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CASE ANALYSIS OF THE 2023 SUSIAIR PILOT HOSTAGE SITUATION AND ITS IMPLICATIONS FOR AVIATION SECURITY IN INDONESIA: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

The hostage-taking of Susi Air pilot Phillip Mark Mehrtens by the West Papua National Liberation Army (TPNPB) in February 2023 in Nduga Regency, Papua—which resulted in a 594-day detention and was resolved through customary mechanisms rather than state mechanisms on 21 September 2024—constitutes a structural diagnostic event for Indonesia's aviation security governance in remote conflict-affected regions. This study employs a Systematic Literature Review (SLR) compliant with the PRISMA 2020 protocol, drawing on 67 peer-reviewed articles retrieved from Scopus, Web of Science, TRID, and AnthroSource/JSTOR covering the period January 2018 to March 2025. Inter-rater reliability was established at Cohen's κ = 0.83, indicating strong agreement across all screening stages. Five principal findings are reported. First, the incident reflects a broader strategic evolution in aviation security threats — from mass-casualty terrorism toward targeted personnel capture as an instrument of asymmetric diplomatic leverage, wherein the victim's foreign nationality functioned as a deliberate amplification mechanism. Second, pioneer aviation operations in remote Papua are characterized by a compound vulnerability condition, defined as the simultaneous, structurally permanent absence of security personnel, screening technology, emergency communication infrastructure, and rapid-response capacity. Third, customary (ondoafi-mediated) governance mechanisms empirically outperformed state security institutions as the operative conflict resolution platform, corroborating the Bougainville precedent. Fourth, the incident generated significant macroeconomic disruption, including aviation insurance premium increases of 23–35% and connectivity losses affecting 247 air-dependent highland communities. Fifth, a critical sequencing constraint is identified: technical and regulatory security reforms cannot achieve sustainable outcomes without prior or concurrent restoration of institutional trust eroded by five decades of conflict securitization. This study introduces compound vulnerability condition as a novel analytical construct and argues that sustainable aviation security in remote Papua requires a holistic governance architecture integrating regulatory reform, formal recognition of customary authority, and political conflict resolution — the last constituting a structural prerequisite rather than a peripheral policy accompaniment.

KEYWORDS: *Aviation Security; Pioneer Aviation; Papua Conflict; Compound Vulnerability; Customary Governance; Indonesia; Systematic Literature Review*

INTRODUCTION

On the morning of February 7, 2023, a Cessna Grand Caravan operated by SusiAir completed its approach to the grass airstrip at Paro, Nduga Regency, in the central highlands of Papua, Indonesia. Within minutes of landing, the aircraft was seized by members of the West Papua National Liberation Army (*Tentara Pembebasan Nasional Papua Barat*, TPNPB), the aircraft was subsequently burned, and the pilot — Phillip Mark Mehrtens, a 37-year-old New Zealand national — was taken captive. He would not be released for 594 days, on September 21, 2024, and his release would be secured not through any state mechanism but through *ondoafi*-mediated customary mediation. This sequence of events is not primarily a story about one man's ordeal or one insurgent group's tactics. It is a diagnostic event — an occurrence that, by exceeding a system's limits of tolerance, reveals the underlying structure responsible for the system's ineffectiveness. The shortcomings revealed here do not belong to any single institution or individual, but rather to the entire framework Indonesia uses to regulate civil aviation security in remote, conflict-ridden areas.

Pioneer aviation is not a niche operational category in Indonesia; it is a lifeline infrastructure whose disruption carries immediate welfare consequences for hundreds of thousands of people. In the provinces of Papua and West Papua, topography renders surface transport impossible across vast highland regions: no roads connect most highland communities to lowland centers, and river networks are navigable only seasonally and partially. For 247 documented highland settlements, scheduled and charter aircraft represent the only reliable access to medical care, essential goods, educational connectivity, and emergency evacuation (Pabalik, 2020). The aircraft that serve these communities operate from remote airstrips that are, by definition, beyond the institutional perimeter of Indonesia's civil aviation security framework — stripped of the security personnel, technology, perimeter infrastructure, and emergency response capacity that ICAO Annex 17 presupposes in every airstrip it purports to regulate. When a TPNPB unit seized the SusiAir aircraft at Paro, it was not defeating a security system; it was operating in a space where no security system existed in any operationally meaningful sense.

The security environment at Paro did not emerge from administrative oversight; it was produced by the five-decade interaction of geography, political conflict, and institutional choice. Papua's incorporation into Indonesia through the 1969 Act of Free Choice (*Penentuan Pendapat Rakyat*) — a process Saltford (2003) characterizes as structurally exclusionary — initiated a sustained legitimacy contest between the Indonesian state and Papuan ethnonationalist movements that has resisted every attempted resolution. Wangge (2023) demonstrates that Indonesia's dominant response to this contest has been securitization: the systematic framing of Papua as a security problem requiring military management rather than a political dispute requiring negotiated settlement. This securitization has two consequences directly relevant to aviation security. First, it has sustained the material conditions — armed insurgency, community displacement, institutional distrust — that make remote airstrips vulnerable to armed seizure. Second, it has degraded the community trust relationships on which any functionally effective security architecture in remote environments ultimately depends: communities that fear state security institutions as instruments of political surveillance do not report threats, do not cooperate with security protocols, and do not provide the social intelligence that compensates for technological deficits in remote operations (Pamungkas, 2024; Chairullah, 2024).

The SusiAir incident is not classifiable within the conventional taxonomy of aviation security threats. Post-September 11 aviation security architecture was designed to address three threat typologies: transnational terrorist organizations attacking high-density metropolitan airport infrastructure, state-sponsored sabotage, and domestic criminal actors. The regulatory expression of this architecture — ICAO Annex 17 and its associated Security Manual — is calibrated to these typologies through layered physical screening, intelligence-led passenger profiling, and perimeter access control at formal airport facilities. None of these measures addresses the seizure of an aircraft and its crew at a remote highland airstrip by an ethnonationalist insurgent group whose strategic objective is not mass casualties but the creation of a diplomatic hostage whose foreign nationality generates international media attention and bilateral government pressure disproportionate to the group's conventional military capacity (Hoffman, 2007; Henderson & Clark, 2022). Mehrtens' New Zealand nationality was not incidental; it was a strategic selection that transformed a local insurgent action into a bilateral diplomatic event between Wellington and Jakarta, generating ICAO attention, international news coverage, and sustained political pressure that no equivalent action against an Indonesian national

would have produced. This is hybrid threat logic — the rational calculation of a militarily inferior actor maximizing political effect through target selection — and it falls entirely outside the analytical vocabulary of existing aviation security regulation.

The physical conditions on the Paro runway at the time of the incident did not represent a significant safety deficiency, but rather a typical operational reality for the regional airline network in the remote areas of Papua. Ramirez et al. (2021) document that remote airstrips across Indonesia lack the full spectrum of ICAO-standard security infrastructure: dedicated security personnel, perimeter fencing, passenger and baggage screening equipment, guaranteed emergency communication links, and rapid-response capacity within defined timeframes. Each of these deficits individually constitutes a serious departure from regulatory standards in a metropolitan context. Their simultaneous presence creates what this study terms a *compound vulnerability condition* — a multiplicative rather than additive accumulation of security gaps whose combined effect is to render conventional security responses not merely inadequate but categorically inapplicable (Price & Forrest, 2016; Elias, 2010). The critical policy implication of this characterization is that the compound vulnerability condition cannot be addressed through incremental ICAO compliance investment: it requires a fundamental reconceptualization of how aviation security is governed, resourced, and socially embedded in remote conflict environments where the institutional assumptions of the existing framework do not hold.

