

Naval Base Infrastructure and Repair Facility Readiness for Flagship Operations: A Qualitative Assessment of EX. ITS Giuseppe Garibaldi

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ABSTRACT

Evaluating naval base infrastructure and repair facility readiness represents a vital strategic imperative to support the operational deployment of heavy flagship platforms within the Indonesian Navy. This research analyzes the technical readiness of port facilities and shipyard maintenance capabilities across three strategic maritime nodes in Surabaya, Jakarta, and Lampung to support operational requirements for EX. ITS Giuseppe Garibaldi. Utilizing a qualitative descriptive methodology, the study integrates in-depth interviews with key naval leadership, direct field observations, document reviews, and qualitative thematic coding via NVivo 15 software combined with IFAS-EFAS SWOT matrices and the Base Readiness Framework. Empirical findings identify critical physical infrastructure bottlenecks, evaluate drydock dimensions, and formulate a structured strategic implementation roadmap. This study confirms that base readiness modernization serves as a vital cornerstone for sustaining fleet power projection and national maritime defense

INTRODUCTION

In modern naval warfare, sustaining the operational mobility and strategic deterrence of capital warships depends fundamentally on the physical readiness of naval base infrastructure and the technical competence of shore repair facilities. Within the Indonesian Navy (TNI Angkatan Laut), the prospective integration of heavy flagship surface platforms such as the STOVL aircraft carrier EX. ITS Giuseppe Garibaldi (displacing 13,800 tons with overall length of 180.2 meters, beam of 30.4 meters, and operational draft of 6.7 meters) represents a monumental leap in national maritime power projection. However, deploying a capital warship of this scale mandates a corresponding transformation in land-based support ecosystems across strategic maritime nodes to guarantee uninterrupted berthing, maintenance, logistics sustainment, and operational staging.

Furthermore, the operational integration of a capital flagship platform like EX. ITS Giuseppe Garibaldi introduces extraordinary technical and structural demands that transcend conventional warship support capabilities. Displacing over 13,800 tons with a broad beam of 30.4 meters and a full-load draft exceeding 6.7 meters, this aircraft-carrier platform requires specialized deep-water berthing basins, reinforced pier bollard pull capacities, and high-volume utility supply connections. Beyond physical berthing dimensions, sustaining flight-deck operations and complex combat management systems necessitates continuous high-voltage electrical shore power (cold-ironing multi-megawatt connections), high-capacity mobile heavy-lift cranes, and dedicated aviation fuel bunkering lines. Without synchronized land-based infrastructure modernization, operating such a heavy naval platform risks severe operational paralysis, prolonged maintenance downtime, and compromised fleet deterrence.

The primary operational support architecture for capital warships in Indonesia revolves around three strategic nodes: Surabaya (Tanjung Perak, PT PAL Indonesia, and Fasharkan), Jakarta (Tanjung Priok, Kolinlamil, and Lantamal III), and Lampung (Panjang and Caligi). Each location offers distinct operational advantages for fleet staging along the Indonesian Archipelagic Sea Lanes (ALKI I and ALKI II). However, existing naval base infrastructure across these nodes exhibits variance in physical capacity, water depth, berthing space, and industrial shipyard support. Operating a heavy platform like EX. ITS Giuseppe Garibaldi introduces unprecedented physical demands, including deeper channel draft requirements, extended pier berthing lengths, high-capacity shore power connections, heavy-lift cranes, and specialized graving docks capable of accommodating wide-beam hulls.

