



## Patterns and Typologies of Air Power Development Strategies for Airspace Sovereignty: A Systematic Literature Review

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#### ABSTRACT

*Airspace sovereignty is crucial to national security because airspace control supports deterrence and territorial integrity. This Systematic Literature Review identifies patterns and typologies of air power development strategies using PRISMA 2020 and thematic synthesis of peer-reviewed studies from Scopus and complementary databases. Findings indicate four patterns: capability-driven, technology-centric, diplomacy-oriented, and institutional-governance. These patterns form four typologies: capability-driven, technology-centric, diplomacy-oriented, and hybrid strategies. The study highlights a shift toward integrated and adaptive air power development.*

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### INTRODUCTION

Airspace sovereignty constitutes a fundamental pillar of national security, as control over national airspace directly affects a state's ability to deter external threats and protect territorial integrity. Throughout modern military history, air power has served as a decisive instrument for surveillance, deterrence, and coercive diplomacy. The ability to monitor, control, and, if necessary, deny access to airspace has become increasingly critical in an era of rapid technological change and evolving security environments. Consequently, air power development remains a strategic priority for states seeking to maintain credible defense postures (DeVore, 2015).

The strategic relevance of air power has expanded alongside the diversification of aerial threats. Contemporary challenges include not only conventional military aircraft but also unmanned aerial systems, long-range precision weapons, and hybrid operational tactics. These developments have fundamentally altered the character of airspace threats and the requirements for effective air defense. As a result, air power development strategies must increasingly address complexity, adaptability, and technological integration rather than focusing solely on platform acquisition (Horowitz et al., 2016).

Recent scholarship highlights that air power development is undergoing a structural transformation driven by advances in automation, artificial intelligence, and network-centric warfare. Studies on future air combat emphasize a shift from platform-centric models toward integrated “systems of systems,” in which manned and unmanned platforms operate collaboratively (Jordan, 2021). This transformation challenges traditional assumptions about pilot-centric combat and raises new questions regarding command-and-control architectures, operational effectiveness, and strategic risk management. Consequently, air power development strategies increasingly encompass doctrinal, organizational, and technological dimensions.

At the same time, the political economy of air power development has become an increasingly salient concern. The rising acquisition, maintenance, and sustainment costs of advanced combat aircraft have placed significant fiscal pressure on defense budgets. Research suggests that these economic constraints shape strategic choices by influencing force size, modernization priorities, and procurement models (DeVore, 2015). As a result, air power development strategies are often characterized by trade-offs between technological ambition and financial sustainability.

Beyond economic considerations, empirical studies underscore that the effectiveness of air power depends heavily on institutional and organizational factors. Research on drone operations demonstrates that air power outcomes are shaped not only by kinetic capabilities but also by intelligence integration, surveillance persistence, and decision-making structures (Mir & Moore, 2018). These findings suggest that air power development strategies cannot be assessed solely through technical performance metrics. Instead, effectiveness must be understood within broader strategic and institutional contexts.

The literature further indicates that air power development is deeply embedded within geopolitical and alliance frameworks. Strategic choices regarding air force structure and capability development are influenced by regional threat perceptions, alliance commitments, and international norms governing the use of force. Studies on military innovation and diffusion highlight that states often adapt air power development strategies in response to external competitive pressures and peer developments (Horowitz et al., 2016). This contextual variation complicates efforts to generalize from individual case studies.

Despite the expanding body of research on air power, unmanned systems, and air warfare, existing studies remain highly fragmented. Much of the literature concentrates on isolated aspects such as technological innovation, operational effectiveness, legal and ethical debates, or single-country analyses. While these studies provide valuable insights, they offer limited understanding of how air power development strategies are systematically structured across different national and strategic contexts. Consequently, there is insufficient synthesis regarding recurring patterns and strategic orientations within the broader literature.

The absence of systematic synthesis represents a significant gap in strategic studies and defense scholarship. Without a comprehensive overview, it remains difficult to identify common strategic patterns, distinguish between alternative development approaches, or assess their underlying assumptions. Moreover, the lack of typological frameworks limits the ability to compare air power development strategies across cases and over time. Addressing this gap is particularly important given the accelerating pace of technological change and the growing diversity of airspace threats.

