

Strategic positioning of navigation and communication technologies in Indonesia's defence UAV ecosystem

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Abstract

This study examines the strategic positioning of navigation and communication subsystems within Indonesia's defence Unmanned Aerial Vehicle (UAV) ecosystem. Guided by the Industrial-Organization (I/O) model, the research integrates market analysis, external environment assessment, and internal capability alignment to develop positioning approaches for GPS-denied inertial navigation and small-form-factor satellite communication (SATCOM) technologies. A qualitative methodology was employed, combining semi-structured interviews with defense stakeholders and secondary sources from policy, industrial, and technical domains. The findings show that effective positioning depends on early engagement with the Ministry of Defense, the armed forces as end-users, and DEFEND ID state-owned enterprises, while also meeting localization and offset requirements. Drawing on Porter's concept of needs-based positioning and applying the Strategy Diamond model, the study identifies arenas, vehicles, differentiators, staging, and economic logic as interdependent elements shaping market entry. The proposed three-phase roadmap, focused on stakeholder engagement, system integration, and local sustainment, supports Indonesia's defense modernization priorities while enabling multinational firms to secure a sustainable market presence.

Keywords: Defense UAV, Strategic Positioning, Industrial-Organization Model, Resilient Navigation, Satellite Communication.

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INTRODUCTION

Resilient navigation and secure communication are widely recognized as mission-critical capabilities in modern UAV operations, particularly for Beyond Visual Line of Sight (BVLOS) modes and autonomous missions. In GPS-denied or -degraded environments and maritime scenarios, UAVs require technologies that ensure positional integrity and continuous control. This challenge is particularly pressing for Indonesia, the world's largest archipelagic nation with more than 17,000 islands and a coastline stretching around 54,000 kilometers (Irham et al., 2023). Extended distances, equatorial climatic conditions, and the risk of electronic warfare against UAV command-and-control (C2) links create vulnerabilities to signal disruption, blocking, and jamming. These geographic and environmental characteristics make Indonesia a particularly demanding operational context for resilient UAV navigation and communication systems.

Recognizing these strategic challenges, Indonesia has pursued defense modernization through the Minimum Essential Force (MEF) roadmap, initiated in 2010 and initially scheduled for completion in 2024. The MEF program emphasizes technological autonomy, strategic procurement, and the integration of advanced technologies (Armadani & Kosandi, 2024). Although fiscal constraints have delayed several milestones, the overarching policy objective remains the reduction of dependence on imported defense systems and the strengthening of domestic industrial capacity (Syawfi, 2025). Current policy requires at least 50 percent of defense equipment to be sourced locally, driving investments in indigenous research and development (Habsari, 2022). This commitment is reflected in defense expenditures, with IDR 134.3 trillion (USD 9.8 billion) allocated in 2024 and IDR 165 trillion (approx. USD 10.6 billion) proposed for 2025 (Syawfi, 2025). Collectively, these initiatives underscore Indonesia's long-term ambition to achieve defense self-sufficiency and sovereign technological capabilities.

Within this modernization framework, Unmanned Aerial Vehicles (UAVs) have emerged as a strategic priority for intelligence, surveillance, reconnaissance (ISR), and maritime domain awareness. The country is pursuing a dual track of foreign acquisition and domestic development. On the foreign side, the acquisition of the ANKA Medium-Altitude Long-Endurance (MALE) UAV from Turkish Aerospace Industries (TAI) includes a cooperative manufacturing agreement with PT Dirgantara Indonesia (TURDEF, 2023). Domestically, the Elang Hitam UAV program, led by a consortium including PT Dirgantara Indonesia, PT Len Industri, the Ministry of Defense, and Bandung Institute of Technology, is resuming after restructuring, with its maiden flight scheduled for July 2025 (Wahyu, 2025). Similarly, PT Len Industri has developed a tactical UAV (DID.311) with 45% local content and a 1,500 km range (DEFEND ID, 2024). These developments illustrate Indonesia's attempt to balance reliance on foreign partnerships with strengthening its indigenous UAV capacity.

Despite this progress, Indonesia continues to encounter significant operational and technical constraints. Signal degradation, frequent connection loss in dense topographies and high-precipitation zones, and electromagnetic spectrum interference remain critical challenges, particularly during BVLOS operations in remote regions. Data shows that over 60% of defense UAV deployments suffer from navigational and communication failures, threatening both mission effectiveness and asset survivability (Schreier, 2022). Moreover, fragmented operations among military branches complicate unified electronic warfare coordination, with inter-branch jamming reported to reduce UAV system effectiveness significantly (Pratama et al., 2025). These conditions underscore the structural inadequacy of GPS-dependent and line-of-sight-based systems within Indonesia's operational environment.

To mitigate these vulnerabilities, UAV platforms require the integration of resilient navigation and communication systems. Inertial Navigation Systems (INS) enable position estimation during GPS outages using gyroscopes and accelerometers (Positioning Navigation Intelligence, n.d.). Robust SATCOM links are equally critical for sustaining BVLOS operations across Indonesia's geographically dispersed territory by ensuring secure C2 connectivity and real-time data transmission (Ball, 2025).

Furthermore, the integration of multi-channel communication pathways encompassing satellite, radio, and cellular networks facilitates automated failover mechanisms and anti-jamming resilience, thereby enhancing overall system survivability under contested or degraded signal conditions.

Concurrently, Indonesia's institutional and industrial framework reinforces the emphasis on resilient and locally supported solutions. Law No. 16/2012 on the defense industry mandates that 85% of major foreign defense contracts be fulfilled through countertrade, local content, or industrial offsets (Grevatt, 2021). President Joko Widodo has explicitly called for the domestic share of defense production to rise from the current average of 41% toward 100% in the coming years (Setkab, 2022). The establishment of Defend ID in 2022, a holding company uniting PT Dirgantara Indonesia, PT Pindad, PT PAL, PT Len Industri, and PT Dahana, illustrates this consolidation of national capabilities (DEFEND ID, 2022). These policy and organizational reforms are complemented by doctrinal shifts within the Indonesian Armed Forces that prioritize accelerated UAV adoption in response to evolving threat environments (Pratama et al., 2025). However, Indonesia must navigate an increasingly competitive external landscape when sourcing advanced UAV subsystems. Suppliers from Turkey, France, and the United States market sophisticated anti-jamming GNSS units and SATCOM datalinks, but these often come with restrictions such as U.S. ITAR export controls, platform incompatibility, or high lifecycle costs. Historical experiences with defence embargoes have demonstrated the strategic risks associated with excessive dependence on imported military hardware (Hakim, 2025). These considerations further reinforce Indonesia's strategic imperative to pursue sovereign solutions that balance performance, affordability, and long-term adaptability.

Despite the growing body of literature on UAV platforms, defense modernization, and national capability development, existing studies remain largely focused on system acquisition, platform performance, or macro-level defense policy. Limited scholarly attention has been devoted to the strategic positioning of critical UAV subsystems, particularly navigation and communication technologies, within highly regulated defense ecosystems in emerging economies. Moreover, the interaction between industry structure, regulatory constraints, and subsystem-level strategic choices remains underexplored from a strategic management perspective.

In this context, this study addresses the identified gap by examining the positioning of resilient navigation and communication subsystems within Indonesia's defense UAV ecosystem through the lens of the Industrial-Organization (I/O) model and complementary strategic frameworks. By shifting the analytical focus from firm-centric narratives to industry-level dynamics, this research contributes to the defense economics and strategic management literature by extending analysis to subsystem-level competition under conditions of regulatory constraint, localization policy, and technological dependency.

In this context, MADS Corp, a multinational defense firm from the United States with more than four decades of operational presence in Indonesia (DSA, 2025), faces strategic challenges in strengthening its position within Indonesia's defense sector. Although the company possesses advanced capabilities in GPS-denied navigation and SATCOM-enabled communication, the integration of its technologies into Indonesia's strategic programs, such as the Elang Hitam UAV and indigenous missile development initiatives, remains limited. Over the past six years, MADS Corp's revenues in Indonesia have been largely derived from support for legacy platforms, including turboprop engines for the NC212i and aircraft components for the Air Force, rather than from participation in new defense systems. Internal projections further indicate that without strategic repositioning, the company's defense business growth in Indonesia will reach a compound annual growth rate (CAGR) of only around 4 percent through 2030, well below its internal target of 10 percent.