Table 1. Comparative Infrastructure Readiness Across Strategic Naval Support Nodes

Comparison Aspect	Surabaya (Tanjung Perak)	Jakarta (Tanjung Priok)	Lampung (Pier Length)
Total Berth Length	4.620 - 5.450 meters	12.830 - 16.853 meters	890 meters
Number of Berths	30+	76 - 81	5
Maximum Depth	10,5 meters	14 meters	12 meters
Garibaldi Berthing Capability	Minimal, requires precise tidal calculations	Deep-water berths available	Adequate depth available
Military Facilities	Existing dedicated naval base complex	Available but commercially dominated	Naval base under construction
Repair Capacity	Shipyards and repair workshops available	Shipyards available, less comprehensive than Surabaya	Civil shipyards available, workshops under construction
Strategic Position	Eastern Fleet Base	National commercial logistics center	New main base near Sunda Strait

Source: Data Processing by Researcher 2026

As detailed in Table 1, comparing infrastructure readiness across Surabaya, Jakarta, and Lampung reveals distinct operational tradeoffs. Surabaya possesses the most comprehensive naval repair facilities through PT PAL and Fasharkan, yet its 10.5-meter maximum basin depth requires precise tidal window calculations for heavy warship berthing. Conversely, Jakarta offers deep-water berths reaching 14 meters and extensive commercial pier capacity, but its facilities are heavily dominated by commercial maritime traffic with limited dedicated military infrastructure. Meanwhile, Lampung provides favorable 12-meter water depth near the strategic Sunda Strait, but its military infrastructure and repair workshops remain under active construction.

Evaluating physical infrastructure gaps such as seabed siltation, inadequate bollard pull ratings, limited drydock crane capacities, and technical workforce shortages is critical to preventing operational bottlenecks and guaranteeing fleet availability. To address these base readiness challenges, this study applies a multi-theoretical framework integrating Base Readiness Theory, Risk-Based Maintenance (RBM), Strategic Logistics Theory, and Systems Engineering. By triangulating these perspectives with empirical qualitative evidence collected across naval infrastructure authorities Kadisfaslanal, Direktorat PT PAL Surabaya, Kafasharkan Surabaya, and base commanders this study identifies internal capabilities and structural deficits, evaluates external threats using NVivo 15

thematic coding and IFAS-EFAS SWOT matrices, and formulates a strategic roadmap for base infrastructure optimization. Ultimately, this research provides actionable policy insights to modernize naval port facilities, ensuring operational readiness for heavy naval platforms across strategic maritime approaches.

LITERATURE REVIEW

Sea Power, Maritime Strategy, and the Role of Naval Bases

The strategic value of naval bases is rooted in classical sea power theory. Mahan (1890) argued that the ability to command the sea rests not only on the fleet itself but also on the geographic position and the network of bases that allow that fleet to be sustained, repaired, and projected over distance. In this view, a warship is only as effective as the shore infrastructure behind it. Hill (1986) extends the discussion to navies of medium powers, whose strategic choices are shaped by limited resources and therefore require selective investment in the capabilities, including support capabilities, that matter most for national policy. This perspective is directly relevant to Indonesia, where the introduction of a capital platform such as EX. ITS Giuseppe Garibaldi must be weighed against finite budgets and an extensive archipelagic geography.

Vego (2009) approaches the same problem at the operational level. His treatment of operational warfare at sea identifies logistics, basing, and sustainment as functions that enable or constrain the employment of naval forces, and he emphasizes that operational plans are only as sound as the logistic support that stands behind them. Alberts and Hayes (2003) add an organizational dimension by arguing that effective command in the information age depends on shared information and agile coordination among distributed actors. For a base system spread across several maritime nodes and involving naval commands, shipyards, and port authorities, this argument supports the need for integrated and coordinated governance rather than isolated, site-by-site management.

Indonesian Archipelagic Sea Lanes and Naval Base Development

Indonesia's geography gives its basing decisions a distinctive strategic logic. Djalal (2009) documents the establishment of the Archipelagic Sea Lanes (ALKI) as the legal and diplomatic framework under which foreign vessels may transit Indonesian waters, and the lanes therefore shape where the Navy must be able to stage, sustain, and repair its forces. Hermawan et al. (2020) and Listiyono et al. (2022) examine Indonesian sea defense strategy in relation to the security of these lanes, linking maritime security and national sovereignty to the Navy's capacity to operate along them. Prakoso (2021) addresses the development of naval bases as a component of national defense, positioning base infrastructure as a prerequisite of, rather than an afterthought to, maritime defense capability.

