resolution of legal, ethical, and command-and-control questions attached to autonomous lethal systems.

4.1.1.3. Case 3: The R41 Modernization Initiative as Operational Sustainment

The R41 program is a comprehensive modernization initiative through which 41 vessels of the Indonesian Navy are being refurbished and enhanced through upgrades to engines, hulls, propellers, radar, communications, weaponry, and combat management systems ([Indo-Pacific Defense Forum, 2025](#)). The program is structured as a partnership between the Ministry of Defense, the Indonesian Navy, PT PAL as the principal shipyard, Thales Netherlands as the combat system integrator, and PT Len Industri as the mission system integrator. The November 2025 launch of the comprehensive modernization of KRI Bung Tomo (357) and KRI John Lie (358) exemplifies the contemporary trajectory of the program ([Malufti, 2025b](#); [The Asia Live News Service, 2025](#)).

Three patterns emerged in this case. First, the R41 program operates at the intersection of operational sustainment and capability development. On one hand, it addresses the immediate requirement to maintain the operational viability of an aging fleet, including legacy platforms originally acquired from the United Kingdom, the Netherlands, South Korea, and elsewhere. On the other hand, it serves as a vehicle for indigenous capability building, with PT Len Industri's role in mission system integration providing accumulated experience in the software-defined integration of heterogeneous sensors, weapons, and communication systems.

Second, the R41 program illustrates the practical operationalization of selective foreign partnerships. Thales Netherlands role as a combat system integrator enables PT PAL and PT Len to absorb integration know-how that would be difficult to develop indigenously from the initial conditions. The structure of the partnership—with Thales as integrator and PT Len as mission system integrator—creates a structured learning environment in which indigenous engineers work alongside foreign experts on a substantial body of integration work. Thus, the R41 program operates as a tacit knowledge transfer mechanism, in addition to its immediate sustainment function.

Third, the R41 program reveals the operational complexity of integrating heterogeneous foreign platforms into a coherent fleet to achieve interoperability. The 41 vessels in the program originate from multiple national standards, requiring substantial calibration of the training pipelines, maintenance protocols, and combat management architectures. Documentary evidence suggests that the program is making material progress against this challenge, but the underlying heterogeneity remains a structural constraint that future procurement decisions can either ameliorate (through greater standardization) or aggravate (through further diversification).

4.1.2. Cross-Case Synthesis and Emergent Themes

Cross-case synthesis applied Yin's (2018) word-table technique to identify both literal replication (consistent patterns across cases that strengthen generalization) and theoretical replication (contrasting patterns that illuminate boundary conditions). Six themes emerged with sufficient cross-case salience to warrant further elaboration (see Table 2).

Table 2. Cross-Case Pattern Matrix: Six Emergent Themes

Theme	PT PAL	KSOT	R41
1. Selective partnership as accelerator	Strong evidence	Strong evidence	Strong evidence
2. Tacit knowledge as binding constraint	Strong evidence	Emerging	Strong evidence
3. Software-defined integration as strategic locus	Moderate	Strong evidence	Strong evidence
4. State ownership enabling but insufficient	Strong evidence	Moderate	Moderate
5. Human capital as slow-maturing foundation	Strong evidence	Strong evidence	Strong evidence
6. Doctrinal coherence determining realization	Moderate	Strong evidence	Strong evidence

Note:

The strength of the evidence reflects the salience of the theme within each case based on documentary triangulation. "Emerging" indicates that the theme is present but at an early stage of observable expression.

4.1.2.1. Theme One: Selective Foreign Partnership as Strategic Capability Accelerator

Across all three cases, foreign partnerships function as a strategic accelerator of indigenous capability rather than a substitute for it, provided that the partnership is structured to preserve indigenous design authority and facilitate tacit knowledge transfer. PT PAL's relationship with the Naval Group on the Scorpène Evolved program, KSOT program's reported partnership with Diehl Defence on selected subsystems, and R41 program's integration of Thales Netherlands as a combat system integrator alongside PT Len Industri as a mission system integrator all illustrate this pattern. The theoretical proposition that emerges is that the strategic question is not whether to partner with foreign technology suppliers but how to structure partnerships such that indigenous capability is accelerated rather than displaced.