To operationalize the strategic analysis, this study employs MADS Corp as a focal firm, not as the primary object of inquiry but as an illustrative empirical case. The firm is used as an analytical lens to demonstrate how foreign technology suppliers formulate and adjust strategic positioning

within Indonesia's defense UAV ecosystem. Anchoring the analysis to a real firm enables the translation of abstract strategic frameworks into concrete, industry-relevant insights, while maintaining the study's primary emphasis on ecosystem-level dynamics rather than firm-specific performance evaluation.

Against this backdrop, the UAV segment emerges as a strategic entry point for subsystem suppliers seeking to deepen engagement within Indonesia's defense ecosystem. MADS Corp's portfolio, encompassing navigation systems capable of operating in GPS-denied environments and SATCOM solutions for beyond visual line of sight (BVLOS) missions, aligns closely with Indonesia's evolving operational requirements for persistent surveillance and autonomous operations. Indigenous platforms such as Elang Hitam therefore provide a concrete empirical context for examining how advanced subsystem technologies can be strategically positioned to support national objectives, particularly Indonesia's ambition to enhance defense autonomy through domestically anchored innovation.

RESEARCH METHOD

The Industrial Organization (I/O) Model of Above-Average Returns is employed in this study because the adoption and positioning of UAV navigation and communication subsystems in Indonesia's defense sector are predominantly shaped by external industry conditions rather than firm-specific resources alone. The defense industry is characterized by strong government intervention, stringent regulatory frameworks, offset and localization requirements, limited buyer concentration, and high entry barriers, all of which align closely with the core assumptions of the I/O model that industry structure and competitive forces are primary determinants of strategic outcomes (Hitt et al., 2013). In the context of Indonesia's defense UAV ecosystem, strategic decisions regarding technology selection, system integration, and supplier positioning are largely influenced by procurement regulations, export control constraints, intergovernmental agreements, and institutional actors, rather than purely by internal technological capabilities. As a result, a firm's ability to achieve a competitive advantage depends on how effectively it positions itself within the existing industry structure, power relationships, and regulatory environment, making the I/O model particularly suitable for analyzing market entry and positioning strategies in this sector.

The research is structured around a sequential analytical framework that progresses from market understanding to strategy formulation and implementation, ensuring coherence between empirical analysis and strategic interpretation. The process begins with market analysis to identify demand for UAV systems, map the defense business landscape, and segment stakeholders and program types using business-to-business (B2B) marketing principles and the Segmentation Targeting Positioning (STP) framework. This is followed by an external environment analysis employing PESTEL, Porter's Five Forces, and competitor assessment to evaluate macro-level conditions, regulatory constraints, and industry structure shaping subsystem adoption, thereby assessing the attractiveness and strategic potential of Indonesia's defense UAV ecosystem. Building on these insights, the study then develops strategic positioning by synthesizing market and environmental findings through the Strategy Diamond framework and needs-based positioning principles, examining how multinational subsystem suppliers can align their offerings with stakeholder requirements, program priorities, and regulatory expectations. The framework subsequently incorporates internal capability alignment through Resource-Based View (RBV) and value chain analysis to assess organizational readiness, local partnership experience, and system integration capabilities. Finally, the formulated positioning strategies are translated into a strategic implementation pathway that reflects operational priorities, regulatory obligations, and stakeholder engagement mechanisms, ensuring continuity from analysis to execution and directly supporting the study's objective of defining effective positioning approaches for UAV navigation and communication systems in Indonesia's defense sector.

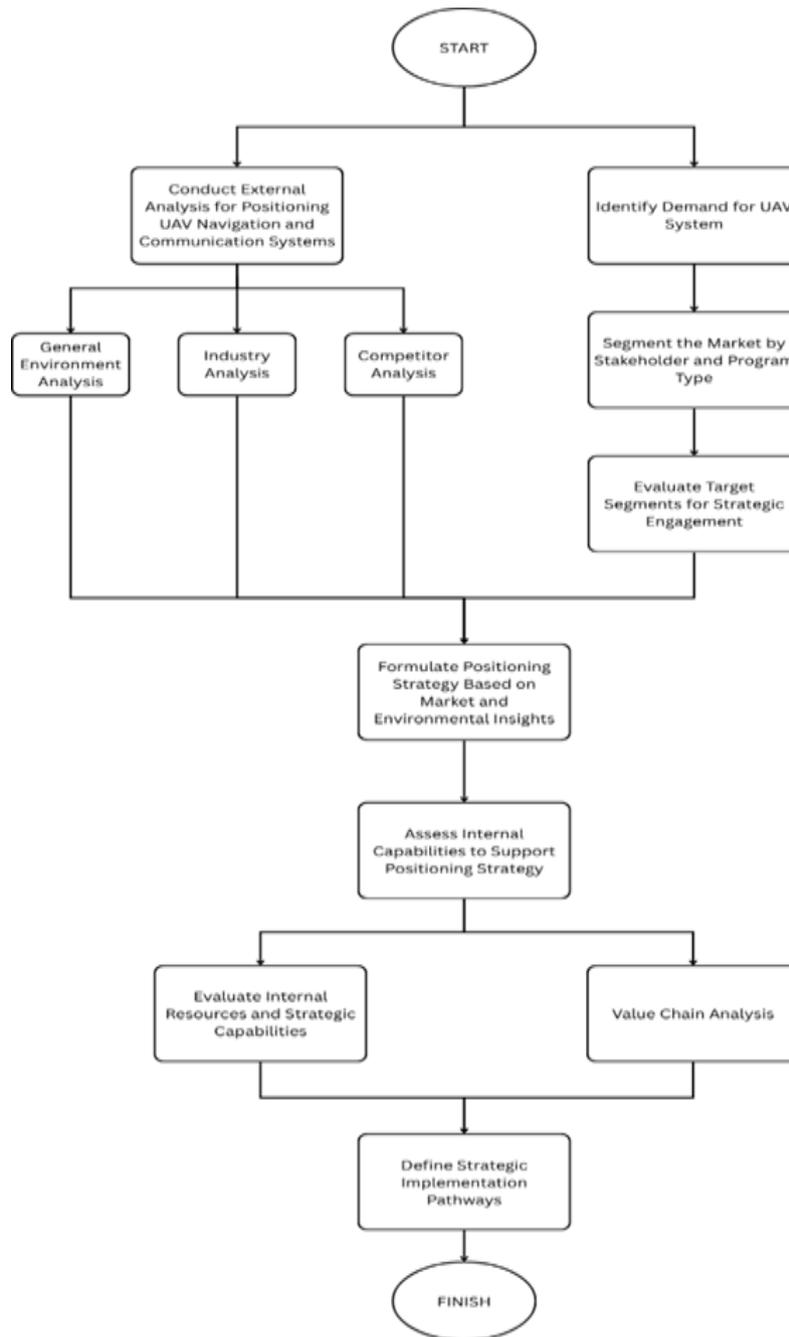


Figure 1. Research Design

Data Collection Methods

To support the exploratory nature of this study and its focus on strategic positioning in a complex institutional environment, data is collected through two main sources: primary data from semi-structured interviews and secondary data from document analysis. This combination enables the capture of stakeholder insights, policy context, and institutional dynamics.

Primary data is collected from individuals directly involved in defense policy, procurement, technology integration, and industry development. This study adopts semi-structured interviews as the sole method for primary data collection, allowing for focused yet flexible engagement with strategically selected participants across government, military, state-owned enterprises, private firms, and internal MADS Corp stakeholders.

Semi-Structured Interviews

Semi-structured interviews provide a structured framework for inquiry while allowing for emergent themes and elaboration from respondents. This format supports open-ended questioning guided by the study’s core research objectives (Merriam & Tisdell, 2016), enabling the capture of institutional perspectives, strategic considerations, and stakeholder expectations. Participants are selected with the aim of ensuring both relevance and diversity across different roles.