The institutional framework is set by the Indonesian Navy's doctrine on base facilities and the development of maintenance facilities (Tentara Nasional Indonesia Angkatan Laut, 2021) and by the legal basis for the armed forces as amended by Law No. 3 of 2025 (Republik Indonesia, 2025). Together with the studies above, these documents define who is responsible for base readiness and

under what mandate. They also form the policy corpus that the present study analyzes.

Maintenance Theory: From Reliability-Centered to Risk- and Condition-Based Approaches

Repair facility readiness is fundamentally a maintenance problem. Moubray (1997) formulates Reliability-Centered Maintenance (RCM) around the functions of an asset, the ways in which those functions can fail, and the consequences of failure, so that maintenance effort is directed according to consequence rather than applied uniformly. Smith and Hinchcliffe (2004) present RCM as a practical route toward world-class maintenance, emphasizing structured implementation within real organizations. Jardine et al. (2006) review condition-based maintenance and describe how data acquisition, data processing, and maintenance decision-making can support diagnostics and prognostics, allowing intervention to be timed by actual equipment condition.

These works provide the conceptual basis for the Risk-Based Maintenance (RBM) lens adopted in this study. Applied to naval bases, the logic extends from ships to the shore assets that support them, namely piers, bollards, cranes, dock systems, and shore power equipment. Prioritizing preventive attention and monitoring according to operational risk is consistent with the paradigm shift from reactive port support to an integrated Base Readiness Framework proposed later in this article.

Systems Engineering and Life-Cycle Support

Blanchard and Fabrycky (2011) treat a system as an integrated whole whose performance depends on the interaction of its elements across the life cycle, and they give explicit weight to logistic support and supportability in system design and analysis. Kossiakoff et al. (2020) similarly present systems engineering as a disciplined approach to defining requirements, integrating components, and managing complexity throughout a system's life. From this perspective, a capital warship and its supporting bases constitute a single system. Berthing basins, drydocks, utilities, workforce skills, and procedures must be specified and integrated together with the platform, since a deficiency in any one element limits the performance of the whole.

Qualitative Methods and Strategic Assessment Tools

The methodological literature supports the qualitative design adopted here. Creswell and Creswell (2023) describe qualitative research design and the logic of drawing on multiple sources of evidence, while Denzin and Lincoln (2018) place triangulation and the use of multiple methods within the broader tradition of qualitative inquiry. Bowen (2009) establishes document analysis as a systematic procedure for examining and interpreting documents, which supports the review of defense policy documents in this study. Miles et al. (2020) set out coding, data display, and conclusion drawing as core operations of qualitative analysis, and Bazeley and Jackson (2019) show how NVivo supports

these operations through organized coding and thematic exploration of interview and document data.

For strategic positioning, David and David (2020) provide the established procedure for internal and external factor evaluation and for SWOT-based strategy formulation, which underpins the IFAS-EFAS matrices used in this study. Combining thematic coding with SWOT matrices therefore links evidence collected in the field to the formulation of strategic options.

Synthesis and Research Gap

The reviewed literature offers four complementary strands: sea power and maritime strategy explain why bases matter (Mahan, 1890; Hill, 1986; Vego, 2009); Indonesian defense studies and doctrine explain the national context of sea lanes and base development (Djalal, 2009; Hermawan et al., 2020; Listiyono et al., 2022; Prakoso, 2021; Tentara Nasional Indonesia Angkatan Laut, 2021); maintenance and systems engineering theory explain how readiness can be managed (Moubray, 1997; Smith and Hinchcliffe, 2004; Jardine et al., 2006; Blanchard and Fabrycky, 2011; Kossiakoff et al., 2020); and qualitative methodology explains how it can be assessed (Bazeley and Jackson, 2019; Bowen, 2009; Creswell and Creswell, 2023; David and David, 2020; Denzin and Lincoln, 2018; Miles et al., 2020).

Within the sources reviewed, these strands are largely treated separately. Strategic and Indonesian studies address the importance of bases and sea lanes at a general level, whereas maintenance and systems engineering works address asset readiness without reference to Indonesia's naval basing conditions. No reviewed source examines the readiness of specific port and shipyard nodes for a particular capital platform. This study addresses that gap by integrating the four strands in a single qualitative assessment of Surabaya, Jakarta, and Lampung for the support of EX. ITS Giuseppe Garibaldi.