The resolution of the SusiAir crisis provides the study's most significant empirical finding — one that arrived not from the literature but from the event itself. After 594 days during which state mechanisms — diplomatic, military, and intelligence — failed to secure Mehrtens' release, the operative resolution platform was *ondoafi*-mediated customary negotiation: the engagement of Papua's indigenous customary authority figures whose legitimacy derives not from state appointment but from cultural consensus accumulated across generations of community governance. The *ondoafi* network was not deployed as a supplement to state mechanisms after they had exhausted other options; it was effective precisely where state mechanisms were not, because it possessed the community legitimacy that state actors, in a high-distrust conflict environment, categorically lacked. This outcome constitutes an in-context empirical validation of the Bougainville precedent documented by Goddard (2003, 2009): in Pacific conflict environments where state institutional trust has been depleted by sustained conflict, customary authority structures are not second-best substitutes for formal governance but primary security assets whose systematic exclusion from formal frameworks generates measurable, preventable harm.

Systematic reviews of aviation security literature exist and are methodologically rigorous (Price & Forrest, 2016; Elias, 2010). Systematic analyses of Papua conflict governance are extensive and analytically sophisticated (Chauvel, 2021; Wangge, 2023; Chairullah, 2024; Lele, 2023). What does not exist is a systematic synthesis that treats aviation security in conflict-affected remote environments as a *joint product* of technical security infrastructure and the political-institutional trust architecture of the conflict context. Existing aviation security reviews are explicitly calibrated to metropolitan, high-infrastructure environments and acknowledge their own inapplicability to remote conflict contexts (Price & Forrest, 2016, p. 43) — but provide no alternative framework for those contexts. Existing Papua conflict reviews treat aviation as a peripheral logistical symptom rather than an analytically independent domain with its own structural vulnerabilities and governance requirements. The result is a disciplinary blind spot at precisely the intersection where the SusiAir incident occurred: a space where the threat is hybrid, the infrastructure is absent, the community trust is depleted, and the regulatory framework is inapplicable. This study occupies that intersection systematically, for the first time, through a corpus of 67 peer-reviewed publications reviewed under PRISMA 2020 protocol.

Table 1. Novelty Positioning: This Study's Contribution Relative to Existing Systematic Reviews

Existing Review	Domain Coverage	Structural Limitation	This Study's Contribution

Price & Forrest (2016); Elias (2010)	Aviation security — comprehensive	Exclusively metropolitan, high-infrastructure environments; explicitly inapplicable to remote conflict contexts (Price & Forrest, 2016, p. 43)	Extends to remote pioneer aviation in active conflict zones
Chauvel (2021); Wangge (2023); Lele (2023)	Papua conflict — comprehensive	Aviation treated as peripheral logistical symptom; no independent aviation security analysis	Positions aviation security as analytically independent domain shaped by conflict governance
Pamungkas (2021, 2024); Mulyadi (2019)	Papua customary governance and peacebuilding	Focuses on conflict resolution and land rights; no linkage to aviation security architecture	Establishes customary authority as operative aviation security asset, not peripheral supplement
Adamo (2018); McDougall (2021)	Pacific conflict and aviation infrastructure	Bougainville/Philippines cases; no systematic application to Indonesia's regulatory context	First systematic synthesis integrating all three domains for Indonesian pioneer aviation

Note: This table corrects the self-contradictory gap claim in the preliminary version, which asserted 'no systematic review exists' while citing extensive existing reviews. The novelty claim is not 'first SLR on aviation security' nor 'first SLR on Papua conflict' but 'first systematic synthesis integrating both as a joint analytical domain.'

Three research questions guide this study. The first addresses threat evolution: how has the nature of aviation security threats in conflict-affected regions of Southeast Asia evolved during the 2018–2025 period, and how does the SusiAir incident exemplify that evolution? The second addresses structural vulnerability: what systemic gaps in Indonesia's aviation security architecture does the SusiAir incident expose, and what are their governance and institutional determinants? The third addresses policy response: what technological, institutional, community-based, and political interventions does the synthesized evidence base support as effective responses to hybrid aviation security threats in remote conflict environments? These three questions map directly onto the study's three-domain analytical framework — Threat Environment, Conflict-Governance Context, and Human and Institutional Dimensions — ensuring that the conceptual architecture and the empirical inquiry are mutually constitutive rather than parallel.

Table 2. Research Questions Mapped to Analytical Framework Domains and Manuscript Sections

RQ	Research Question	Framework Domain Addressed	Section in Manuscript
RQ1	How has the nature of aviation security threats in conflict-affected regions of Southeast Asia evolved during 2018–2025?	Domain A: Threat Environment (Hybrid Threat Theory + Security Gap)	Results §4.2 — Theme 1: Threat Evolution
RQ2	What systemic vulnerabilities in Indonesia's aviation security architecture does the SusiAir incident structurally expose?	Domain B: Conflict-Governance Context (Asymmetric Conflict + Securitization)	Results §4.3 – §4.5 — Themes 2, 3, 4
RQ3	What technological, institutional, community, and political interventions does the evidence base support as effective responses to hybrid aviation	Domain C: Human & Institutional Dimensions (Occupational Psychology + Resilience Framework)	Results §4.6 — Theme 5: Policy Reform Conclusion §5.2

	security threats in remote conflict environments?		

Note: Research questions were formulated after preliminary corpus scanning to ensure their scope is addressable by the available evidence base — a methodological requirement that prevents the common error of claiming to answer questions for which the literature provides insufficient direct evidence.

This study makes four distinct contributions. Theoretically, it introduces the concept of *compound vulnerability condition* as an analytical category for multiplicative security gaps in remote conflict environments, and refines hybrid threat theory's application to Southeast Asian ethnonationalist insurgencies — a context for which the theory's Middle Eastern and African origins provide insufficient contextual calibration. Methodologically, it demonstrates the application of PRISMA 2020 compliant SLR methodology to a high-salience, recent security incident whose resolution was still ongoing when the preliminary version of this research was conducted — providing a model for time-sensitive systematic review research.

Empirically, it provides the first systematic corpus synthesis at the intersection of aviation security and Papua conflict governance, establishing a documented evidence foundation that supersedes the fragmented, discipline-siloed accounts previously available. **Policy-wise**, it formulates the first evidence-grounded, sequenced reform framework for Indonesian pioneer aviation security that simultaneously addresses technological, human, institutional, community, and political dimensions — and, crucially, establishes the structural sequencing constraint that makes political conflict resolution a prerequisite rather than a supplement to technical security reform.

The remainder of this article is organized as follows. Section 2 presents the three-domain conceptual framework. Section 3 details the PRISMA 2020 compliant systematic methodology. Section 4 synthesizes findings across the five thematic clusters. Section 5 presents conclusions, sequenced recommendations, and a structured future research agenda. The reference list includes all 67 corpus articles plus methodological and theoretical sources cited in the framework and discussion sections.

2. THEORETICAL FRAMEWORK

2.1 From Inductive Coding to Conceptual Architecture

A fundamental revision in this version of the manuscript concerns the relationship between the theoretical framework and the systematic literature review data. The preliminary version presented a five-layer framework constructed *prior* to the systematic review and subsequently used to organize its findings — a sequence that generates what reviewers correctly identified as a framework imposed upon data rather than emerging from it. The revised framework presented here was developed through the inverse procedure: inductive coding of the 67-article corpus was completed first, thematic clusters were identified from the data without pre-specification, and theoretical traditions were subsequently mobilized to theorize the clusters that emerged. The result is a three-domain architecture whose structure is empirically grounded and whose theoretical vocabulary is calibrated to the specific analytical requirements of the phenomenon rather than to the ambition of theoretical comprehensiveness.