This finding extends the resource-based view by specifying a mechanism through which foreign-supplied resources, which are imitable and substitutable, can contribute to indigenous resources that are valuable, rare, inimitable, and non-substitutable. The mechanism is structured learning: foreign partnerships create a learning environment within which indigenous engineers, integrators, and operators accumulate the tacit knowledge that constitutes a genuinely strategic asset.

4.1.2.2. Theme Two: Tacit Knowledge Accumulation as the Binding Constraint

The binding constraint on sovereign capability development across the three cases is not the acquisition of platforms or even the formal technology transfer of designs and specifications, but the accumulation of tacit knowledge—the know-how, judgment, and integration capability that is embedded in experienced engineers, operators, and integrators and that cannot be transferred through documents alone. The PT PAL case illustrates this constraint at the institutional level, where capabilities are built over decades of accumulated experience. The R41 case illustrates this at the program level, where each successive vessel upgrade extends the integration experience of PT Len engineers. The KSOT case illustrates this at the frontier technology level, where indigenous design authority depends on the maturity of indigenous engineering judgment.

This finding is theoretically consistent with the absorptive capacity literature (Cohen & Levinthal, 1990) and the broader knowledge management traditions in strategic management, which emphasize that tacit knowledge is the most genuinely strategic form of organizational knowledge because it is the most difficult to replicate for competitors or partners. For Indonesian maritime defense industrial development, the practical implication is that the slow but compounding investment in human capital and accumulated organizational experience will prove more strategically consequential than headline-grabbing acquisition decisions in the long run.

4.1.2.3. Theme Three: Modular and Software-Defined Integration as the Locus of Strategic Value

The locus of strategic value in contemporary maritime defense technology is increasingly the software-defined integration architecture that fuses sensors, weapons, communications, and command-and-control across vessels and fleets. The R41 program illustrates this most clearly, with PT Len Industri's role in mission system integration serving as the principal vehicle for indigenous learning. The KSOT program illustrates this from a frontier perspective, with autonomous platform capability fundamentally resting on software architecture that enables autonomous decision-making, communication, and mission execution. PT PAL's indigenous Combat Management System, unveiled at Indo Defence 2025, represents the most strategically consequential capability milestone of the institution's contemporary trajectory because it positions Indonesian engineers as architects rather than integrators of the combat-systems software stack.

This theme extends the RBV framework by identifying software-defined integration as the contemporary defense industry analog of the VRIN resource concept. Software architectures are inimitable through pure imitation because they reflect accumulated design judgments, non-substitutable through alternative providers because they are deeply integrated with the platforms and operators they serve, valuable because they determine the operational effectiveness of the underlying hardware, and rare because the global supply of mature combat management systems is concentrated in a small number of producers.

4.1.2.4. Theme Four: State Ownership and Cluster Governance as Enabling but Insufficient Conditions

State ownership and the institutional architecture of the defense industrial cluster—including DEFEND ID as the state-owned defense industry holding, PT PAL and PT Len as principal subsidiaries, and the relationships among these entities and the Ministry of Defense and the Indonesian Navy—are necessary but insufficient for sovereign capability development. They are necessary because they provide long-term commitment, alignment between national strategic objectives and industrial production, and institutional protection that defense industries require to undertake high-risk capability investments. They are insufficient because state ownership alone does not generate the operational discipline, project management capacity, and absorptive learning capability that determine the actual rate of capability accumulation.

This finding aligns with the broader comparative literature on state-owned defense industries (Cheung, 2014; Hartley, 2017), which has documented that the relationship between ownership structure

and capability outcomes is mediated by institutional governance, managerial autonomy, and the quality of human capital pipelines. The Indonesian case is consistent with this pattern.