METHODS

This research was conducted across three strategic naval support nodes in Surabaya, Jakarta, and Lampung through field observations, stakeholder interviews, port infrastructure documentation, policy document analysis, and strategic assessment using integrated NVivo-SWOT frameworks. Research activities spanned March to July 2026, involving Focus Group Discussions (FGDs) with TNI AL infrastructure directorate representatives, shipyard directors, naval base commanders, and maritime logistics experts. FGDs invited comparative insights from established naval base planners and port infrastructure managers across Indonesian maritime sectors. In addition to field approaches comprising direct berthing pier observations, semi-structured interviews with key informants, utility capacity mapping, and facility readiness assessments, this study was complemented by comprehensive literature reviews. Literature reviews strengthened the conceptual foundation and provided academic rigor for naval base infrastructure strategies within capital warship support contexts.

Key references include Prakoso (2021) emphasizing naval base development strategies, Hermawan (2020) highlighting maritime security applications in archipelagic waters, and Listiyono (2022) addressing port infrastructure readiness in sea lane defense. International benchmarks draw from Vego (2009) documenting operational naval warfare logistics and Hill (1986) analyzing maritime strategy dynamics in naval base industrialization. The methodological approach integrates Base Readiness Theory, Strategic Logistics Theory, and Risk-Based Maintenance as analytical frameworks, operationalized through NVivo 15 for qualitative thematic coding of facility capabilities (berthing, drydocks, shore power, dredging) and SWOT analysis for strategic positioning of naval infrastructure capabilities. Data collection employed purposive sampling of 5 expert informants, direct observation of 3 naval base nodes, and content analysis of 38 defense policy documents (UU No. 3/2025 through Disfaslanal Infrastructure Directives 2020-2025). By combining empirical field validation with theoretical triangulation, this methodology produces implementation-ready strategic roadmaps calibrated to Indonesia's naval base realities, ensuring academic validity and operational applicability for TNI AL fleet modernization imperatives.

RESULTS AND DISCUSSION

Evaluating naval base infrastructure and repair facility readiness represents a strategic imperative inseparable from multi-site network coordination, advanced physical dock capacity, and national defense resolve. Assessing port support readiness across Surabaya, Jakarta, and Lampung exemplifies how integrated efforts among naval infrastructure directorates, shipyard executives, and regional base commanders can systematically transform legacy port berthing into resilient flagship support capabilities. Through comprehensive empirical field assessments across three strategic maritime support nodes, five expert stakeholder consultations, and qualitative strategic modeling, this research identifies precise base readiness implementation pathways calibrated to Indonesia's unique naval infrastructure ecosystem and capital warship operational constraints. The following presents key empirical findings organized by major strategic dimensions, addressing physical berthing capacities, shipyard repair readiness, utility infrastructure, and multi-node governance.

Multi-Base Infrastructure Maturity across Surabaya, Jakarta, and Lampung

Indonesia demonstrates heterogeneous naval base infrastructure maturity across its primary maritime support nodes. Surabaya represents the most technically capable repair hub due to PT PAL's heavy industrial shipyard facilities and Fasharkan's maintenance workshops. However, berthing basin depth in Tanjung Perak faces continuous siltation, requiring regular dredging to maintain the necessary 8-meter operational draft for EX. ITS Giuseppe Garibaldi. Meanwhile, Jakarta (Tanjung Priok/Kolinlamil) provides excellent strategic berthing and logistics access near central command headquarters but lacks wide-beam graving dock facilities for capital ship maintenance. Lampung (Panjang/Caligi) offers favorable deep-water berthing approaches but requires

substantial utility infrastructure upgrades to support heavy naval platforms effectively.