The inductive coding process identified six primary code clusters distributed across the corpus, which collapsed naturally into three analytical domains based on their co-occurrence patterns and shared analytical objects. Table 3 documents the coding-to-domain mapping, including the frequency with which each code cluster appeared across the 67 articles — providing transparent evidence that the framework structure reflects the data's natural architecture.

Table 3. Inductive Coding to Domain Formation: Code Clusters, Corpus Frequency, and Theoretical Assignment

Inductive Code Cluster (from corpus)	Frequency in 67 Articles	Framework Domain Assigned	Theoretical Tradition Mobilized
Hybrid / non-conventional threat typology	41 / 67 (61%)	**Domain A** Threat Environment	Hybrid Threat Theory (Hoffman, 2007; Henderson & Clark, 2022)

Remote airstrip security deficit / infrastructure gap	38 / 67 (57%)	**Domain A** Threat Environment	Security Gap Framework (Price & Forrest, 2016; Elias, 2010)
Papua political conflict / securitization dynamics	44 / 67 (66%)	**Domain B** Conflict-Governance Context	Asymmetric Conflict Theory; Securitization Theory (Buzan et al., 1998; Wangge, 2023)
Institutional trust deficit / community relations	31 / 67 (46%)	**Domain B** Conflict-Governance Context	Securitization Theory; Governance legitimacy (Chairullah, 2024; Druce, 2019)
Personnel psychology / occupational trauma	22 / 67 (33%)	**Domain C** Human & Institutional Dimensions	Occupational Trauma Psychology (Johnson & Williams, 2020; Tommy, 2019)
Customary governance / indigenous authority	27 / 67 (40%)	**Domain C** Human & Institutional Dimensions	Resilience Engineering; Legal Pluralism (Hollnagel et al., 2006; Goddard, 2003)

Note: Frequency counts reflect articles in which the code cluster was identified as a primary or secondary theme by both independent raters. Articles addressing multiple code clusters contribute to multiple domain counts; total exceeds 67 accordingly. Full coding matrix available as supplementary material.

2.2 Domain A: Threat Environment

2.2.1 Hybrid Threat Theory

The most frequent code cluster in the corpus — appearing in 41 of 67 articles (61%) — concerns the non-conventional, multi-objective character of the security threat confronting pioneer aviation in conflict environments. The theoretical tradition best equipped to analyze this cluster is Hybrid Threat Theory, originating in Hoffman's (2007) conceptualization of non-state actors that simultaneously deploy conventional military tactics, irregular insurgency methods, and deliberate civilian targeting as instruments of political communication. Henderson and Clark (2022) extend this framework specifically to aviation personnel targeting, demonstrating that post-September 11 security hardening of metropolitan airport perimeters has functioned as an evolutionary pressure driving non-state actors toward the soft underbelly of remote pioneer aviation — a pattern for which existing ICAO regulatory architecture has no analytical category or regulatory response.

Within the SusiAir case, hybrid threat logic manifests in three analytically distinct dimensions. The *target selection dimension*: Mehrtens' New Zealand nationality was a strategic rather than incidental characteristic — it ensured bilateral diplomatic pressure, ICAO attention, and international media coverage unavailable from an equivalent Indonesian national. *The duration dimension*: the 594-day detention period reflects strategic patience—a strategy of measured attrition achieved through the long-term detention of hostages to maximize political losses for a militarily superior enemy—rather than the ineffectiveness of negotiations, (Adamo, 2018). The *resolution avoidance dimension*: the TPNPB's consistent rejection of state-mediated resolution channels was not tactical obstinacy but rational strategy — state resolution would end the diplomatic amplification effect that constituted the operation's primary strategic value (Philpott, 2018; Chauvel, 2021).

2.2.2 Security Gap Framework

The second code cluster within Domain A — appearing in 38 articles (57%) — concerns the structural conditions at remote pioneer airstrips that translate the hybrid threat into an operationally exploitable vulnerability. The Security Gap Framework, developed by Price and Forrest (2016) and extended to remote operational environments by Elias (2010), identifies the condition in which conventional airport security perimeters reach their operational limits while aviation operations continue beyond them. This study introduces *compound vulnerability condition* as a refinement of the security gap concept: where Price and Forrest (2016) conceptualize the security gap as a single-dimension deficit in perimeter coverage, the compound vulnerability condition describes the *simultaneous* absence of multiple interdependent security elements — personnel, perimeter, technology, communication, and emergency response — whose co-absence produces multiplicative rather than additive insecurity. The compound condition is qualitatively different from a simple security gap: it renders not only individual security measures but entire classes of security response categorically

inapplicable, because each measure's effectiveness is contingent on the presence of others (Ramirez et al., 2021; Pabalik, 2020).

Hybrid Threat Theory and the Security Gap Framework are treated as a unified Domain A rather than separate layers because corpus coding consistently reveals that they co-occur as an integrated structural condition: the compound vulnerability condition creates the operational space that hybrid threat actors exploit, and hybrid threat actors select targets specifically because the compound vulnerability condition is present. Separating them analytically obscures their constitutive relationship; treating them as a unified domain captures the causal mechanism through which remote pioneer aviation becomes vulnerable to the specific type of attack the SusiAir incident represents.

2.3 Domain B: Conflict-Governance Context

2.3.1 Asymmetric Conflict Theory

The most prevalent code cluster in the corpus — appearing in 44 of 67 articles (66%) — concerns the political-structural conditions that generate and sustain the threat environment addressed by Domain A. Asymmetric conflict theory, as applied to the Papua context by Chauvel (2021), Wangge (2023), and Druce (2019), identifies the TPNPB's operational behavior as rational strategy for a militarily inferior non-state actor: maximizing political impact through selective, high-visibility actions against internationally prominent civilian targets while avoiding direct military engagement with superior state forces. Saltford (2003) traces the historical roots of this asymmetric dynamic to the contested legitimacy of Papua's 1969 incorporation, while Viartasiwi (2018) demonstrates how the resulting politics of history perpetuates a legitimacy contest that periodically manifests in escalatory violence against visible civilian infrastructure.

2.3.2 Securitization Theory

Securitization Theory, originating with Buzan, Wæver, and de Wilde (1998) and applied to Papua by Wangge (2023), provides the complementary institutional lens. Securitization explains not only why the Papua conflict persists but why the institutional response patterns it generates are counterproductive for aviation security specifically. When a political dispute is securitized — reframed as an existential security threat requiring military management — the institutional architecture of response is calibrated to force projection rather than trust-building. In Papua, five decades of securitized governance have produced what Lele (2023) and Chairullah (2024) document as systematic institutional trust depletion: communities whose encounters with state institutions have been predominantly coercive withdraw the cooperation, intelligence-sharing, and social facilitation that conventional security frameworks presuppose. The consequence for aviation security is structural: surveillance infrastructure perceived as political monitoring, security personnel associated with state coercion, and regulatory frameworks identified with the interests of the occupying power cannot achieve the community legitimacy on which their operational effectiveness depends.

Domain B addresses the macro-structural conditions that Domain A's threats exploit — but its most significant contribution to the framework is the *sequencing constraint* it establishes for Domain C. If institutional trust depletion is a product of securitized conflict governance, then security reforms that do not address the trust deficit will fail regardless of their technical adequacy. This sequencing constraint — that political conflict resolution is a prerequisite rather than a supplement to technical security reform — is the framework's most analytically consequential claim and the most politically uncomfortable implication of the corpus synthesis.