Table 1. Key Organizations for Interview

Category	Role/Organization	Expertise/Justification
Military End-Users	Indonesian Air Force Communication & Electronics Division UAV Sub-Division	Direct users and specifiers of navigation and communication systems for platforms like UAVs
Defense State-Owned Enterprises (DEFEND ID)	PT LEN Industri (Persero)	Active in indigenous electronics and radar; potential co-developer or system integrator
	PT Dirgantara Indonesia (PTDI)	Aircraft OEM; develop and joint-manufacture MALE UAV platforms
Private Defense Integrators	PT Infoglobal Teknologi Semesta	Works on UAV and missile guidance systems; potential system integrator
Policy Advisors / Academics / Consultants	Defense policy advisors, consultants, think tanks (e.g., KKIP, CSIS Indonesia, Center for Defense and Strategic Studies Unhan, or independent consultants	Offer independent perspectives on procurement policy, localization strategy, and foreign supplier engagement
Multinational Company Peer	RS	Established multinational supplier with proven success in Indonesia’s defense market.
Internal MADS Corp. Stakeholders	Technical Sales Team	Technical articulation of product capabilities and strategic fit

All interviews were conducted with informed consent and documented as meeting notes (minutes of the meeting). Rather than being audio-recorded and transcribed, key insights were captured during or immediately after each discussion. To ensure alignment with the research objectives and capture perspectives relevant to each strategic dimension, interview questions are tailored to different stakeholder categories. The following matrix illustrates how each question aligns with the study’s research questions and identifies the corresponding stakeholder groups targeted for each theme of inquiry.

Table 2. Interview Question Set

RQ	Interview Question	Target Stakeholder Groups
	What UAV platforms are currently operated by TNI-AU, and where are they stationed?	TNI-AU
RQ1	What operational challenges does TNI-AU face in deploying and maintaining UAVs across Indonesia’s maritime and remote areas?	TNI-AU

RQ	Interview Question	Target Stakeholder Groups
RQ1	What are the critical system needs for the upcoming UAV program like Elang Hitam?	PTDI, PT LEN, TNI-AU
	How do foreign suppliers understand and respond to the local operational environment?	MADS Corp. Technical Team, Multinational Peer
RQ2	How do Indonesia's defense offset and localization policies affect procurement decisions?	KKIP, PT LEN, PTDI
	What are the certification and export control considerations for system integration?	PTDI, TNI-AU, MADS Corp. Technical Team
RQ2	What is the perceived openness or restriction of various UAV platforms (e.g., CH-4B, ANKA) to third-party integration?	TNI-AU, PTDI, PT LEN
	How do foreign suppliers view Indonesia's regulatory pathway and market structure?	MADS Cop. Internal, Multinational Peer
RQ3	What export-controlled (non-ITAR) solutions are available and suitable for Indonesia's UAV programs?	MADS. Corp Technical Sales
	What has MADS Corp.'s global experience been with integration, testing, and demo programs?	MADS Corp. Technical Team
RQ3	How should MADS Corp. position its technologies in relation to legacy and new UAV platforms?	MADS Corp. Technical Team, PTDI, PT LEN
	What kind of support (technical, training, documentation) should MADS Corp. provide to local partners?	MADS Corp. Technical Team, PTDI, PT LEN, Private Integrators
RQ4	What partnership models (e.g., co-production, ToT, MRO) are most effective in helping foreign suppliers gain traction in Indonesia's defense market?	KKIP, PTDI, PT LEN, Private Integrator, Multinational Peer
	What are the expectations for foreign suppliers beyond equipment delivery?	PTDI, PT LEN, KKIP, TNI-AU
RQ4	How do successful foreign companies structure their presence and integration in Indonesia?	Multinational Peer, PTDI, PT LEN
	When is the Elang Hitam UAV flight test expected, and what steps should MADS Corp. take afterward to ensure its technologies are considered in the evaluation process?	PTDI, TNI-AU

Secondary Data

Secondary data is used to complement primary interview findings by providing contextual, regulatory, and strategic background on Indonesia's defense sector and UAV ecosystem. This includes a review of official policy documents, organizational reports, and relevant academic and industry literature. The purpose of using secondary sources is twofold: first, to enrich the external analysis phase of the research; and second, to validate and triangulate insights drawn from stakeholder interviews.

Key sources of secondary data include:

1. Government and policy documents, such as Indonesia's 2015 Defense White Paper, the Minimum Essential Force (MEF) roadmap, and regulations related to offset, technology transfer, and defense industrial policy.
2. Press releases and public statements from state-owned enterprises (e.g., PT Dirgantara Indonesia, PT LEN) and the Ministry of Defense, particularly those related to UAV

development and procurement, local partnership initiatives, and strategic cooperation agreements.

3. Industry publications and defense news platforms reporting on UAV trends, GNSS-denied navigation systems, SATCOM integration, and export control issues relevant to multinational defense firms.
4. Academic journals and technical papers that provide theoretical grounding on GNSS vulnerability, resilient navigation systems, B2B marketing strategy, and strategic positioning frameworks.

Data Analysis Methods

Given the qualitative focus of this research, primary data derived from semi-structured interviews were analyzed using thematic analysis, complemented by content analysis and triangulation. As interviews were not audio-recorded, the primary analytical material consisted of detailed interview notes and meeting minutes compiled during or immediately after each discussion. These notes were systematically reviewed and manually coded following the thematic analysis procedures outlined by Braun & Clarke (2006).

Initial codes were generated inductively from the interview notes and subsequently organized according to the study's four core research questions. Related codes were then clustered into broader themes reflecting external environmental factors, strategic positioning logic, internal organizational capabilities, and implementation considerations. To enhance analytical rigor and consistency, ChatGPT was employed as an auxiliary tool to support thematic verification and pattern identification, while interpretive decisions remained under the full control of the researcher (Morgan, 2023).

In parallel, content analysis was applied to secondary sources such as policy documents, industry reports, and public statements. This process enabled the identification of key terms, policy positions, and recurring narratives relevant to procurement behavior, localization strategies, and system adoption trends. These insights strengthened the external environment assessment within the Industrial-Organization (I/O) framework adopted for the study.

Finally, triangulation was employed to enhance validity by cross-referencing findings from interviews, AI-assisted thematic outputs, and secondary data. Consistencies across multiple sources and stakeholder groups were treated as evidence of thematic reliability and analytical robustness.

RESULTS AND DISCUSSION

Market Analysis

The analysis of the defense UAV market in Indonesia shows complex dynamics involving various stakeholders, such as the Ministry of Defense, the TNI, SOEs under DEFEND ID, and overseas suppliers. Referring to stakeholder and institutional theory, UAV procurement decisions are not only based on price, but also on technology transfer, local industry involvement, and compliance with local offset and content policies. The B2B and relationship-based market structure shows a long and multi-tiered procurement process, as happened in the newly contracted ANKA MALE UAV program in 2023 after years of evaluation and negotiation. Market segmentation is also evident among TNI branches, where the Air Force emphasizes range and carry ability, the Navy focuses on maritime monitoring, and the Army needs portable UAVs for tactical operations. This difference shows that industrial market segmentation is more determined by operational needs and usage contexts, rather than demographics. On the other hand, the industry's involvement in the value chain as both end-users, regulators, and industry partners determines strategic segments, where foreign suppliers willing to transfer technology and local production have an advantage in market access.

Collaborative approaches such as those undertaken by TAI and PTDI reflect the importance of shared value creation in project-based industries such as defense. Table 3 below summarizes the primary UAV programs and initiatives in Indonesia's defense market, highlighting their stakeholder and segmentation characteristics.