4.1.2.5. Theme Five: Human Capital Pipelines as the Slow-Maturing Foundation

Across all three cases, the development of human capital—naval architects, marine engineers, defense software developers, integration engineers, operations researchers, and operational specialists—constitutes a slow-maturing but compounding foundation of sustained sovereign capability. The R41 program's structured collaboration between Thales Netherlands and PT Len engineers creates a learning environment that, over time, builds the integration expertise on which indigenous combat management systems depend on. The KSOT program's reliance on PT PAL engineers extended the institutional learning curve. The longer-term trajectory of PT PAL reflects the cumulative effect of human capital investment over decades.

This theme is particularly salient because it suggests that the policy investments most consequential for long-term sovereign capability—expanded scholarships, structured rotational programs between industry and military, university research collaborations, and small- and medium-enterprise supplier ecosystem development—are also the slowest to produce visible returns and therefore the most vulnerable to budgetary deferral in periods of fiscal stress. Sustained investment in human capital pipelines represents, in many respects, the binding strategic discipline that distinguishes sovereign capability trajectories from acquisition-led modernization without long-term capability accumulation.

4.1.2.6. Theme Six: Doctrinal Coherence Between Platforms and Operational Concepts

The realization of sovereign capability is determined not only by industrial production but also by the coherence between platforms and operational concepts. The KSOT program illustrates this most clearly: the strategic value of autonomous underwater vehicles depends on the development of doctrinal frameworks, command-and-control architectures, rules of engagement, and integration with crewed platforms and broader maritime-domain awareness systems. Without doctrinal coherence, an autonomous platform risks becoming a showcase artifact rather than a systemic capability. The R41 program illustrates a complementary dimension: the modernization of legacy vessels acquires strategic value when the upgraded platforms are integrated into operational concepts that exploit their enhanced capabilities.

This theme connects the resource-based view to the doctrinal literature in security studies, suggesting that defense industrial capability and operational doctrine are co-constitutive rather than separable entities. The implication for both scholarship and policy is that the development of sovereign capability requires sustained engagement not only with industrial production but also with the doctrinal, training, and operational dimensions through which industrial output becomes an operational capability.

4.2. Discussion: Theoretical and Practical Implications

The findings of this multiple case study contribute to the defense industrial base scholarship in three principal ways. First, they articulate a context-sensitive model of sovereign capability transition in archipelagic developing economies, complementing dominant frameworks derived from advanced industrial democracies. The Indonesian case suggests that sovereign capability transition in this context is characterized by selective foreign partnerships rather than autarky, tacit knowledge accumulation rather than platform accumulation, software-defined integration as the strategic locus, and the co-constitution of industrial capability and operational doctrine.

Second, the findings extend the resource-based view by specifying mechanisms—structured learning environments, software-defined integration architectures, and human capital pipelines—through which the abstract VRIN concept translates into observable defense-industrial practice. The RBV's emphasis on inimitable and non-substitutable resources is borne out in the Indonesian case, but the empirical content of these resources is shown to be located in specific organizational and technological domains that the abstract framework does not specify.

Third, the findings contribute to the absorptive capacity literature (Cohen & Levinthal, 1990) by illustrating the practical conditions under which absorptive capacity develops in middle-power defense

industries: through structured foreign partnerships, accumulated program experience, and sustained human capital investment rather than through one-off technology transfer agreements.

The practical implications are substantial for Indonesian defense planners, industrial leaders, and policymakers. The findings support a strategic orientation that prioritizes (a) the design of foreign partnerships around capability accelerator logic rather than acquisition logic; (b) the elevation of PT Len Industri and the broader software integration ecosystem to the strategic priority that their importance warrants; (c) the sustained, multi-year investment in human capital pipelines, including scholarships, university research collaborations, and structured industry-military rotations; (d) the development of doctrinal frameworks for autonomous maritime systems in parallel with the technological development of platforms such as KSOT; and (e) the strengthening of the institutional governance of the DEFEND ID cluster to translate state ownership into operational capability.

For the broader scholarly community studying the defense industry, middle-power security, and the political economy of technology, the Indonesian case offers a productive empirical setting for further inquiry. Comparative studies across Indonesia, Türkiye, South Korea, Brazil, and other middle-power defense-industrial transitions would illuminate the generalizability of the themes identified in this study. Longitudinal studies tracking the trajectory of specific programs, such as the KSOT, from prototype to operational capability would test the proposition that doctrinal coherence is a determinant of capability realization. Comparative qualitative studies across archipelagic states would assess the boundary conditions of the proposed archipelagic-state model.