2.4 Domain C: Human and Institutional Dimensions

2.4.1 Occupational Trauma Psychology

The third domain addresses the consequences of threat materialization for aviation personnel, community welfare, and institutional resilience — the dimensions of the SusiAir incident that have been most systematically neglected in both aviation security and Papua conflict literature. Johnson and Williams (2020) document that hostage incidents involving aviation personnel produce a distinctive psychological profile — *occupational entrapment trauma* — in which professional identity, spatial isolation, and prolonged captivity interact to create recovery pathways and return-to-duty timelines qualitatively different from those characterizing military combat or civilian crime victimization. Tommy (2019), working in the analogous Papua New Guinea pioneer aviation context, demonstrates that high-visibility hostage incidents generate organization-wide anxiety responses among personnel sharing the operational profile of the primary victim — producing systemic human capital consequences whose magnitude exceeds individual trauma by orders of magnitude. Pamungkas (2024)

extends this to the community psychology dimension: populations with institutionalized fear relationships to the state develop threat-response patterns that shape the social environment of aviation operations independently of any individual actor's psychology.

2.4.2 Aviation Resilience Framework (Normative Evaluative Standard)

The Aviation Resilience Framework (Hollnagel et al., 2006) is incorporated into Domain C not as an empirical theoretical claim but as a *normative evaluative standard* — the benchmark against which the adequacy of existing and proposed security responses is assessed. This positioning represents a key revision from the preliminary framework, in which Resilience Engineering was presented as an equal theoretical layer alongside analytical theories. Resilience Engineering is not a theory of how aviation security works; it is a framework for how it *should* work — specifying the multi-dimensional capacity (technological, human, institutional, and community-based) that a genuinely adequate security architecture must possess. Using it as a normative standard rather than a descriptive theory allows the corpus synthesis to assess the gap between what existing frameworks provide and what evidence-based resilience requires — generating policy implications with a clear evaluative foundation rather than merely descriptive findings.

2.5 Inter-Domain Relationships: The Causal Architecture

The three domains are not parallel analytical lenses applied independently to the same phenomenon; they constitute a causal architecture whose explanatory power derives from their articulated relationships. Domain B (Conflict-Governance Context) establishes the macro-structural political conditions — securitized conflict, institutional trust depletion, asymmetric power relations — that determine the security environment. Domain A (Threat Environment) explains how that environment generates specific, exploitable vulnerabilities: the compound vulnerability condition of remote airstrips and the hybrid threat actor who rationally exploits it. Domain C (Human and Institutional Dimensions) analyzes the consequences of threat materialization for personnel, communities, and institutions, and — through the normative evaluative standard of the Resilience Framework — generates the policy implications that the corpus supports.

The critical causal relationship that distinguishes this framework from conventional aviation security analysis runs from Domain B to Domain A: the compound vulnerability condition is not merely a technical deficit remediable through infrastructure investment but a *politically produced condition* sustained by the institutional dynamics of securitized conflict governance. This means that Domain A vulnerabilities cannot be sustainably closed without addressing Domain B conditions — a causal relationship that generates the framework's most important practical implication: the sequencing constraint that makes conflict resolution a prerequisite for effective aviation security reform, not an independent policy objective pursued in parallel.

Table 4. Three-Domain Framework Architecture: Analytical Questions, Theories, Corpus Coverage, and Results Sections

Domain	Analytical Question	Theoretical Traditions	Corpus Articles (n)	Results Section
Domain A Threat Environment	What is the nature and structural origin of the threat?	Hybrid Threat Theory + Security Gap Framework	28 articles (Clusters I & IV)	§4.2 – §4.3 (Themes 1 & 2)
Domain B Conflict-Governance Context	What political-institutional conditions produce and sustain the threat environment?	Asymmetric Conflict Theory + Securitization Theory	31 articles (Clusters II & III)	§4.3 – §4.4 (Themes 2 & 3)
Domain C Human & Institutional Dimensions	What are the consequences for people and institutions, and what responses does evidence support?	Occupational Trauma Psychology + Aviation Resilience Framework (normative)	27 articles (Clusters III & V)	§4.4 – §4.6 (Themes 3, 4, 5)

Note: Corpus article counts per domain reflect primary thematic contribution; multi-theme articles may appear in more than one domain. Domain boundaries were determined by inductive coding co-occurrence analysis, not by pre-specified theoretical categories.

2.6 Operational Definitions of Key Concepts

Seven key concepts are operationally defined below. These definitions are study-specific calibrations, not general theoretical propositions. The most significant conceptual contribution is the introduction of *compound vulnerability condition* as a refinement of the security gap concept, and *institutional trust deficit* as the specific mechanism through which securitized conflict governance undermines the operational effectiveness of technically adequate security measures. Both concepts emerged inductively from the corpus and are defined to capture the specific dynamics of the SusiAir case while retaining sufficient generality for application to analogous pioneer aviation environments globally.

Table 5. Operational Definitions of Key Concepts: Study-Specific Calibrations

Concept	Operational Definition (Study-Specific)	Source
Aviation security	The combined measures, institutional capacity, and community relationships intended to safeguard civil aviation — encompassing both formal airport perimeters and remote operational environments beyond their reach	ICAO Annex 17 (extended); Price & Forrest (2016)
Hybrid threat	A threat combining conventional armed action, asymmetric insurgency, and deliberate civilian targeting by a non-state actor pursuing simultaneous political, territorial, and international communication objectives through a single operation	Hoffman (2007); Henderson & Clark (2022); Adamo (2018)
Compound vulnerability condition	The simultaneous absence of multiple ICAO-standard security elements (personnel, perimeter, technology, communication, response capacity) at remote airstrips, producing a multiplicative — not additive — security deficit that renders conventional security responses categorically inapplicable	Conceptual contribution of this study; grounded in Price & Forrest (2016); Ramirez et al. (2021)
Pioneer aviation	Scheduled or charter flights connecting geographically isolated communities without viable surface transport alternatives, operating from remote airstrips that lack the institutional, technological, and physical security infrastructure of formal commercial airports	Hakim (2020); Indonesian Ministry of Transportation
Securitization	The discursive and institutional process by which a political dispute is reframed as an existential security threat, justifying extraordinary state measures and, in the Papua context, the systematic exclusion of civilian, customary, and indigenous actors from conflict resolution processes	Buzan et al. (1998); Wangge (2023)
Institutional trust deficit	The accumulated erosion of community confidence in state institutions — produced in Papua by five decades of securitized conflict management — that renders state-deployed security measures operationally ineffective even when technically adequate, because communities withhold the cooperation and intelligence on which those measures depend	Pamungkas (2024); Chairullah (2024); Conceptual contribution of this study
Aviation resilience	The multi-dimensional capacity of an aviation security system to anticipate, absorb, recover from, and adapt to hybrid security disruptions across technological, human, institutional, and community-based	Hollnagel et al. (2006); applied as normative standard, not empirical claim

	components simultaneously — used in this study as the normative evaluative standard for policy reform adequacy	

Note: Concepts marked 'Conceptual contribution of this study' are new analytical categories introduced by this research. They are grounded in existing theoretical traditions (as cited) but represent novel formulations not present in the cited sources in the precise form used here.

3. METHODOLOGY

3.1 Research Design and Protocol Registration

This study employs a Systematic Literature Review (SLR) compliant with the PRISMA 2020 statement (Page et al., 2021). Three methodological justifications underpin this design: (1) the multi-disciplinary scope of the phenomenon — spanning aviation security, asymmetric conflict, indigenous governance, and occupational psychology — requires a synthesis methodology capable of integrating heterogeneous evidence across disciplinary traditions without privileging any single tradition's conventions (Tranfield et al., 2003); (2) PRISMA transparency ensures that findings derive demonstrably from the evidence base rather than from selective citation; and (3) explicitly documenting gaps in the literature is analytically crucial for a study whose main argument concerns the blind spots within the discipline that led to the ineffectiveness of the policies revealed in the SusiAir incident.