Table 3. Overview of UAV Platforms in Indonesia's Defense Ecosystem

UAV Platform	Type / Class	Origin (OEM)	Stakeholder Involvement	Status (as of 2025)
ScanEagle	Small Tactical UAV	United States (Boeing Insitu)	Operated by the Navy (maritime patrol). Stakeholders: TNI-AL (user), U.S defense aid (supplier)	±8 units in service for coastal surveillance
Aerostar	Tactical UAV (ISR)	Israel (Aeronautics)	Operated by the Air Force (Skwadron 51). Stakeholders: TNI-AU, foreign supplier; minimal local industry role	4 units acquired ~2015; now primarily for training
CH-4B Rainbow	MALE UCAV (Armed ISR)	China (CASC)	Operated by Air Force (Skwadron 52) for long-range ISR and strike trials. Stakeholders: TNI-AU (user), direct foreign purchase; limited offset involvement	6 units delivered in 2019; operational debut 2019 in joint exercise; airworthiness certified 2021
Wulung	Small Tactical UAV (ISR)	Indonesia (PTDI & BRIN)	Indigenous development for Navy/Coast Guard use. Stakeholders: PTDI/BRIN (developers), TNI-AL and Bakamla (prospective users), government R&D funding	Prototype tested, type certified in 2016; demo flights in 2025 to attract adopters. 150 km range, 50 knots cruise (Martiar, 2025)
DID.311	Tactical UAV (ISR)	Indonesia (PT LEN)	Joint R&D by MoD Balitbang, PT LEN, ATIL-Thailand. Stakeholders: MoD, TNI branches, PT LEN, ATIL	Flight-performance test Nov 2024; integration underway for BLOS; local content ~45%
Elang Hitam	MALE UAV (armed-capable)	Indonesia (PTDI consortium)	Initial consortium: BPPT (now BRIN), MoD, PTDI, ITB, LAPAN, TNI-AU, and PT LEN. Stakeholders: PTDI consortium, MoD, TNI-AU	Prototype shown in 2019; budget diverted to civilian purposes in 2022; PTDI took over and revived it with private funds; test flights planned in 2025.
ANKA	MALE UAV (ISR/strike-capable)	Turkey (TUSAŞ/TAI)	MoD procurement with local assembly. Stakeholders: TNI branches, MoD, PTDI, TAI	12 units ordered in 2023. 6 built locally; deliveries begin 2025. Includes offset and training packages

Indonesia's defense UAV ecosystem reflects a hybrid approach between imported solutions and local initiatives. UAVs such as ScanEagle and Aerostar meet short-term tactical ISR needs but contribute little to strengthening domestic capacity. In contrast, the Elang Hitam program aims to build local MALE UAVs in line with the policy of independence, despite resource and capability constraints. PTDI's support and external funding in 2025 will revive the program, while ANKA's acquisition from Turkey is accelerated to meet operational needs and technology transfer. This approach reflects the tension between normative expectations in stakeholder theory and the pragmatic need for a ready-to-use platform. From a marketing perspective, ANKA's acquisition demonstrates a targeted targeting strategy: TAI fills the void of MALE UAVs with solutions that meet the needs of maritime surveillance and industry cooperation, such as local production and technology transfer to PTDI. This is in line with a value-based targeting approach that emphasizes long-term ecosystem development. The external environment analysis using the I/O model highlights the influence of macro factors (PESTEL), industrial structure (Porter's Five Forces), and global competition on the UAV market strategy in Indonesia.

From an Industrial-Organization (I/O) perspective, these market characteristics indicate that competitive advantage in Indonesia's defense UAV sector is primarily shaped by external structural forces rather than firm-specific efficiency alone. High buyer concentration, strong regulatory intervention, and mandatory offset requirements constrain strategic choices and reinforce the importance of institutional alignment. This finding supports the I/O model's central argument that industry structure and government policy act as dominant determinants of strategic positioning, particularly in defense markets where procurement decisions are politically and institutionally mediated.

Beyond technological considerations, institutional and structural constraints also shape the pace and direction of UAV capability development in Indonesia. (Gindarsah & Priamarizki, 2021), Drawing on the concept of under-balancing, argue that inefficiencies within state bureaucracy, limited fiscal commitment, and fragmented modernization priorities have constrained the development of Indonesia's naval and air force capabilities. This perspective reinforces the applicability of the Industrial-Organization model adopted in this study, as it underscores how external institutional forces, rather than firm-level efficiency alone, condition strategic outcomes in defense markets characterized by centralized procurement and strong political oversight.

PESTEL Analysis

Indonesia's political environment under President Prabowo reflects a continued commitment to military modernization and defense self-reliance, reinforcing the implementation of Law No. 16/2012 on local content and offset requirements in foreign defense procurement. Indonesia's strategic cooperation with France and Turkey, exemplified by the procurement of Rafale fighter jets and ANKA UAVs, reflects a deliberate policy to diversify defense partnerships and reduce reliance on any single foreign partner (The Diplomat, 2023; Defence Security Asia, 2025). Tensions in the North Natuna Sea are driving increased maritime surveillance through UAVs. Relations with the US remain strong militarily (e.g., Garuda Shield), but are constrained by regulations such as ITAR that make technology transfer difficult. For MADS Corp., it is important to align with national priorities, forge local partnerships through DEFEND ID, and offer politically neutral non-ITAR solutions.

From an economic perspective, Indonesia's defense budget remains relatively modest at approximately 0.7–0.8 percent of GDP, with a substantial portion allocated to personnel expenditures, thereby limiting fiscal flexibility for the acquisition of advanced defense technologies (Surahman et al., 2024). Even so, the potential for a budget increase to 1.5% of GDP and the establishment of a state wealth fund and Danantara open financing opportunities for strategic defense projects (Triantama, 2025). Economic growth and the drive for modernization continue to drive demand for efficient technology solutions, especially those that

support territorial surveillance and border security (DSA, 2025). MADS Corp. can take advantage of this situation by offering competitive pricing, phased technology upgrades, and co-financing arrangements that improve program feasibility.

Social factors also shape Indonesia's defense UAV ecosystem. Public opinion generally supports defense independence and indigenous capability development, although foreign acquisitions are frequently scrutinized with respect to transparency, sovereignty, and national interest considerations (Rammal et al., 2014). Flagship programs such as the Elang Hitam MALE UAV carry strong symbolic value as expressions of technological sovereignty, despite ongoing technical and operational challenges. At the same time, the defense sector faces structural difficulties in attracting and retaining engineering talent, as skilled professionals are often drawn to more competitive opportunities in the commercial sector (Wahyu, 2025). Consequently, foreign suppliers are expected not only to deliver hardware but also to contribute to human capital development through training, knowledge transfer, and sustained local engagement, positioning themselves as long-term strategic partners rather than transactional vendors.

Technological dynamics further underscore the importance of advanced navigation and communication subsystems within Indonesia's UAV programs. Recent advances in sensor fusion further reinforce this argument. Ahmadi et al. (2025) demonstrate that tightly coupled GNSS/IMU integration using factor graph optimization and robust m-estimators significantly improves positioning accuracy, providing empirical evidence that high-grade inertial navigation systems are both technically mature and operationally viable. These capabilities directly align with Indonesia's requirements for persistent ISR missions in environments vulnerable to signal degradation.

The growing emphasis on resilience against GNSS disruption is strongly supported by recent academic literature. Zidan et al. (2021) comprehensively identify vulnerabilities in civilian and non-encrypted GNSS, including jamming, spoofing, multipath, and non-line-of-sight effects, which pose critical risks to unmanned aerial systems operating in contested or maritime environments. To mitigate these risks, prior studies highlight the importance of hybrid navigation architectures rather than reliance on standalone GNSS solutions.

Operational requirements increasingly demand beyond-visual-line-of-sight (BVLOS) capability, robust C4ISR integration, and resilience against jamming and signal denial. Legacy platforms such as the CH-4B remain constrained by line-of-sight communication limitations, which partly motivated Indonesia's acquisition of more capable systems such as ANKA (DSA, 2025). While domestic research and development efforts by institutions such as PT LEN and universities continue to progress, they have not yet produced high-precision navigation and communication systems at scale, sustaining reliance on foreign technology providers. In this context, MADS Corp can address critical capability gaps by offering non-ITAR high-precision inertial navigation systems, modular SATCOM solutions, and integration-ready architectures designed to support long-term localization and technological self-sufficiency.

For airborne platforms such as MALE UAVs, positioning accuracy, particularly in the vertical dimension, remains a persistent technical challenge. Ma et al. (2019) show that satellite-ground joint positioning using pseudolites can significantly improve dilution of precision for aerial targets, including UAVs operating at medium altitudes. However, their analysis also emphasizes that such improvements are contingent upon stringent time-synchronization requirements, as timing errors are directly translated into pseudorange inaccuracies. Experimental validation by (Hameed et al., 2025) further demonstrates the feasibility of pseudolite-assisted navigation when precise synchronization is achieved, reporting sub-meter pseudorange RMSE and positioning errors on the order of 0.5 m. These findings suggest that alternative navigation infrastructures can meaningfully complement GNSS in environments where satellite signals are degraded, provided that system-level integration challenges are adequately addressed.