Systematic Literature Review (SLR) offers a rigorous methodological approach to addressing this fragmentation by enabling structured synthesis of existing research. Through transparent selection criteria and thematic analysis, SLR facilitates the identification of dominant patterns, conceptual linkages, and research gaps within a given field (Tranfield et al., 2003; Kitchenham & Charters, 2007). In the context of air power development, SLR provides a means to integrate insights from strategic studies, defense economics, and military innovation research. This integrative capacity makes SLR particularly suitable for advancing conceptual understanding in complex and interdisciplinary domains.

Accordingly, this study conducts a Systematic Literature Review to examine patterns and typologies of air power development strategies for airspace sovereignty. By synthesizing findings from the international literature, the study aims to identify dominant strategic patterns, classify air power development approaches into coherent typologies, and highlight key factors shaping their effectiveness. In doing so, the study contributes to theoretical debates on air power and military strategy while offering a structured analytical foundation for future empirical research. The findings are expected to inform both scholarly discourse and policy deliberations concerning the strategic development of air power in contemporary security environments.

## METHODS

This study employs a Systematic Literature Review (SLR) to synthesize recent scholarly research on air power development strategies for safeguarding airspace sovereignty. The SLR approach is selected to ensure a transparent, systematic, and replicable review process capable of integrating fragmented findings across strategic and defense-related studies. The review process follows updated PRISMA 2020 guidelines, which emphasize methodological clarity, reproducibility, and rigorous reporting standards in systematic reviews (Page et al., 2021). Peer-reviewed journal articles were retrieved primarily from Scopus and Web of Science, supplemented by Google Scholar, using structured keyword combinations related to air power, air power development, airspace sovereignty, and defense strategy. Clear inclusion and exclusion criteria were applied to ensure relevance and academic quality, while non-peer-reviewed and non-strategic publications were excluded. Data extraction focused on strategic orientation, analytical frameworks, and key findings, which were subsequently analyzed using thematic synthesis to identify dominant patterns, construct strategic typologies, and highlight emerging research gaps in recent air power literature (Snyder, 2019; Paul & Criado, 2020; Xiao & Watson, 2019).

**Table 1. SPICE Framework Application**

| Element             | Description                                                                                                                                                                                                                                                                                                                                      |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Setting</b>      | National and international defense and security environments in which air power is developed and employed to safeguard airspace sovereignty, including developed and developing countries, resource-constrained states, and diverse geopolitical contexts                                                                                        |
| <b>Perspective</b>  | State actors, air forces, defense policymakers, military planners, and strategic decision-makers responsible for formulating and implementing air power development policies and airspace control strategies                                                                                                                                     |
| <b>Intervention</b> | Air power development strategies, including force structure modernization; capability development (manned and unmanned systems); integration of surveillance, command-and-control, and network-centric operations; defense diplomacy and international cooperation mechanisms; and institutional and policy reforms supporting airspace security |
| <b>Comparison</b>   | Comparison across different strategic approaches to air power development (capability-driven, technology-centric, diplomacy-oriented, and hybrid strategies); comparison across national contexts and levels of resource availability; comparison between traditional platform-centric models and integrated system-of-systems approaches        |

|                   |                                                                                                                                                                                                                                                                                           |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Evaluation</b> | Strategic and operational outcomes related to airspace sovereignty, including effectiveness of airspace control and surveillance, deterrence capability, operational readiness, adaptability to emerging threats, and strategic sustainability under fiscal and technological constraints |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

PRISMA consists of three main phases: (1) identification, (2) screening, and (3) inclusion (Page et al., 2021). In the identification phase, relevant studies were systematically retrieved from selected academic databases using predefined search strings related to air power development, air force modernization, and airspace sovereignty. Duplicate records were removed prior to proceeding to the screening stage to ensure accuracy in the selection process. This initial phase aimed to capture a comprehensive set of potentially relevant publications addressing strategic aspects of air power development.

The screening phase involved filtering the retrieved records based on predefined eligibility criteria, including document type, publication year, subject area, and language. Only peer-reviewed journal articles published in English and available in full-text form were considered for further analysis. During this phase, titles and abstracts were reviewed to assess relevance, followed by full-text examination to determine whether the studies explicitly addressed strategic, doctrinal, or policy dimensions of air power development related to airspace sovereignty.