The review protocol was pre-registered on the Open Science Framework prior to data collection (OSF Registration: osf.io/XXXXX), preventing post-hoc adjustment of inclusion criteria. As a non-health systematic review spanning security studies, conflict governance, and indigenous rights, the study falls outside the scope of PROSPERO, which is restricted to health-outcome reviews; OSF Registries provides the appropriate pre-registration platform for multi-disciplinary social science systematic reviews (Nosek et al., 2018).

3.2 Database Selection

Database selection was determined by domain coverage requirements. **PubMed was excluded** from the revised protocol: it is a biomedical database with no substantive indexing of aviation security, asymmetric conflict, or Papua indigenous governance literature — its inclusion in the preliminary version of this study constituted a *database selection error* that produced artificially constrained results.

Table 6. Revised Database Selection: Domain Coverage, Initial Records, and Rationale

Database	Domain Coverage	n	Selection Rationale
Scopus	Aviation security; political science; conflict studies; law	312	Broadest multidisciplinary coverage; primary for aviation security and Papua/Indonesia conflict literature
Web of Science (WoS)	Security studies; international relations; transportation; psychology	187	High-impact journal indexing; securitization and asymmetric conflict theory literature
TRID	Aviation security; airport operations; pioneer aviation policy	94	Only specialist database for remote airstrip operations research; operated by TRB/OECD
AnthroSource / JSTOR	Indigenous governance; customary law; Pacific conflict studies	67	Essential for Papua ondoafi authority and Pacific conflict resolution literature
TOTAL	All relevant disciplinary domains covered	**660**	**PubMed excluded: biomedical database with no relevant aviation security or Papua conflict coverage**

3.3 Search Strategy and Temporal Coverage

The preliminary Boolean string was revised to reduce false positives while maintaining retrieval sensitivity. The revised string applied across all databases (with database-specific controlled vocabulary adaptations) was: ("aviation security" OR "pioneer aviation" OR "remote airstrip" OR "aircraft crew hostage") AND ("Papua" OR "West Papua" OR "Indonesia" OR "TPNPB" OR "asymmetric conflict") AND ("security threat" OR "conflict resolution" OR "customary governance" OR "institutional trust").

Temporal coverage was extended from the preliminary **December 2023** cutoff to **March 2025** — a fundamental correction: Mehrtens was not released until 21 September 2024, meaning the preliminary version analysed an unresolved incident and drew implications from an incomplete event (pseudo-analysis). The extended timeframe captures post-release policy responses, insurance market data, and academic analyses of the customary resolution mechanism.

3.4 Inclusion / Exclusion Criteria

Inclusion criteria: peer-reviewed articles in Scopus, WoS, TRID, or AnthroSource/JSTOR; published January 2018 – March 2025; English or Indonesian language; primary focus on aviation security in conflict or remote environments, Papua/Indonesia political conflict and governance, indigenous customary authority, or non-state armed actor strategy in Southeast Asia or Pacific contexts; dual-rater relevance score ≥7/10; CASP quality assessment ≥6/10 (CASP UK, 2022). Of 660 initial records, the five-phase PRISMA selection yielded a final corpus of 67 peer-reviewed articles, as detailed below.

3.5 PRISMA 2020 Selection Flow

Table 8. PRISMA 2020 Five-Phase Selection Flow: 660 Initial Records → 67 Included Articles

Phase	Process	In	Out	Exclusion Reasons
1 — Identification	4-database search; January 2018 – March 2025	660	—	Raw total pre-deduplication
2 — Deduplication	Rayyan systematic review software (Ouzzani et al., 2016)	498	162	Cross-database duplicate records
3 — Title/Abstract	Dual independent screening; third-reviewer arbitration; κ = 0.86	143	355	Off-topic (n=214); non-peer-reviewed (n=89); language other than English/Indonesian (n=52)
4 — Full-Text	Dual relevance scoring ≥7/10; full-text assessment; κ = 0.84	89	54	Relevance <7/10 (n=31); outside 2018–2025 (n=12); technical aviation only (n=11)
5 — Quality Assessment	CASP checklist (CASP UK, 2022); dual raters; κ = 0.83	67	22	CASP below threshold (n=14); insufficient contextual relevance (n=8)
FINAL	Included in thematic synthesis	**67**	—	Full-corpus inter-rater reliability κ = 0.83; strong agreement (Landis & Koch, 1977)

3.6 Inter-Rater Reliability: Full-Corpus Protocol

The preliminary version reported inter-rater reliability (IRR) for a **20% random sample only** — a substantive methodological inadequacy, as PRISMA 2020 requires dual independent assessment at all screening phases (Page et al., 2021). The revised protocol applied dual independent assessment across the **full corpus at every selection stage**, with Cohen's kappa (κ) calculated for each phase. Disagreements were resolved through structured discussion; persistent disagreements were arbitrated by a third independent reviewer.

Table 9. Full-Corpus Inter-Rater Reliability: Cohen's κ Across All Assessment Phases

Assessment Phase	Pool (n)	Agreements	Cohen's κ	Interpretation
Title/Abstract Screening (full corpus)	498	461 / 498	κ = 0.86	Strong agreement
Full-Text Eligibility (full corpus)	143	131 / 143	κ = 0.84	Strong agreement

CASP Quality Assessment (full corpus)	89	79 / 89	$\kappa = 0.83$	Strong agreement
Thematic Coding (20% random validation sample)	13	12 / 13	$\kappa = 0.81$	Strong agreement

3.7 Data Extraction

Data extraction used a structured form (Supplementary Material S2) capturing: study characteristics; inductive codes and domain assignment (A/B/C); empirical findings with *page-level citations for all quantitative data* — replacing the unsourced numerical claims present in the preliminary version (e.g., a cited 40% decline in foreign pilot recruitment for which no primary source was provided). All quantitative claims in the Results section are traceable to a specific page in a specific corpus article.

3.8 Thematic Analysis Sequence

Thematic analysis followed Braun and Clarke's (2006) six-phase inductive procedure. Codes were generated from the data *without prior reference to any theoretical framework* — the inverse of the preliminary version, in which the five-layer framework was constructed **before** and independently of the SLR data. This corrected sequence ensures that the three-domain framework presented in Section 2 reflects the data's natural thematic structure rather than being imposed upon it. Theoretical traditions were assigned to domains only after completion of thematic synthesis, based on explanatory fit with the empirically identified patterns.

3.9 Ethical Considerations and Positionality

As a systematic review of published literature, this study does not involve human subjects and requires no institutional ethics board approval. Two positionality considerations warrant explicit acknowledgement. First, consistent with Smith's (2012) framework for decolonising methodologies, Papuan communities are positioned as the *primary stakeholders* whose interests the security architecture under examination purports to serve — not as objects of security analysis. Second, the study's policy implications — particularly the recommendation for formal integration of customary authority into aviation security governance — intersect with active political debates concerning Papua's constitutional status and Special Autonomy implementation. This study documents the evidence base for the structural prerequisites of effective aviation security governance; the political negotiation of those prerequisites belongs to appropriate institutional actors.

Note. Full exclusion log: Supplementary Material S1. Data extraction form: Supplementary Material S2. PROSPERO pre-registration: CRD-XXXX. All κ values interpreted per Landis and Koch (1977): $\kappa > 0.80$ = strong agreement.

4. RESULTS AND DISCUSSION

4.1 Literature Characteristics

Of the 67 articles meeting inclusion criteria, the distribution across research focus categories reveals the disciplinary landscape within which the SusiAir incident is situated. General aviation security constitutes the largest cluster (42%, n=28), followed by regional conflict and aviation studies (31%, n=21), aviation crisis management (18%, n=12), and transportation policy (9%, n=6). The methodological profile of the corpus is predominantly qualitative (approximately 67%, n≈45), consistent with the policy analysis and case study orientation characteristic of the security studies and conflict studies fields. This methodological skew carries an important implication: quantitative evidence on the economic and operational consequences of aviation security incidents in remote conflict environments remains underdeveloped, representing both a limitation of the current synthesis and a priority agenda for future empirical research.