Environmental considerations also play an increasingly important role in shaping defense procurement decisions. Indonesia's archipelagic geography and humid maritime climate impose demanding operational conditions, requiring UAV subsystems that are highly durable, corrosion-resistant, and capable of sustained operation in extreme environments. In parallel, the gradual introduction of Green and Sustainable Public Procurement (G/SPP) principles is beginning to influence defense acquisition practices, encouraging greater attention to energy efficiency, lifecycle sustainability, and e-waste management (Erizaputri et al., 2024; Kuncoro et al., 2024). UAV technologies that combine operational resilience with environmental compliance are therefore likely to gain a competitive advantage. For MADS Corp, this necessitates ensuring that its systems not only meet technical performance requirements but also align with Indonesia's emerging sustainability objectives.

Finally, the legal and regulatory environment remains a decisive factor in Indonesia's defence UAV ecosystem. Defence procurement is governed by strict requirements on transparency, local content, and industrial participation under Law No. 16/2012, including a minimum offset obligation of 35 percent for contracts exceeding USD 3 million. The integration of UAV subsystems typically requires collaboration with licensed local partners such as PT Dirgantara Indonesia or PT LEN Industri, reinforcing the importance of partnership-based market entry strategies. At the international level, export control regimes, particularly ITAR, continue to restrict the transfer of certain technologies, complicating integration processes and extending procurement timelines. As a result, flexible, offset-ready, and non-ITAR solutions are more likely to align with Indonesia's defense industrial objectives and gain institutional acceptance within its tightly regulated procurement environment.

The combined PESTEL and Five Forces analyses further reinforce the relevance of the I/O model in explaining subsystem adoption dynamics in Indonesia's defense UAV ecosystem. Political regulation, legal offset obligations, and centralized procurement significantly elevate entry barriers, while high buyer power and supplier concentration limit strategic maneuverability. In such an environment, competitive positioning is less about outperforming rivals on cost or technology alone and more about securing legitimacy, regulatory fit, and institutional acceptance, core mechanisms emphasized in the I/O framework.

Porter's Five Forces Summary

The UAV navigation and communication system market in Indonesia has high barriers to entry due to strict regulations, certification requirements, and a market structure dominated by experienced players (DEFEND ID, 2022). The threat of substitution is moderate, with increasing interest in non-GNSS navigation such as visual odometry and quantum sensors, although adoption is still early (Finnerty, 2025). Supplier strength is high due to dependence on critical components produced by a small number of global vendors. Purchasing power is also high, with the MoD centralizing procurement and demanding offsets and diversification of partners (Grevatt, 2021). Competition is fierce, with many global and regional suppliers in the INS and SATCOM UAV markets, targeting Indonesia's ISR needs in border areas (Interview with NA, 2025).



Figure 2. High-End Inertial Sensor Player Landscape
 Source: Yole Group, 2025

The ANKA MALE UAV program illustrates the tight market rivalry. Initial ANKA units in Indonesia are configured with Turkish-sourced INS and SATCOM systems, likely Aselsan for INS and CTech for SATCOM, delivered as part of TAI’s baseline avionics architecture. This configuration ensures seamless compatibility with ANKA’s flight management systems. While Indonesia’s co-production arrangement with PTDI may create future opportunities for local substitution or integration, the standardization of Turkish systems currently limits entry for alternative foreign suppliers.

The SATCOM domain is similarly crowded. Global players, including Cobham, Thales, Hughes, Skytrac, Viasat, and Iridium, offer proven small-form-factor UAV terminals and maintain commercial footprints in Southeast Asia. As SATCOM evolves toward multi-network, encrypted, and low-SWaP configurations, differentiation increasingly depends on secure integration, waveform compatibility, and readiness for national certification. In Indonesia, SATCOM solutions must also demonstrate compatibility with domestic satellite service providers such as Telkomsat and Pasifik Satelit Nusantara (PSN), which are often mandated or preferred for defense connectivity.

To complement the broader industry and environmental assessments, this section presents a focused competitor analysis of technology providers relevant to Inertial Navigation System (INS) and SATCOM in Indonesia’s defense UAV ecosystem. Using the analytical framework outlined in Chapter 2, each competitor is assessed individually across four strategic dimensions: future objectives, current strategy, underlying assumptions, and capabilities.

Inertial Navigation Systems

ASELSAN (Turkey) targets 50% of revenue to come from international markets by 2030, up significantly from 12.2% in 2024, with Indonesia being a priority market in its expansion into Southeast Asia. The opening of an office in Jakarta and the signing of five strategic agreements in June 2025 with PT LEN, PT PINDAD, and PT PAL demonstrate their long-term commitment to local defense industry cooperation. ASELSAN’s market entry strategy focuses on partnerships, technology transfer, and joint production, particularly for inertial navigation systems such as the KILAVUZ and ANS-510 series. Their approach assumes that ITAR-free status provides regulatory advantages and that Indonesia prioritizes technology transfer and local content over the highest technological performance. ASELSAN also relies on the perception that Southeast Asian countries tend to seek non-Western alternatives for the sake of strategic autonomy and believes that long-term engagement is more effective than short-term sales. In terms of capabilities, ASELSAN offers tactical-grade FOG and MEMS navigation systems such as the ANS-420 and ANS-510, supported by political support, competitive pricing,

and a broad defense portfolio. However, limitations remain, such as a global track record that is inferior to Safran or Collins, as well as the lack of operational implementation of their navigation system in Indonesia.

Safran (France) is targeting the expansion of its role in Indonesia from an aircraft engine supplier to an integrated defense system integrator. Relying on a 30-year relationship with PT Dirgantara Indonesia (PTDI), Safran now offers navigation solutions, guided munitions such as AASM/HAMMER, and integrated avionics to support Rafale's strategic modernization and integration programs (Gindarsah & Priamarizki, 2021). Its strategy is based on premium technology relationships and differentiation, with HRG Crystal-based inertial navigation such as Geonyx™ and Sigma 95, designed for high-precision performance GNSS-free operations. Indonesia is willing to pay more for the flagship system, as well as relying on its long-standing partnership with PTDI and the Ministry of Defense as a competitive advantage (Setiaji et al., 2022). Cross-domain integration (propulsion, navigation, weapons) is considered a strategic plus. With a global reputation as an HRG technology leader, Safran's portfolio includes air, sea, and land applications, and is compatible with the French platform operated by Indonesia. However, high prices can limit penetration, especially in cost-sensitive UAV programs. Safran also emphasizes less local or offset production than competitors such as ASELSAN, while the integration of its systems requires adequate technical infrastructure and local human resources.



Figure 3. Safran Sigma 95L Compact INS
Source: (Safran Federal Systems, 2023)

Collins Aerospace / RTX (United States), a division of RTX, seeks to expand its role in Indonesia's defense sector by leveraging its track record in civil aviation. After successfully upgrading the C-130's digital cockpit with PT GMF AeroAsia and PT Dirgantara Indonesia, Collins is now targeting expansion into inertial and mission navigation systems for broader defense applications. Collins' strategy focuses on transitioning from the civilian to defense sectors through the integration of navigation systems into larger avionics packages, such as MAPS Gen II for GPS-free operations. The assumption is that reputation in civil aviation creates trust in the defense sector, and that Indonesian customers value continuity, system integration, and technical support more than mere technical excellence. Collins' portfolio includes MEMS-based IMUs such as SilMU02 and LITIS, as well as Athena UAS systems that combine autopilot and sensor control (Soares Lira da Silva et al., 2016). However, export constraints due to U.S. ITAR regulations and a lack of commitment to local production pose challenges in competing with other, more flexible producers, such as Turkey, especially in cost-sensitive UAV programs.

Satellite Communication System

CTech (Turkey), a subsidiary of Turkish Aerospace Industries (TUSAŞ), is targeting a position as a global provider of secure satellite communications for unmanned systems, with a strategy to expand the market to Southeast Asia through bilateral cooperation, including a 2025 memorandum of understanding with Pacific Satellite Nusantara (PSN) for the development of on-the-move SATCOM technology in the defense sector. Taking a partnership-based approach

and technology transfer, CTech relies on its track record of system integration in UAVs such as ANKA and AKSUNGUR, with STANAG 4606 compliant SATCOM terminals and throughput of up to 20 Mbps. It is assumed that intergovernmental cooperation, interoperability of NATO systems, and willingness to transfer technology are key to regional market access. With terminals such as the DEV-KA-12 and DEV-KU-18 that have been tested on various Turkish platforms and UAVs of interest in Indonesia, as well as local cooperation with PSN, CTech presents itself as a competitive, flexible, and credible integrated system provider in the regional defense ecosystem. However, the company's limited global market presence, relatively low brand recognition outside Turkey, and dependence on Turkish defense exports constrain its strategic autonomy. CTech also trails more established players like Hughes in areas such as multi-orbit and AI-based network optimization.