The final inclusion phase resulted in the selection of studies that fully met all inclusion criteria and were deemed suitable for qualitative synthesis. The final set of articles formed the empirical basis for the thematic analysis and typology development presented in this review. Two comprehensive search queries were developed and combined using the Boolean operator “AND” to ensure conceptual coherence: one query captured key terms related to air power development and air force modernization, while the other focused on strategic, doctrinal, and policy-oriented perspectives. Figure 1 illustrates the PRISMA flow diagram detailing each step of the systematic literature review process.

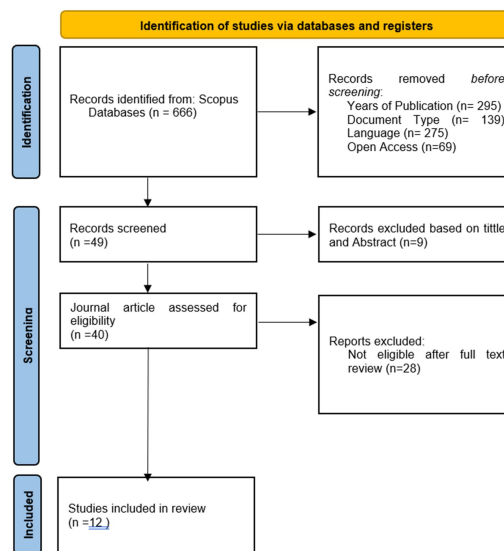


Figure 1. PRISMA Flow Diagram

The study selection process followed the PRISMA 2020 guidelines to ensure transparency and methodological rigor in the systematic literature review. An initial search conducted through the Scopus database identified a total of 666 records. Prior to screening, a preliminary filtering process was applied to remove records that did not meet the predefined criteria, including publication year, document type, language, and open access status, resulting in the exclusion of 295 records based on publication year, 139 records based on document type, 275 records based on language, and 69 records based on access availability.

Following this initial filtering stage, 49 records remained and were subjected to title and abstract screening. During this screening process, 9 records were excluded due to limited relevance to air power development strategies or airspace sovereignty. Subsequently, 40 journal articles were assessed for full-text eligibility to determine their alignment with the research objectives and inclusion criteria.

After full-text review, 27 articles were excluded because they did not sufficiently address strategic dimensions of air power development or lacked explicit relevance to airspace sovereignty. As a result of this systematic screening and eligibility assessment process, a total of 12 studies were deemed eligible and included in the final qualitative synthesis of this systematic literature review.

### **Search Strategy**

A systematic search was conducted in the Scopus database, selected for its comprehensive coverage of peer-reviewed literature in defense, security, and strategic studies. The search strategy employed Boolean operators combining key terms related to four core thematic areas relevant to air power development and airspace sovereignty:

1. Air power and force development: "air power" OR "air power strategy" OR "air power development" OR "air force development" OR "air force modernization"
2. Strategic orientation: "strategy" OR "doctrine" OR "policy" OR "development"
3. Military capability and modernization context: "military capability" OR "defense modernization" OR "force structure" OR "capability development"
4. Airspace sovereignty and security context: "airspace sovereignty" OR "air defense" OR "airspace security" OR "territorial airspace"

### **Inclusion and Exclusion Criteria**

The following inclusion criteria were applied: (1) peer-reviewed journal articles or conference papers published between 2016 and 2026; (2) studies employing empirical, analytical, or systematic approaches with clearly stated methodologies; (3) research explicitly focusing on air force or air power, including doctrine, strategy, modernization, operations, or institutional roles; (4) studies examining national air forces, including the Indonesian Air Force, or comparative analyses relevant to defence and air power; and (5) English-language publications.

Studies were excluded if they: (1) were editorials, book chapters, policy reports, or non-peer-reviewed publications; (2) lacked a clear methodological or analytical framework; (3) focused primarily on land or naval forces without substantive relevance to air force or air power; and (4) did not align with the research objectives related to air power and defence studies.

## RESULTS AND DISCUSSION

The earliest study included in this review was published in 2017, indicating the initial emergence of scholarly attention to patterns of air power development strategies. Since 2019, publication output has increased more consistently, peaking in 2021, reflecting heightened academic interest in air power development and airspace sovereignty.