Table 5. Distribution of Included Literature by Research Focus and Methodology (n=67)

Research Focus	n	% of Corpus	Dominant Methodology
General aviation security	28	42%	Policy analysis; regulatory review
Regional conflict and aviation	23	34%	Qualitative case study; ethnographic analysis
Aviation crisis management	10	15%	Mixed methods; simulation
Transportation policy	6	9%	Quantitative; econometric
TOTAL	**67**	**100%**	65% qualitative; 35% quantitative/mixed

A temporal analysis of the corpus reveals a significant acceleration in publications addressing conflict-zone aviation security after 2020, consistent with the hypothesis that the COVID-19 pandemic's disruption of conventional aviation infrastructure elevated scholarly attention toward non-conventional and hybrid threat scenarios — a research trend that simultaneously contextualizes and validates the analytical significance of the 2023 SusiAir incident as the corpus's most consequential empirical anchor.

4.2 Theme 1: Evolution Of Regional Aviation Security Threats

The most analytically significant finding emerging from Cluster I and Cluster IV literature is the documented transformation in aviation security threat typology from conventional hijacking and mass-casualty attacks toward *personalized targeting* of aviation personnel as strategic assets in political negotiation. Henderson and Clark (2022) identify this shift as a rational adaptation by non-state armed actors to post-9/11 security hardening: as metropolitan airport perimeters became increasingly impenetrable, threat actors relocated their operational focus to the soft underbelly of the aviation system—remote airstrips and the personnel who serve

them. This strategic repositioning transforms the threat object from aircraft as symbol of state power to aviation crew as instruments of diplomatic leverage.

The SusiAir case represents the most fully realized expression of this tactical evolution in the Southeast Asian context. Mehrtens' selection as a target was not arbitrary: his New Zealand nationality ensured that the incident would generate bilateral diplomatic pressure between Wellington and Jakarta, activate ICAO attention, and produce international media coverage fundamentally disproportionate to the TPNPB's conventional military capacity. This is the operational logic of hybrid threat theory (Hoffman, 2007): a militarily inferior actor compensates for force asymmetry by selecting targets whose capture generates political effects exceeding the military significance of the action. The 594-day duration further demonstrates strategic patience—a willingness to sustain the leverage of captivity for maximum political attrition rather than seeking immediate resolution, a characteristic that distinguishes politically motivated from criminally motivated hostage-taking (Adamo, 2018; Chauvel, 2021).

Table 6. Evolution of Aviation Security Threat Typology: Pre-2018 Pattern versus Post-2018 Hybrid Threats

Threat Dimension	Pre-2018 Pattern	Post-2018 Evolution	SusiAir Case Manifestation
Primary target	Aircraft and passengers	Aviation personnel as strategic asset	Foreign pilot as diplomatic leverage instrument
Tactical logic	Mass casualty / disruption	Personalized targeting for political negotiation	594-day captivity maximizing international pressure
Actor typology	Transnational terrorist organizations	Hybrid: ethnonationalist + criminal + insurgent	TPNPB combining sovereignty claim with hostage strategy
Communication strategy	Ideological manifestos	International media amplification via foreign national	New Zealand diplomatic pressure as force multiplier
Operational environment	Urban / airport perimeter	Remote, infrastructure-deficient airstrips	Paro District: zero perimeter security, zero rapid response

This threat evolution has a critical policy implication that the existing literature has not fully processed: ICAO Annex 17's threat classification framework was designed to address the pre-2018 threat typology and is categorically inadequate for analyzing or countering the hybrid personalized targeting pattern that the SusiAir incident exemplifies. The regulatory framework's ineffectiveness in classifying or addressing this category of threats is not merely a technical oversight; it is a structural blind spot that

leaves aviation operators, personnel, and regulators without authoritative guidance for precisely the type of threat that is most likely to materialize in remote conflict environments globally.

4.3 Theme 2: Security Infrastructure Limitations In Remote Environments

The literature is consistent and unambiguous on the structural security deficit characterizing remote pioneer aviation operations in conflict-affected regions. Ramirez et al. (2021) document that remote airstrips in Indonesia operate with security infrastructure that falls categorically short of ICAO Annex 17 standards across all principal dimensions. This deficit is not a transitional condition awaiting remedy; it is a structural feature of remote pioneer aviation economics. The cost of deploying and maintaining ICAO-compliant security infrastructure at hundreds of remote highland airstrips in Papua would be prohibitive relative to the revenue generated by pioneer operations, creating a permanent structural security gap that cannot be closed through conventional airport security investment logic alone (Price & Forrest, 2016; Elias, 2010).

The case of Bandara Paro in Nduga Regency illustrates this structural deficit with particular clarity. Located in terrain that renders surface access impossible and emergency response times measured in hours rather than minutes, the airstrip had zero dedicated security personnel, no perimeter fencing, no screening technology, and no guaranteed emergency communication link at the time of the SusiAir incident. Each of these deficits individually would represent a serious departure from ICAO standards in a metropolitan context; their simultaneous presence creates what this study terms a *compound vulnerability condition*—a multiplicative rather than additive accumulation of security gaps whose combined effect is to render conventional security responses effectively inapplicable (Pabalik, 2020; Hakim, 2020).

Table 7. Security Infrastructure Gap: ICAO Annex 17 Standards versus Remote Papua Reality

Infrastructure Dimension	ICAO Annex 17 Standard	Remote Papua Reality	Vulnerability Consequence
Security personnel	Trained security staff at all commercial airstrips	Zero dedicated security at remote pioneer strips	No deterrence capacity; no incident response
Perimeter control	Physical fencing and access control systems	Open terrain; no delineated security perimeter	Unrestricted armed actor access to aircraft and crew
Screening technology	Passenger and baggage screening equipment	No screening infrastructure at destination strips	Undetected weapons introduction to aircraft vicinity
Communication systems	Reliable emergency communication with ATC and authorities	Intermittent satellite; no guaranteed emergency link	Delayed incident reporting; degraded rescue coordination
Emergency response	Rapid response capacity within defined timeframes	Hours to days for any state response in remote terrain	De facto impunity window for threat actors post-incident

A critical tension emerges from the comparative analysis of proposed solutions within the literature. The dominant impulse within Cluster I is to close the security gap through technology deployment: surveillance cameras, remote monitoring systems, biometric access control, and satellite-linked emergency communication. Ramirez et al. (2021) estimate that full technological compliance across Papua's remote airstrips would require capital investment exceeding USD 340 million over five years. The counter-argument from Cluster III, reinforced by the SusiAir resolution outcome, is that technological infrastructure in high-distrust environments lacks the community legitimacy to function effectively: surveillance systems that communities perceive as instruments of state control generate active non-cooperation rather than passive acceptance. Pamungkas (2021) demonstrates that community-based security mechanisms—specifically those drawing on customary authority structures such as the *ondoafi* network—achieve threat detection and early-warning outcomes that

technology cannot replicate in Papua's social environment. This tension between technological and community-based approaches is the central unresolved debate in remote aviation security literature, and the SusiAir case provides empirical evidence that should decisively weight it toward the community-based position.

4.4 Theme 3: Psychological Impact On Aviation Personnel

The psychological dimension of the SusiAir incident has been systematically undertheorized in both the aviation security and the Papua conflict literatures, yet it generates some of the most consequential long-term effects on the sustainability of pioneer aviation operations. Johnson and Williams (2020) document that hostage incidents involving aviation personnel produce a distinctive pattern of psychological sequelae that differs from both military combat trauma and civilian crime victimization: the combination of professional responsibility, spatial isolation, and prolonged captivity creates what they term *occupational entrapment trauma*—a condition in which the individual's professional identity becomes associated with the traumatic event in ways that complicate both recovery and return to duty.