Thales (France) seeks to strengthen its global leadership in military SATCOMs through the development of multi-orbit hybrid architectures (GEO, MEO, LEO) designed to enhance resilience, sovereignty, and operational flexibility. In Southeast Asia, including Indonesia, Thales leverages its NATO-standard defence portfolio as well as active participation in regional forums such as the Bali Air Show and Indo Defence to expand its market reach. The company's strategy emphasizes the integration of SATCOM terminals into multidomain defense systems such as aircraft, ISR platforms, and national command networks, with features of electronic protection, anti-jamming, and high data security. Thales assumes that the need for strategic autonomy and communications resilience will drive the adoption of multi-orbital technologies in the region, with its historical advantages in Indonesia, such as the MASTER T RADAR, TRS 2215, naval combat systems, and ForceShield air defense, as the cornerstones of further expansion. Despite being known for advanced technologies such as FlytLINK™ for MALE UAVs, Thales faces pricing challenges and a less aggressive localization approach than regional competitors, which could affect its competitiveness in meeting Indonesia's offset and TKDN requirements.

Hughes (United States), Network Systems targets global leadership in the defense SATCOM market through multi-orbit innovation and AI-based network orchestration, with a strategic focus on the Indo-Pacific region, including Indonesia. The company adopts a software-based architecture that supports optimization of GEO, MEO, and LEO networks with dynamic switching features and high resiliency for UAV operations, including collaboration with General Atomics on the MQ-1C and MQ-9 platforms. In Indonesia, Hughes has established a long-term partnership with PSN through the JUPITER system to support national connectivity and military services. The company assumes that multi-orbital flexibility and commercial-military synergies will become the new standard in SATCOM systems, while local collaboration is expected to alleviate concerns related to U.S. regulations. Despite its high technical capabilities, such as a 200 Mbps terminal and a WGS-certified HM400 modem, Hughes still faces obstacles in the form of restrictions on U.S. technology exports and political sensitivity, which could limit the localization and adoption of the system in Indonesia's UAV program.



Figure 4. Hughes HM400 SATCOM Modem
Source: (Hughes, 2025)

Indonesia's Strategic MALE UAV Program

In alignment with the Industrial-Organization (I/O) Model of Above-Average Returns (Hitt et al., 2020), this section identifies the most attractive segment within Indonesia's defense UAV ecosystem. Drawing upon the earlier analyses of stakeholder dynamics, procurement behavior, and regulatory pressures, this study finds that the Medium-Altitude Long-Endurance (MALE) UAV segment, particularly the Elang Hitam and ANKA programs, offers the highest potential for technology engagement, especially in GPS-denied and SATCOM technologies.

Indonesia's defense priorities have increasingly emphasized maritime domain awareness, border surveillance, and persistent ISR missions, particularly in contested zones such as the Natuna Sea and outer island regions. These missions require UAVs with robust autonomy and reliable command and control (C2) capabilities, even in GNSS-denied or infrastructure-limited environments (Sochfan et al., 2025). As such, inertial navigation and satellite communication systems have become critical enablers, positioning them as key entry points for technology suppliers amid tight platform competition.

1. **Elang Hitam:** Indonesia's flagship MALE UAV program, developed by a national consortium involving PTDI, PT LEN, and research institutions, has now been revived by PTDI with a new funding structure and flight tests scheduled for 2025. Its modular architecture without the attachment of foreign systems provides high flexibility for the integration of new technologies, making it highly aligned with local content policies (Law No. 16/2012). Interviews with PTDI and PT LEN confirmed institutional interest in navigation solutions and non-ITAR SATCOM to maximize technology transfer, so that Elang Hitam becomes the most prospective segment for foreign OEMs such as MADS Corp in establishing technology partnerships.
2. **ANKA UAV:** Made by Turkish Aerospace Industries (TAI), has been ordered by the Indonesian government since 2023, with the second six units assembled locally by PTDI. Although the navigation systems and SATCOMs in the first batch are confirmed to be from Turkish partners such as CTech and ASELSAN, the local assembly model provides a medium-term opportunity for MADS Corp to enter through system replacement in the next batch or future upgrades, particularly if technical excellence and policy suitability (e.g., non-ITAR and modularity) can be proven. With PTDI as an integrator, technical interaction is open even though the path is narrower than that of Elang Hitam.
3. **Supporting Program:** In addition to the Elang Hitam and ANKA, TNI-AU's CH-4B UAV offers limited opportunities, especially in the integration of SATCOM for BVLOS operations, which is still possible if it is through cooperation with private system integrators. Meanwhile, PT LEN's local tactical UAV, DID.311, is still in the early development stage and has not yet become a strategic priority compared to the Elang Hitam. Since PT LEN is also involved in the Elang Hitam program, the main focus at this time remains on the MALE segment, while opening up an initial discussion space regarding a suitable system for DID.311.

Strategy Formulation

MADS's strategic positioning in Indonesia's defense UAV sector is anchored in a needs-based approach, focusing on fulfilling specific operational and industrial priorities rather than applying a broad product-push model. This reflects Porter's notion that successful strategy stems from serving all requirements of a clearly defined customer segment (Porter, 1996). To structure this logic, the company applies Hambrick and Fredrickson's Strategy, which examines five key facets: arenas, vehicles, differentiators, staging, and economic logic. The application of the Strategy Diamond demonstrates how strategic coherence emerges when firm-level choices are aligned with externally imposed industry constraints. In line with Porter's needs-based positioning, MADS's focus on navigation and communication subsystems reflects a deliberate narrowing of scope to serve clearly defined operational and institutional needs. At the same time, the selected arenas, vehicles, and differentiators are not purely discretionary but conditioned by

procurement rules, offset policies, and platform governance, underscoring the interaction between firm strategy and industry structure as predicted by the I/O model.

Arenas

In defining its arenas, MADS identifies Indonesia's MALE UAV ecosystem, primarily the Elang Hitam and ANKA programs, as its central focus. The company aims first at the domestic market, establishing a solid foothold before pursuing potential regional export opportunities. This positioning resonates with Indonesia's national agenda of strengthening indigenous UAV capabilities. The main customer segment consists of the Indonesian armed forces, with the Air Force, Navy, and Army expected to deploy MALE UAVs for intelligence, surveillance, and reconnaissance missions. Both the domestically developed Elang Hitam and the co-produced ANKA will play a pivotal role in supporting national security tasks such as maritime domain awareness across the country's archipelagic territory.

From a product and technology perspective, MADS limits its scope to specialized UAV subsystems, specifically navigation and communication systems. These include a high-precision inertial navigation unit that can operate independently of GPS and a compact SATCOM terminal designed for long-endurance UAV missions. By concentrating on these avionics' components, MADS addresses mission-critical requirements such as accurate navigation over extended periods and secure beyond-line-of-sight command and control. Moreover, in alignment with Indonesia's Defense Industry Law (Law No. 16/2012), MADS commits to active involvement in the value chain by partnering with PT Dirgantara Indonesia (PTDI) and PT Len Industri (PT LEN). This ensures that integration, testing, training, and MRO support are carried out domestically, embedding MADS within the national defense ecosystem rather than acting solely as an external supplier.

Vehicles

The vehicles chosen by MADS reflect Indonesia's emphasis on local collaboration and technology transfer. The company prioritizes partnerships with PTDI and PT LEN, ensuring that its inertial navigation and communication systems are embedded within the country's UAV development and production structure. These collaborations enable MADS to integrate directly into existing program frameworks, securing its role as a long-term partner.

Beyond simple alliances, MADS adopts a co-development model that incorporates embedded technology transfer. Local engineers are actively involved in adapting and refining the systems, while joint R&D teams customize subsystems to meet Indonesia's specific operational requirements. Certain assembly or calibration processes are licensed for execution within the country, building technical expertise and gradually transferring knowledge to Indonesian counterparts. In this way, MADS aligns its growth with Indonesia's defense industrial objectives while reinforcing trust and long-term cooperation.