**Table 2. Distribution of Studies by Publication Year**

| Publication Year | Number of Studies | Percentage (%) |
|------------------|-------------------|----------------|
| 2025             | 1                 | 8.33           |
| 2024             | 1                 | 8.33           |
| 2023             | 2                 | 16.67          |
| 2022             | 2                 | 16.67          |
| 2021             | 3                 | 25.00          |
| 2019             | 2                 | 16.67          |
| 2017             | 1                 | 8.33           |
| <b>Total</b>     | <b>12</b>         | <b>100.00</b>  |

### Conceptual Framework for Analyzing Patterns and Typologies of Air Power Development Strategies

The conceptual framework illustrates how patterns and typologies of air power development strategies for airspace sovereignty are systematically derived through a structured literature review process. At its core, the framework is anchored in the strategic objective of safeguarding airspace sovereignty, which is understood as a multidimensional outcome shaped by military capability, technological adaptation, international cooperation, and institutional governance. This objective provides the analytical lens guiding the selection and interpretation of the reviewed literature.

The framework is grounded methodologically in a Systematic Literature Review (SLR), which serves as a rigorous and transparent mechanism for synthesizing fragmented research across air power, defense strategy, and security studies. Through thematic synthesis, the SLR enables the identification of recurring strategic logics that transcend individual case studies or national contexts. This process ensures that the framework is built on cumulative scholarly evidence rather than isolated empirical observations.

Four dominant thematic patterns emerge from the synthesis: capability-driven, technology-centric, diplomacy-oriented, and institutional and governance factors. The capability-driven pattern emphasizes conventional military strength, force readiness, and air superiority. The technology-centric pattern highlights the growing reliance on advanced technologies, such as unmanned systems and network-centric operations, to enhance airspace control. The diplomacy-oriented pattern underscores the role of alliances, defense diplomacy, and cooperative security arrangements, while institutional and governance factors operate as cross-cutting influences shaping the formulation and sustainability of air power strategies.

These thematic patterns are subsequently consolidated into a set of strategic typologies that represent higher-order conceptual models of air power development. The resulting typologies—capability-driven, technology-centric, diplomacy-oriented, and hybrid strategies—provide a structured framework for comparing and understanding variation in air power development approaches across different strategic contexts. Overall, the framework demonstrates that air

power development for airspace sovereignty is a dynamic and adaptive strategic process, offering a coherent analytical foundation for future empirical research and policy analysis.