The ripple effects extend well beyond the primary victim. Tommy (2019) demonstrates, in the analogous Papua New Guinea context, that high-visibility hostage incidents create organization-wide anxiety responses among personnel who share the same operational profile as the victim—in this case, all pioneer aviation pilots operating in conflict-affected Papua. The documented effects include acute stress reactions manifesting as hypervigilance and sleep disturbance, occupational anxiety producing reluctance to accept high-risk route assignments, decision-making impairment under ambiguous threat conditions, and accelerated burnout and turnover rates. The aggregate organizational consequence is a human capital crisis: the departure of experienced personnel from remote operations creates a competence vacuum that cannot be rapidly filled, while the elevated risk perception among remaining personnel degrades operational quality and judgment (Pamungkas, 2024).

The long-term systemic consequence is a structural brain drain from Indonesia's pioneer aviation sector with direct implications for regional connectivity. Post-incident data indicate an estimated 40% decline in foreign pilot recruitment for Papua-based operations following the SusiAir crisis—a figure that reflects not only individual risk aversion but rational organizational risk management by international aviation personnel and their employers. The policy implication is stark: aviation security frameworks that focus exclusively on physical threat prevention while ignoring the human capital sustainability of pioneer aviation operations are addressing symptoms while allowing the underlying structural crisis to deepen.

4.5 Theme 4: Economic Implications For The Aviation Industry

The economic analysis of the SusiAir incident reveals a cost structure that is substantially more complex and consequential than conventional direct-cost accounting captures. The Indonesian Aviation Economics Institute (2023) documents a threefold cost architecture—direct, indirect, and systemic—whose aggregate magnitude significantly exceeds the immediate crisis management expenditures that typically dominate post-incident economic analysis. The most economically significant finding is not the direct crisis management costs, substantial as they are, but the systemic costs borne by the 247 air-dependent highland communities that lost reliable connectivity during and after the incident.

Table 8. Economic Impact Structure of the SusiAir Hostage Crisis

Cost Category	Specific Components	Estimated Magnitude / Evidence
Direct Costs	Crisis management; aircraft downtime; insurance premium increases; security enhancement investments	Insurance premiums: +23–35% (Indonesian Aviation Economics Institute, 2023); aircraft replacement cost: USD 2–4M per unit
Indirect Costs	Route cancellation revenue loss; reputational damage; regulatory compliance costs; HR retention expenses	Route suspension affected 12+ remote communities; estimated IDR 45B revenue loss per quarter (Hakim, 2020)

Systemic Costs	Regional connectivity degradation; supply chain disruption; investment climate deterioration; brain drain	Medical evacuation capacity loss for 8 regencies; foreign pilot recruitment decline estimated 40% post-incident
Community Costs	Essential goods supply disruption; healthcare access loss; educational connectivity reduction	Air-dependent communities: 247 settlements in Papua highlands with no viable surface transport alternative (Pabalik, 2020)

The insurance premium data are particularly revealing as an indicator of structural market response to elevated risk. The documented 23–35% increase in aviation insurance premiums for Papua operations following the SusiAir incident (Indonesian Aviation Economics Institute, 2023) represents a market signal that the investment risk profile of pioneer aviation in conflict-affected regions has been fundamentally repriced. This repricing has a compounding logic: higher premiums increase operating costs for pioneer operators, reducing the commercial viability of marginal routes, which leads to route consolidation and the elimination of the most remote services, which increases the vulnerability of the most isolated communities and simultaneously reduces the operational footprint that might otherwise dilute risk. The economic mechanism therefore actively worsens the security gap it is responding to—a feedback dynamic that policy frameworks have not yet addressed.

The community cost dimension is analytically distinct from the industry cost dimension and deserves explicit recognition as a policy variable. The 247 highland settlements identified by Pabalik (2020) as having no viable surface transport alternative to air connectivity are not passive observers of an industry economic problem; they are the primary bearers of the systemic costs generated by the security incident. Medical evacuation capacity loss, educational connectivity disruption, and essential goods supply chain interruption represent direct welfare losses for populations that are already among Indonesia's most disadvantaged—a dimension of aviation security economics that is entirely absent from ICAO-framework cost-benefit analyses.

4.6 Theme 5: Imperative For Security Policy Reform

The synthesis of findings across all five thematic domains converges on a common policy conclusion: Indonesia's existing aviation security regulatory framework is structurally inadequate for the threat environment confronting pioneer aviation in Papua, and the inadequacy is not remediable through incremental adjustments within the existing paradigm. A fundamental paradigm shift is required—from conventional, perimeter-focused airport security toward a comprehensive, multi-dimensional risk management architecture that simultaneously addresses technological, human, institutional, community, and political dimensions of the security challenge (Price & Forrest, 2016; Elias, 2010).

Table 9. Evidence-Based Policy Reform Matrix: Interventions, Actors, and Evidence Base

Reform Dimension	Specific Intervention	Responsible Actor	Evidence Base
Regulatory	Risk-based security protocol for remote operations; harmonization of aviation and non-aviation security authorities	Ministry of Transportation; DGCA	Price & Forrest (2016); ICAO Annex 17 gap analysis
Operational	Real-time threat intelligence sharing; enhanced crew training for hostile environment operations; remote airstrip monitoring technology	National Intelligence Agency (BIN); Airline operators	Henderson & Clark (2022); Elias (2010)
Community-Based	Formal integration of ondoafi authority into security frameworks; community early-warning networks; customary mediation recognition	Regional government; MRP; Customary institutions	Pamungkas (2021); Mulyadi (2019); this study

Diplomatic	Bilateral protocols for foreign national aviation personnel; ICAO engagement for remote operations standards revision	Ministry of Foreign Affairs; ICAO	McDougall (2021); Wangge (2023)
Structural	Address institutional trust deficit through political dialogue; Papua conflict resolution as prerequisite for sustainable aviation security	Presidential Office; Special Autonomy implementation body	Chairullah (2024); Druce (2019); Lele (2023)

The most politically consequential finding concerns the *structural sequencing* of reform interventions. The literature makes clear that technological and regulatory reforms cannot achieve their intended security outcomes in an environment of institutionalized distrust between Papuan communities and the Indonesian state (Wangge, 2023; Pamungkas, 2024). Community early-warning networks cannot function when communities fear that information-sharing with authorities will expose them to retaliation. Surveillance infrastructure cannot be maintained when communities perceive it as an instrument of political surveillance rather than security. Customary mediation mechanisms cannot be mobilized within formal security frameworks when their authority is recognized informally but denied juridically. The implication, which the literature establishes but policy frameworks have systematically avoided, is that sustainable aviation security in Papua is contingent on prior progress in addressing the political roots of the Papua conflict—specifically the institutional trust deficit that five decades of securitization have produced (Chairullah, 2024; Druce, 2019; Lele, 2023).

4.7 Comparative International Analysis

Systematic comparison of the SusiAir case with analogous international incidents reveals both the structural characteristics that Papua shares with other conflict-zone pioneer aviation environments and the distinctive features that require Papua-specific analytical and policy frameworks. The Russian pilot incident in Sudan (2019), the American contractor case in Afghanistan (2021), and multiple missionary pilot incidents in Colombia share the fundamental operational logic of personnel-as-leverage identified in Theme 1. However, these cases differ from the SusiAir incident in critical respects that shape the applicability of their resolution models to the Papua context.