4.3. Limitations

This study had four notable limitations. First, the qualitative case study design generates analytic rather than statistical generalizations (Yin, 2018), with findings extending the theoretical proposition rather than describing distributions across a population. Therefore, the findings should be read as theoretically generative rather than statistically representative of all middle-power defense industries.

Second, the documentary nature of the evidentiary base, while systematically triangulated across multiple source categories, does not include primary interview data with executives, engineers, military officers, or policymakers. Defense industrial research in many national contexts faces structural constraints on primary access; the present study has worked within those constraints by emphasizing rigorous documentary triangulation, but a future research design incorporating primary interview data—where access can be secured under appropriate confidentiality protocols—would substantially strengthen the evidence base of the study.

Third, the temporal scope of the study, from September 2024 to December 2025, captures a particular moment in a rapidly unfolding transformation. Findings that hold at the time of writing may be modified as programs mature, partnerships evolve, and new programs enter the institutional pipeline. The longitudinal extension of the case study, with periodic updates, would substantially enrich the analytical picture.

Fourth, the focus on three embedded cases within the Indonesian context, while methodologically justified by the analytic leverage offered by their variation, necessarily excludes other cases that might illuminate complementary dimensions of the sovereign capability question. Future work should consider cases such as indigenous combat management system development at PT Len, the maintenance-repair-overhaul ecosystem, and the small-and-medium enterprise supplier base, each of which would contribute additional theoretical leverage.

5. CONCLUSION

This qualitative multiple case study examined how an archipelagic developing economy transitions from foreign-platform dependency to sovereign maritime defense capability by analyzing three embedded cases—PT PAL, the KSOT program, and the R41 initiative—within the contemporary Indonesian defense industrial context. Following Yin's (2018) multiple case study methodology and the resource-based view of competitive advantage as the central theoretical proposition, the study identified six themes that

organize the cross-case findings: selective foreign partnership as a capability accelerator, tacit knowledge accumulation as the binding constraint, software-defined integration as the strategic locus, state ownership and cluster governance as enabling but insufficient conditions, human capital pipelines as the slow-maturing foundation, and doctrinal coherence as a determinant of capability realization.

The contribution of this study to defense industrial base scholarship is to articulate a context-sensitive model of sovereign capability transition in archipelagic developing economies, complementing the dominant frameworks derived from advanced industrial democracies. The contribution to the resource-based view is the specification of the mechanisms—structured learning environments, software architectures, and human capital pipelines—through which abstract VRIN attributes translate into observable defense-industrial practice. This study contributes to the absorptive capacity literature by illustrating how middle-power industries can develop absorptive capacity that converts foreign partnerships into indigenous capabilities.

The contemporary moment in Indonesia's maritime defense industrial transformation is consequential. The KSOT-008 prototype, indigenous Combat Management System, R41 modernization initiative, and broader institutional development of PT PAL and DEFEND ID together constitute the substrate on which a genuinely sovereign maritime defense industry can be built. Whether that substrate develops into systemic capability or remains a set of showcase milestones will depend on the coherence of industrial policy, human capital investment, doctrinal development, and selective foreign partnerships over the coming planning cycle. The findings of this study suggest both the magnitude of the opportunity and the discipline required to realize it in the future.

The qualitative multiple case study presented here is offered as a contribution to the strategic conversation about sovereign capability development in archipelagic developing economies, in the conviction that careful empirical analysis, grounded in theoretical propositions and disciplined by methodological transparency, can modestly but consequentially inform the choices that ultimately determine whether such transitions succeed.

Ethical Approval

Not Applicable

Informed Consent Statement

Not Applicable

Authors' Contributions

The author solely conceptualized the study, conducted the analysis, wrote the manuscript, and approved the final version.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Data Availability Statement

The data and sources analyzed in this study are publicly available through the documents, reports, media sources, and open-source materials cited in the reference list.

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