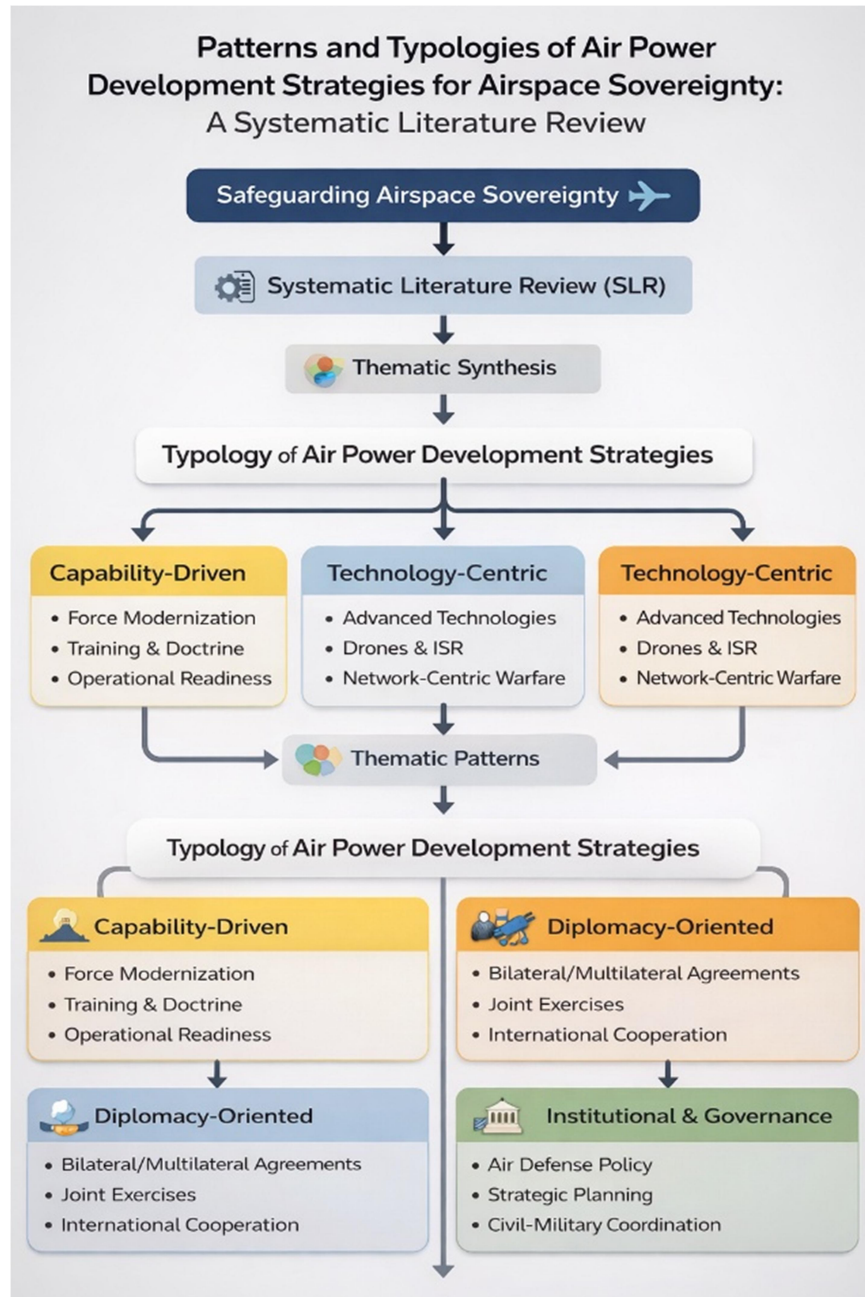


Figure 2. Conceptual Framework for Analyzing Patterns and Typologies of Air Power Development Strategies

### Capability-Driven Air Power Development

The capability-driven theme reflects a strategic orientation that prioritizes the enhancement of core military capabilities to achieve and maintain air superiority and effective airspace control. Studies within this theme emphasize force readiness, fleet modernization, pilot training, and the robustness of command-and-control systems as central components of air power development. This approach is grounded in conventional military thinking, where deterrence and sovereignty are closely linked to the availability of credible and deployable combat power. The literature

demonstrates that organizational capacity and sustained investment play a decisive role in shaping air power effectiveness, particularly in conventional deterrence contexts (DeVore, 2015; Horowitz et al., 2016).

### Technology-Centric Air Power Development

The technology-centric theme highlights the growing reliance on advanced technologies as primary drivers of air power effectiveness. Research within this theme focuses on the integration of unmanned aerial systems, automation, artificial intelligence, and network-centric operations to enhance surveillance, persistence, and operational flexibility. Rather than prioritizing platform quantity, technology-centric strategies emphasize qualitative advantages derived from systems integration and information superiority. Empirical and conceptual studies suggest that technological innovation has reshaped assumptions about cost-efficiency, risk distribution, and the future structure of air forces (Jordan, 2021; Horowitz et al., 2016).

### Diplomacy-Oriented Air Power Development

The diplomacy-oriented theme underscores the role of international cooperation and defense diplomacy in strengthening air power effectiveness and safeguarding airspace sovereignty. Studies within this category emphasize alliances, intelligence sharing, joint training, and interoperability as strategic instruments that complement national air power capabilities. The literature indicates that air power effectiveness increasingly depends on relational and networked forms of security cooperation, particularly in regions characterized by transnational threats and complex geopolitical environments. Empirical analyses of drone operations and security partnerships highlight how cooperative frameworks enhance situational awareness and strategic reach beyond national capabilities (Mir & Moore, 2018; Horowitz et al., 2016).