Differentiators

MADS's positioning is characterized by a set of technical and organizational attributes aligned with the operational requirements of Indonesia's UAV programs. One distinguishing feature of MADS's offering is the INS-X4 inertial navigation system, which utilizes fiber-optic gyro technology to support navigation under GPS-denied conditions. With a reported drift rate of approximately 0.8 nautical miles per hour, the system is designed to support operational reliability for Elang Hitam and ANKA UAVs in contested environments where electronic interference is a threat (Figure 7 CNS by MADS Corp INS-X4 Navigation System, Source: CNS).



Figure 5. CNS by MADS Corp INS-X4 Navigation System
Source: (CNS, 2025)

Complementing the INS-X4, MADS offers the SFF SATCOM unit, a compact Inmarsat Swift Broadband terminal designed for UAV applications at roughly one kilogram. Despite its compact size, it delivers data rates up to 200 kbps and supports both satellite and terrestrial 4G/5G networks, enabling resilient over-the-horizon command-and-control across Indonesia's vast geography (Figure 8. MADS Corp SFF SATCOM, Source: MADS Corp).



Figure 6. MADS Corp SFF SATCOM
Source: (MADS Corp, 2025)

The systems are also designed with open architecture principles, allowing seamless integration across multiple platforms and ensuring compatibility with diverse avionics standards such as RS-232/422, ARINC-429, and Ethernet. This architectural flexibility facilitates integration across platforms and services. Another critical differentiator is that MADS's products are ITAR-free, removing restrictions tied to U.S. export regulations. This grants Indonesia greater strategic autonomy and supports its ambition to export indigenously developed UAVs in the future.

Moreover, MADS differentiates itself through its partnership philosophy, embedding its engineers into Indonesian teams and focusing on areas where it can add value, such as advanced inertial sensing and SATCOM, without displacing domestic expertise. This cooperative approach is reinforced through long-term lifecycle support, including training, maintenance, spare parts, and software updates. Post-sale support arrangements are intended to address sustainment and lifecycle requirements expected by Indonesian stakeholders that its systems will remain sustainable and effective throughout their service life.

Staging

The implementation of MADS's strategy is phased over a 36-month horizon. In the short term (Months 1–6), the priority lies in building foundations through cooperation agreements with PTDI and PT LEN, aligning technical requirements, and initiating early training sessions for local engineers. Regulatory approvals and preparations for system integration are also key activities during this stage.

During the mid-term phase (Months 7–18), the focus shifts to prototype integration and validation. Both the INS and SATCOM units are installed on Elang Hitam prototypes and locally assembled ANKA UAVs, followed by flight evaluations. Lessons from these trials inform

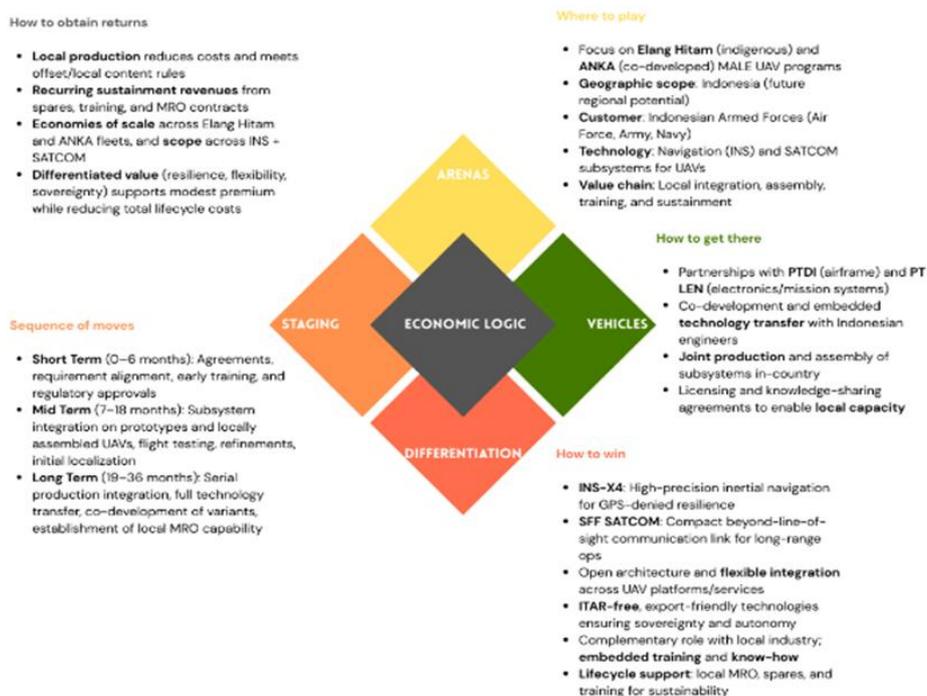
refinements, while localization begins through limited in-country assembly and deeper technology transfer initiatives.

By the long term (Months 19–36), MADS seeks to achieve full-scale production integration, establish local maintenance and support facilities, and enable Indonesian engineers and technicians to independently handle integration and sustainment. At this stage, co-development of future variants is expected to further tailor solutions to evolving Indonesian requirements.

Economic Logic

The economic logic underpinning MADS’s strategy combines cost efficiency, service revenues, economies of scale, and value-based pricing. By producing and assembling components locally with PTDI and PT LEN, MADS lowers production costs, avoids tariffs, and meets offset obligations. This allows the company to remain competitive in bidding processes while sustaining margins. Revenue is also structured around long-term support and maintenance contracts, ensuring recurring income streams through training, spares, and upgrades. Once established, these services provide a recurring revenue stream linked to system sustainment and upgrades, as customers depend on the original supplier for specialized expertise. Scale advantages arise as the systems become standard across both Elang Hitam and ANKA, and potentially across all branches of the Indonesian military. Shared infrastructure between the navigation and communication product lines further improves efficiency.

Finally, the pricing approach reflects value-based logic, balancing performance, regulatory flexibility, and lifecycle costs. The company justifies this premium by highlighting superior performance under GPS denial, regulatory flexibility, and reduced total lifecycle costs. In this way, MADS creates a balance between affordability for Indonesia and sustainable profitability for itself. The application of the Strategy Diamond demonstrates how MADS’s choices of arenas, vehicles, differentiators, staging, and economic logic interlock to form a coherent, mutually reinforcing strategy. This approach exemplifies Porter & Linde (1995) in practice, allowing MADS to align fully with Indonesia’s MALE UAV requirements while supporting the country’s ambition of building an indigenous defense industry (Figure 9: MADS Corp Strategic Positioning through the Strategy Diamond Model)



Source: Author

Figure 7. MADS Corp Strategic Positioning through the Strategy Diamond Model

Internal Capability Alignment

Although the Industrial-Organization (I/O) Model emphasizes the influence of external factors on strategic outcomes, the successful implementation of the strategy also depends on the company's ability to align internal resources with the demands of the chosen strategy. Once attractive markets have been identified and strategies have been formulated, companies need to evaluate whether they have the technology assets, organizational competencies, and operational structures that support implementation. This includes an assessment of tangible and intangible resources, as well as the company's ability to create value in a tightly regulated and performance-sensitive environment, such as in Indonesia's defense UAV ecosystem, including the Elang Hitam and ANKA programs.

The Resource-Based View (RBV) approach states that a company's competitive advantage comes from internal resources that are unique and difficult for competitors to replicate. RBV distinguishes resources into two types: tangible (such as facilities, capital, and equipment) and intangible (such as technical knowledge, intellectual property rights, and reputation). Only resources that meet the VRIN (valuable, rare, inimitable, non-substitutable) criteria can generate a sustainable competitive advantage, and MADS Corp adopts this principle to build its advantages in global UAV and defense systems, including in Indonesia.

Tangible Resources

MADS Corp's tangible resources include manufacturing and R&D infrastructure spread across the U.S., Canada, Europe, India, and Malaysia, supporting the production of satellite navigation and communications systems. The company has testing facilities, critical component inventory, and a global ERP-backed logistics system, as well as staging facilities for export. Its financial capital supports continued investment in R&D and offset programs, while its regional organizational structure with offices and workforce in Indonesia ensures continued local involvement in UAV and defense projects.