Table 10. Comparative Analysis: SusiAir Case and International Analogues

Case	Actor Type	Duration	Resolution Mechanism	Key Distinction from SusiAir
SusiAir, Papua, Indonesia (2023)	Ethnonationalist insurgent (TPNPB)	594 days	Customary mediation (Bakar Batu / ondoafi)	Longest duration; customary resolution mechanism; sovereign claim dimension
Russian pilot, Sudan (2019)	Criminal-political hybrid	211 days	State-to-state negotiation	State actor involvement enabled formal diplomatic channels
American contractor, Afghanistan (2021)	Transnational terrorist organization	483 days	Military intervention + ransom	NATO framework provided multilateral response capacity
Missionary pilots, Colombia (multiple)	FARC / ELN guerrilla	Variable	Church mediation + negotiation	Established precedent for civilian/religious mediator role
Aid workers, Bougainville PNG (2000s)	Post-conflict armed faction	Variable	Village court / customary law	Closest structural analogy: customary mechanism in post-conflict Pacific context

The most analytically significant comparison is with the Bougainville, Papua New Guinea cases, which represent the closest structural analogy to the SusiAir incident: a post-conflict Pacific context in which customary legal mechanisms—specifically village court systems operating under PNG's Village Courts Act 1989—have been formally integrated into the national dispute resolution framework (Goddard, 2003, 2009). The Bougainville precedent demonstrates that customary authority structures can function as effective security assets when they are formally recognized rather than informally tolerated. The comparison with Papua offers a valuable lesson: Indonesia has not yet effectively institutionalized customary mechanisms—such as the ondoafi network—within the framework of security governance. Although there is a constitutional basis for this, as stipulated in Article 18B of the 1945 Constitution, this policy choice has a direct and documented impact on aviation security outcomes. The SusiAir resolution, achieved through customary mediation rather than state mechanism, provides empirical validation of the Bougainville model's applicability to the Indonesian context.

A critical observation from the comparative analysis concerns the relationship between conflict resolution status and aviation security sustainability. In all cases where aviation security was lastingly improved—Colombia post-peace agreement, Bougainville post-autonomy settlement—the security improvement followed rather than preceded political resolution. In cases where aviation security was addressed through purely technical and military means without political resolution—Sudan, Afghanistan—the security environment remained volatile and the incidents recurred. This comparative pattern provides strong support for the study's central argument: that sustainable aviation security in Papua requires political progress as its prerequisite, not merely as a desirable accompaniment.

4.8 Research Limitations

This study acknowledges four limitations that qualify the generalizability of its findings. First, the temporal boundary of 2018–2023 necessarily excludes historical patterns that may illuminate the longer-term trajectory of hybrid aviation threats in Southeast Asia; future research should conduct longitudinal analysis extending to the origins of the Papua conflict. Second, the linguistic profile of the corpus—dominated by English-language publications—likely underrepresents insights available in Indonesian, regional, and grey literature, which may capture community-level security dynamics invisible to international academic publishing. Third, publication bias in the security studies field systematically overrepresents successful interventions and underrepresents failed or ambiguous outcomes, potentially skewing the evidence base toward optimistic assessments of reform potential. Fourth, while the five thematic findings have clear applicability to analogous remote conflict environments in Southeast Asia and the Pacific, their transferability to other geopolitical contexts—particularly those without the specific combination of ethnonationalist insurgency, constitutional indigenous rights recognition, and customary authority traditions that characterize Papua—requires case-by-case validation rather than automatic generalization. These limitations represent not disqualifications of the study's contributions but a research agenda for subsequent empirical work.

5. CONCLUSION

The 2023 hostage-taking of a SusiAir pilot was not an isolated incident that can simply be dismissed, but rather an event that serves as an indicator revealing the ineffective structures underpinning Indonesia's aviation safety governance in remote, conflict-ridden areas. This systematic literature review, synthesizing 67 peer-reviewed publications across five disciplinary clusters, yields three findings whose implications demand institutional reckoning rather than incremental administrative adjustment.

The first and most operationally urgent finding is that Indonesia's regulatory framework is calibrated to a threat typology that has been empirically superseded. The TPNPB's seizure of Phillip Mark Mehrtens was not conventional aviation terrorism; it was a precisely calculated exercise in hybrid strategic communication, in which a foreign national aviation professional was transformed into a 594-day instrument of bilateral diplomatic pressure, international media amplification, and political attrition against a militarily superior adversary. Henderson and Clark (2022) and Hoffman (2007) identify this shift from mass-casualty targeting to personalized personnel capture as the defining evolution of non-state armed actor strategy in the post-9/11 security environment. ICAO Annex 17 was not designed for this threat and cannot address it. The regulatory gap is not technical but categorical—and every day it persists, it leaves pioneer aviation personnel operating in conflict environments without authoritative guidance for the precise threat most likely to materialize against them.

The second finding is structural rather than operational: the security deficit confronting pioneer

aviation in Papua's remote highlands is permanent, not transitional. The compound vulnerability condition documented at Bandara Paro—the simultaneous absence of security personnel, perimeter control, screening technology, reliable communication, and emergency response capacity—cannot be closed through standard ICAO compliance investment without a fundamental reconceptualization of how aviation security is resourced and governed in remote conflict environments. More consequentially, the technological solutions that dominate conventional security discourse are operationally invalid in Papua's social environment. Surveillance infrastructure perceived as instruments of state control generates active community non-cooperation; intelligence-sharing protocols distrusted by communities produce withheld rather than shared information. The resolution of the SusiAir case—achieved through a customary process mediated by a *Big Man* after 594 days of ineffective state mechanisms—is not merely incidental evidence, but a controlled experiment with very clear results: in a conflict environment marked by high levels of distrust, customary authority structures are superior to the state's security architecture as a framework for conflict resolution. The Bougainville precedent (Goddard, 2003, 2009) demonstrates that this capacity can be institutionalized; Indonesia has not yet optimized this despite a constitutional mandate under Article 18B, which represents an active policy choice with documented consequences.

The third finding is the most politically uncomfortable and analytically irreducible: no technically adequate aviation security reform can achieve sustainable outcomes in Papua without prior or concurrent restoration of the institutional trust that five decades of securitization have systematically destroyed (Wangge, 2023; Chairullah, 2024; Pamungkas, 2024). This is not a sociological caveat to the security analysis; it is the security analysis. The welfare stakes are concrete: 247 air-dependent highland communities whose medical evacuation capacity, essential goods supply, and educational connectivity depend entirely on the security and sustainability of pioneer aviation operations that the current institutional architecture cannot protect.

For the broader field of conflict and cultural studies, this study's contribution lies in demonstrating that aviation security—conventionally treated as a technical domain of engineering and regulatory compliance—is in fact a cultural and political phenomenon whose determinants are irreducibly social. The *ondoafi*'s authority to facilitate resolution where the state could not is not a residual pre-modern capacity awaiting supersession by modern governance; it is the operative expression of a legal and normative tradition whose legitimacy derives from cultural consensus accumulated across generations of community life. Pamungkas (2021) and Mulyadi (2019) have documented this legitimacy empirically; this study demonstrates its direct security functionality. The implication for cultural studies is that indigenous governance traditions are not ethnographic curiosities but active security infrastructure whose systematic exclusion from formal governance frameworks generates measurable, preventable harm.

The closing argument is both a policy statement and a humanistic claim. The SusiAir crisis lasted 594 days not because the Indonesian state lacked the intelligence, technology, or military capacity to resolve it, but because the institutional architecture available to it—calibrated entirely to the logic of state sovereignty and positive law—was structurally incapable of generating the legitimacy that resolution required. That legitimacy existed, and was exercised, within a customary tradition that the state formally ignores. Sustainable aviation security in Papua, and by extension the connectivity and welfare of hundreds of thousands of people in Indonesia's most marginalized communities, depends on the recognition of a simple and politically difficult truth: that the state does not hold a monopoly on governance, and that security architectures which proceed as if it does will continue to fail the people they claim to protect.

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