Technical Shipyard Repair Capabilities and Drydock Capacity at PT PAL and Fasharkan

Executing intermediate and depot-level maintenance for a capital warship requires specialized shipyard infrastructure capable of handling wide-beam hulls and heavy tonnage. PT PAL Surabaya possesses Indonesia's largest graving docks, capable of accommodating the 30.4-meter beam and 180-meter length of EX. ITS Giuseppe Garibaldi. However, technical assessments reveal critical operational bottlenecks: 62% of drydock mobile cranes require capacity upgrades to handle heavy flight-deck equipment, and high-voltage shore power transformers need expansion to support cold-ironing electrical requirements (440V/60Hz multi-megawatt demand). Enhancing PT PAL's drydock infrastructure is essential to guarantee hull inspection, propeller shaft maintenance, and structural repair readiness.

Qualitative NVivo 15 Mapping of Physical Infrastructure Bottlenecks and Utility Constraints

Qualitative thematic coding via NVivo 15 across stakeholder interview transcripts identifies core physical bottlenecks shaping base support readiness. Primary physical constraints include inadequate pier berthing lengths, low bollard pull ratings on legacy piers, insufficient shore to ship high pressure fresh water supply lines, and limited fuel bunkering transfer rates. Furthermore, human resource coding highlights specialized technical skill gaps among naval shipyard personnel regarding gas turbine propulsion maintenance, automated flight-deck elevator systems, and advanced naval electronics repair. Resolving these physical and human capital constraints requires targeted infrastructure investments, specialized technical training, and synchronized utility upgrades across designated support bases.

Internal Factor Analysis Summary (IFAS): Evaluating Strengths and Weaknesses

Empirical qualitative synthesis synthesizes organizational capabilities and internal technical deficits influencing port support readiness across regional base commands. Primary internal strengths encompass firm command commitment from Mabesal leadership, strategic geographic positioning along ALKI choke points, and established heavy shipbuilding facilities at PT PAL Surabaya. Major internal weaknesses include shallow channel depths in legacy naval basins, inadequate multi-megawatt shore power infrastructure, limited high-capacity mobile cranes, and specialized technical skill shortages among base support personnel. Strategic internal priorities must focus on dredging berthing basins, retrofitting high-capacity electrical shore power connections, and expanding technical maintenance training programs.

External Factor Analysis Summary (EFAS): Opportunities and Technological Threats

Systematic environmental screening identifies strategic external drivers and external risks shaping naval base modernization. Key external opportunities comprise national maritime highway development policies, joint public-private shipyard partnerships with commercial facilities, and technology transfer agreements associated with warship acquisitions. External threats involve rapid coastal siltation rates requiring expensive continuous maintenance dredging, supply chain disruptions for imported specialized warship spare parts, and rising commercial port congestion surrounding strategic naval piers. Strategic positioning dictates leveraging commercial port partnerships while securing dedicated naval maritime channels protected from commercial shipping interference.

Strategic SWOT Matrix: Formulating Base Readiness Optimization Pathways

Synthesizing internal capabilities and external strategic factors establishes prioritized strategic pathways for optimizing naval base infrastructure across strategic nodes. The primary SO strategy leverages national maritime policy and PT PAL capabilities to establish Surabaya as the primary depot-level maintenance hub for heavy warships. Concurrently, WO strategies focus on executing targeted dredging operations and installing high-capacity shore power transformers at Jakarta and Lampung berthing piers. Furthermore, ST strategies mitigate port congestion by establishing designated naval anchorage zones, while WT strategies streamline inter-agency logistics protocols to accelerate spare parts clearance and delivery across all regional base commands.

Paradigm Shift from Reactive Port Support to Integrated Base Readiness Framework

Sustaining capital warship operations requires a fundamental paradigm shift from legacy reactive port berthing toward an integrated Base Readiness Framework. Traditional port support protocols treat naval bases as static docks for fuel and water replenishment, failing to provide proactive technical maintenance staging. Integrating real-time facility monitoring, automated utility metering, and predictive maintenance scheduling for base support equipment transforms legacy piers into responsive naval support hubs. This operational framework directly enhances fleet mobility under Strategic Logistics Theory, ensuring that land-based infrastructure dynamically mirrors the intensive operational demands of heavy capital warships deployed on maritime security missions.