Intangible Resources

MADS Corp's intangible assets include technical expertise, a culture of innovation, a global reputation, institutional relationships, and internal organizational systems. The company relies on a global technical workforce in the development of systems such as INS-X4 and SFF SATCOM, as well as acquisition-based innovation approaches and structured R&D in various technology centers. The company's reputation in civil and military aviation, coupled with its 40-year history in Indonesia, reinforces stakeholder trust. The ability to build strategic partnerships with local entities such as PTDI and PT LEN, as well as expertise in export compliance, allows MADS Corp to effectively navigate the complexities of Indonesia's defense industry.

Core Capabilities and VRIN Analysis

Based on the analysis of tangible and intangible resources, MADS Corp has six core capabilities that support its differentiation and cooperation strategy in Indonesia's defense sector. These capabilities are: (1) export-aligned product and compliance structuring; (2) navigation-grade inertial navigation technology; (3) an integrated global innovation ecosystem; (4) industry collaboration and stakeholder engagement capabilities; (5) credibility and operational track record in Indonesia; and (6) platform-agnostic system integration capabilities. Each of these capabilities is considered valuable, rare, difficult to replicate, and not easily replaceable, making it a source of sustainable competitive advantage that is relevant in supporting Indonesia's national UAV defense strategy.

Table 4. VRIN Analysis of Six Core Capabilities

Capabilities	Valuable (V)	Rare (R)	Inimitable (I)	No substitutable (N)	Competitive Consequence
Expert Compliance	Yes	Yes	No	Yes/No	Temporary Competitive

Structuring					Advantage
Navigation-Grade INS Tech	Yes	Yes	Yes	Yes/No	Sustainable Competitive Advantage
Innovation Ecosystem	Yes	Yes	Yes	Yes/No	Sustainable Competitive Advantage
Stakeholder Engagement	Yes	Yes	Yes	Yes/No	Sustainable Competitive Advantage
Credibility in Indonesia	Yes	Yes	No	Yes/No	Temporary Competitive Advantage
Systems Integration	Yes	Yes	Yes	Yes/No	Sustainable Competitive Advantage

The capability assessment affirms MADS Corp’s readiness to execute its core strategies in Indonesia. The combination of export-aligned structuring and platform-agnostic systems allows the company to pursue a focused differentiation strategy, particularly in supplying advanced inertial navigation and SATCOM solutions for UAVs and other platforms. Simultaneously, the firm’s embedded innovation and proven ability to work with local partners, such as PTDI and PT LEN, strengthened its cooperative strategy, enabling alignment with local content mandates, offset programs, and stakeholder priorities. These capabilities not only enhance market fit and regulatory agility but also reinforce execution strength for localized delivery, integration, and sustainment.

While the Resource-Based View outlines the strategic value of internal resources and capabilities, it is equally important to understand how these elements are mobilized across MADS Corp’s operational structure to deliver value. The value chain analysis provides a process-level view of how primary and support activities contribute to implementing the firm’s focused differentiation and cooperative strategy (Grote et al., 2024), particularly in the context of Indonesia’s defense UAV ecosystem. Each activity is examined in terms of its ability to support localization, compliance, integration, and sustainment objectives in programs such as Elang Hitam and ANKA.

Primary Activities

MADS Corp’s inbound logistics relies on a globally distributed supplier base for critical components such as GNSS receivers, gyroscopes, processors, and RF modules used in INS and SATCOM systems (Quan et al., 2015). Managed through an integrated ERP system, procurement ensures timely sourcing, quality control, and aerospace-grade storage prior to assembly. Operational activities span production, assembly, calibration, and testing of systems in facilities adhering to dual-use aerospace standards. R&D is embedded into operations to drive continuous innovation and alignment with mission requirements. Outbound logistics are tightly controlled under export compliance, with MADS supporting documentation and transport coordination aligned with Indonesian procedures. The marketing and sales team in Southeast Asia, led by an account director, engages institutional stakeholders and promotes non-ITAR, integration-ready systems through workshops, U.S. Commercial Service support, and regional exhibitions. Service operations include structured RMA and R&O processes at certified facilities and provide integration support, documentation, and training to Indonesian partners for sustainment.

Support Activities

MADS Corp’s firm infrastructure supports regulated defense operations through centralized Asia-Pacific oversight, structured financial controls, legal compliance, and robust IT systems for secure coordination across divisions. Human resources emphasizes technical depth and cross-functional collaboration, with key regional personnel acting as cultural bridges to navigate local procurement norms. Technology development focuses on product and process innovation, including digital twin simulations, automated testing, AI-based diagnostics, and

cybersecurity enhancements to support adaptive, mission-ready systems. Procurement functions ensure the acquisition of high-performance modules and services via global and local suppliers, governed by strategic sourcing principles and close coordination with engineering and production teams.

Limitations

This study is subject to several methodological and analytical limitations that should be acknowledged. First, the qualitative findings are derived from a purposive sample of stakeholders involved in Indonesia's defense UAV ecosystem. While this approach enables in-depth insight into institutional dynamics, it limits the generalizability of the results beyond the specific programs and actors examined. Second, primary data collection relied on interview notes and meeting minutes rather than full audio recordings and verbatim transcripts. Although this approach was chosen due to confidentiality constraints in the defense sector and was mitigated through systematic coding and triangulation, it may have constrained the richness of narrative detail and reduced the ability to capture nuanced expressions or direct quotations. Third, the study adopts MADS Corp as an illustrative focal firm to conduct strategic analysis. While this enhances analytical clarity, it may introduce case-specific bias, as strategic insights are partially shaped by the firm's particular technological portfolio and organizational context. Future studies could strengthen robustness by incorporating longitudinal data, comparative case studies across multiple suppliers, or mixed-method approaches that combine qualitative insights with quantitative procurement or performance data.

CONCLUSION

The study found that MADS Corp can overcome historical barriers to entering the Indonesian defense market by adopting a collaborative approach that is aligned with national policies and operational needs, particularly in strategic UAV programs such as Elang Hitam and ANKA. Success is determined not only by technological advantages such as GPS-denied and SATCOM-resistant navigation systems but also by the extent to which the company can play a role as a local partner that supports the independence of Indonesia's defense industry. The analysis shows that alignment with local integration, regulatory compliance, and sustainable support are key factors for the adoption of foreign systems amid the dominance of defense SOEs and strict TKDN policies. MADS has the technical potential and track record to support this strategic repositioning, but it needs to strengthen technical compatibility, expand technology transfer, and build local maintenance capacity.

Suggestion

The results of this study lead to several strategic and scientific recommendations aimed at enhancing the digital integration within port environments. For the management of PT BNCT, it is highly advised to maintain the technical superiority of the TOS Upgrade through periodic software maintenance, rigorous system audits, and achieving full interoperability between the central operating system and field equipment. Furthermore, the utilization of VMT must be optimized by strengthening localized network connectivity, ensuring the excellent physical condition of hardware devices, and systematically improving operator competence to ensure that the data recording process remains precise and free from manual errors. To sustain the integrity of Container Data Accuracy, management should implement an automated data verification mechanism that periodically reconciles system records with physical yard conditions, thereby reducing mismatches that lead to operational delays.

In terms of improving overall Operational Performance, there is a critical need to strengthen inter-unit coordination and develop a workforce that is highly adaptive to emerging maritime technologies, ensuring that digital systems are viewed as primary tools for productivity. Regarding future academic inquiries, this research contributes significantly to the TAM literature by empirically proving the mediating role of information quality in the relationship

between technology usage and organizational outcomes. While this study provides a foundational understanding, it is limited by its single case study focus on Terminal B and its cross-sectional design, which only captures a specific moment in time. Therefore, future researchers are encouraged to employ a longitudinal design to capture the evolution of performance metrics both before and after the implementation of a TOS Upgrade, while also considering additional variables such as employee motivation or technological innovation to provide a more comprehensive perspective on the digital transformation of the port sector.

Recommendations

For this reason, three main recommendations were proposed. First, MADS must establish initial and structured engagement with key stakeholders such as the Ministry of Defense, TNI, KKIP, as well as national integrators such as PTDI and PT LEN. Second, the business model should include a concrete localization strategy and regulatory compliance from the outset, not only as an administrative requirement, but as a key selling point. Third, the company needs to provide full lifecycle support through knowledge transfer, local MRO capabilities setup, and technical training. This approach will not only strengthen MADS' position in the Indonesian market but also demonstrate a long-term commitment to the development of the national defense industry.

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