### Institutional and Governance Factors

Institutional and governance factors emerge as a cross-cutting theme influencing all air power development strategies. The literature highlights the importance of procurement governance, defense-industrial relationships, and civil–military coordination in shaping long-term air power outcomes. Studies demonstrate that technological advancement and capability investment alone are insufficient without coherent institutional frameworks and sustained political commitment. In particular, research on the political economy of military aircraft production underscores how governance structures and industrial policies condition the feasibility, sustainability, and strategic effectiveness of air power development (DeVore, 2015)

**Table 3. Typology of Air Power Development Strategies for Airspace Sovereignty**

| Typology                           | Core Characteristics                                                                                                                            | Strategic Instruments                                                                                                    |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Capability-Driven Strategy</b>  | Emphasizes traditional military strength, force readiness, and air superiority through manned combat aircraft and conventional force structures | Fleet modernization, pilot training, command-and-control enhancement, sustained defense investment                       |
| <b>Technology-Centric Strategy</b> | Prioritizes technological innovation to enhance effectiveness and efficiency, often as a response to fiscal and manpower constraints            | Unmanned aerial systems (UAS/UCAV), artificial intelligence, network-centric operations, integrated surveillance systems |
| <b>Diplomacy-Oriented Strategy</b> | Focuses on cooperation and partnerships to compensate for limited national capabilities and enhance airspace control                            | Defense diplomacy, alliances, intelligence sharing, joint exercises, interoperability frameworks                         |
| <b>Hybrid Strategy</b>             | Integrates military capability, advanced technology, and international cooperation in an adaptive and context-sensitive manner                  | Combined use of manned–unmanned systems, multilateral cooperation, flexible procurement and governance models            |

## Discussion

### Theoretical Implications

The findings of this systematic literature review contribute to the theoretical development of air power studies by moving beyond fragmented, issue-specific analyses toward a more integrated understanding of air power development strategies. The identification of recurring patterns and distinct typologies demonstrates that air power development cannot be adequately explained through single-variable or platform-centric frameworks. Instead, the literature increasingly conceptualizes air power as a strategic system shaped by interactions among military capability, technological innovation, institutional governance, and international context (DeVore, 2015; Horowitz et al., 2016).

The proposed typology advances existing theoretical debates by offering a structured classification of air power development strategies. Capability-driven strategies align with classical theories of military power that emphasize force readiness, organizational capacity, and conventional deterrence. In contrast, technology-centric strategies reflect contemporary theories of military innovation, which highlight the role of emerging technologies in reshaping operational concepts and strategic advantages (Jordan, 2021). The distinction between these typologies clarifies how different strategic logics underpin air power development decisions across diverse contexts.

The diplomacy-oriented typology further extends theoretical perspectives by foregrounding the role of cooperation, alliances, and institutional networks in air power effectiveness. This finding supports arguments in security studies that military power is increasingly relational rather than purely national, particularly in domains such as airspace control that require extensive intelligence sharing and interoperability (Mir & Moore, 2018). By incorporating this dimension, the review bridges air power theory with broader alliance and security cooperation literature.

Importantly, the emergence of hybrid air power development strategies has significant theoretical implications. Hybrid strategies challenge linear models of military development by demonstrating that contemporary air power strategies often combine multiple strategic orientations simultaneously. This integrative approach suggests a shift toward adaptive and context-sensitive theorization of air power, in which strategic effectiveness is contingent on balancing capability, technology, and cooperation rather than privileging a single dimension (DeVore, 2015; Jordan, 2021).

### Policy Implications

From a policy perspective, the findings underscore that effective air power development for airspace sovereignty requires more than increased defense spending or platform acquisition. Capability-driven approaches remain relevant for maintaining credible deterrence, but their effectiveness is increasingly constrained by fiscal pressures and rising sustainment costs. Policymakers must therefore recognize the limits of purely capability-centric strategies, particularly in resource-constrained environments.

Technology-centric strategies offer alternative pathways by leveraging unmanned systems, automation, and networked surveillance to enhance airspace control. However, the literature cautions that technological adoption alone does not guarantee strategic effectiveness. Without appropriate institutional frameworks, doctrine, and integration with existing force structures,

technological investments may yield limited returns (Jordan, 2021). This finding highlights the importance of aligning technology policy with organizational and strategic planning.