Institutionalizing Base Infrastructure Governance and Maintenance SOPs

Sustained base readiness mandates institutionalizing infrastructure governance while establishing standardized operating procedures across all naval support nodes. Disfaslanal must establish unified base readiness standards, automated utility connection protocols, and permanent facility maintenance evaluation frameworks. Simultaneously, regional naval base

commands must be empowered with dedicated infrastructure maintenance budgets to execute preventative pier repairs and continuous basin dredging. Institutionalizing rigorous infrastructure governance ensures that naval bases across Surabaya, Jakarta, and Lampung maintain continuous readiness to support EX. ITS Giuseppe Garibaldi, optimizing asset life cycles and safeguarding Indonesia's maritime sovereignty.

CONCLUSIONS AND RECOMMENDATIONS

This study assessed the readiness of naval base infrastructure and repair facilities in Surabaya, Jakarta, and Lampung to support the operation of EX. ITS Giuseppe Garibaldi. The findings show that readiness across the three nodes is heterogeneous, and that no single node currently meets all the requirements of a capital warship. Surabaya is the most technically capable repair hub because of the heavy industrial facilities of PT PAL and the maintenance workshops of Fasharkan, but its basin depth is constrained by continuous siltation and requires regular dredging and careful tidal-window planning. Jakarta offers deep-water berths and strong logistics access but lacks wide-beam graving dock facilities. Lampung has favorable water depth and a strategic position near the Sunda Strait, but its military infrastructure and repair workshops are still under development and its utility systems require substantial upgrades.

Across the nodes, the principal bottlenecks are physical and human. On the physical side, they include inadequate pier berthing lengths, low bollard pull ratings on legacy piers, insufficient high-pressure fresh water supply, limited fuel bunkering transfer rates, shore power transformers that need expansion to meet multi-megawatt cold-ironing demand, and drydock mobile cranes, 62% of which require capacity upgrades. On the human side, skill gaps persist among shipyard and base support personnel in gas turbine propulsion maintenance, flight-deck elevator systems, and advanced naval electronics repair.

The IFAS-EFAS analysis translates these findings into strategic pathways. The SO strategy positions Surabaya as the primary depot-level maintenance hub for heavy warships. The WO strategies focus on targeted dredging and the installation of high-capacity shore power at Jakarta and Lampung. The ST strategies address port congestion through designated naval anchorage zones, and the WT strategies streamline inter-agency logistics to accelerate the clearance and delivery of spare parts. Beyond these measures, the study concludes that sustained readiness requires a shift from reactive port support to an integrated Base Readiness Framework, supported by unified readiness standards, standardized operating procedures, and dedicated maintenance budgets for regional base commands. Base readiness modernization is therefore a precondition for sustaining fleet power projection and safeguarding national maritime defense.

FURTHER STUDY

This study has several limitations that point to directions for future work. First, the findings rest on a qualitative design with five expert informants, three naval base nodes, and 38 policy documents, collected between March and July 2026. They therefore describe stakeholder perceptions and documented conditions rather than engineering measurements, and they cannot be statistically generalized. Second, the analysis focuses on a single platform, EX. ITS Giuseppe Garibaldi, and on three nodes, so conclusions may not apply directly to other heavy platforms or to other Indonesian naval bases.

Future research could address these limitations in several ways. Technical studies could measure bathymetry, siltation rates, pier structural capacity, and shore power load requirements directly, and could model tidal windows for heavy-draft berthing at Tanjung Perak. Economic studies could estimate the cost and life-cycle cost of dredging, crane upgrades, shore power installation, and new graving dock capacity, so that investment priorities can be compared. Mixed-methods designs could combine the present qualitative findings with multi-criteria decision tools to rank the three nodes, or additional nodes, against weighted readiness criteria. Studies with larger and more varied informant groups, including operators, port authorities, and technical personnel, could test the robustness of the themes identified here. Finally, research on workforce competency development and on the implementation of the proposed governance framework and maintenance standards could evaluate whether the recommended strategies improve readiness over time.

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