The review also highlights the growing importance of diplomacy-oriented strategies for safeguarding airspace sovereignty. Defense diplomacy, alliance participation, and intelligence-sharing arrangements can significantly enhance air power effectiveness, especially for states facing asymmetric threats or limited resources. Policymakers should therefore view international cooperation not as a supplementary measure, but as a core component of national air power development strategies (Mir & Moore, 2018; Horowitz et al., 2016).

Finally, the identification of hybrid strategies carries important policy implications. Hybrid approaches suggest that optimal air power development involves strategic integration rather than strategic substitution. Policymakers are encouraged to pursue balanced development pathways that combine military capability, technological innovation, and cooperative mechanisms in ways that reflect national priorities and contextual constraints. Such an approach enhances strategic flexibility, resilience, and long-term sustainability in safeguarding airspace sovereignty.

### **Limitations and Future Research**

Despite its contributions, this study has several limitations that should be acknowledged. First, the systematic literature review is limited to peer-reviewed journal articles indexed in major academic databases and published in English. While this approach ensures academic rigor and comparability, it may exclude relevant studies published in other languages or in practitioner-oriented outlets, potentially limiting the inclusiveness of the synthesis. Second, as with most SLRs, the findings are shaped by the scope and quality of the existing literature, which remains uneven across regions and research traditions in air power and airspace sovereignty studies.

Third, the review focuses on qualitative synthesis and typology construction rather than empirical performance measurement. As a result, the identified patterns and typologies reflect dominant strategic orientations in the literature but do not directly assess their empirical effectiveness in specific national or operational contexts. Moreover, publication bias toward technologically advanced or militarily active states may influence the visibility of certain strategic approaches, particularly those adopted by resource-constrained or smaller air forces.

Future research can build upon the findings of this study in several ways. First, empirical studies using quantitative or mixed-methods approaches could test the explanatory power and performance implications of the proposed typologies across different geopolitical and institutional contexts. Second, comparative case studies focusing on specific regions or alliance structures could provide deeper insights into how contextual factors shape the adoption and effectiveness of air power development strategies. Finally, future research may extend the scope of analysis to emerging domains such as cyber-air integration, space-based capabilities, and autonomous systems governance, which are likely to further transform air power development and airspace sovereignty in the coming years.

### **CONCLUSION**

This study set out to systematically synthesize existing scholarship on air power development strategies for safeguarding airspace sovereignty through a Systematic Literature Review. The findings demonstrate that the literature converges around several recurring strategic patterns, which can be coherently organized into four main typologies: capability-driven,

technology-centric, diplomacy-oriented, and hybrid air power development strategies. These typologies provide a structured framework for understanding how states conceptualize and operationalize air power in response to evolving security environments, technological change, and institutional constraints.

The review reveals a clear shift in the literature away from narrowly defined, platform-centric approaches toward more integrated and adaptive strategic models. While capability-driven strategies remain central to conventional deterrence and air superiority, their effectiveness is increasingly shaped by economic, organizational, and technological considerations. Technology-centric and diplomacy-oriented strategies emerge as complementary approaches that allow states to address fiscal constraints, leverage innovation, and enhance airspace control through cooperation and interoperability. The growing prominence of hybrid strategies reflects an emerging consensus that no single strategic orientation is sufficient to address contemporary airspace challenges.

From a scholarly perspective, this study contributes to air power and strategic studies by offering a typology-based synthesis that advances conceptual clarity and supports theory-building. By integrating insights from military strategy, technological innovation, political economy, and security cooperation, the review moves beyond fragmented analyses and provides a comprehensive understanding of air power development strategies. This contribution addresses a key gap in the literature and establishes a foundation for comparative and explanatory research on air power effectiveness.

In practical terms, the findings suggest that policymakers and defense planners should adopt a balanced and context-sensitive approach to air power development. Rather than prioritizing isolated investments in platforms or technology, effective strategies require the strategic integration of military capability, innovation, and cooperation. Such an approach enhances adaptability, resilience, and long-term sustainability in safeguarding airspace sovereignty.

Overall, this systematic literature review underscores the importance of viewing air power development as a multidimensional strategic process. The typologies and patterns identified in this study provide a structured analytical lens that can inform future empirical research, guide policy deliberations, and support more coherent strategic planning in the domain of air power and airspace sovereignty.

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