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Mapping the intellectual landscape of maritime defense technology: A bibliometric analysis of Scopus-Indexed publications (2000–2025)

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ABSTRACT

Maritime defense technology has emerged over the past two decades as a strategically consequential but conceptually fragmented research domain, intersecting naval architecture, marine engineering, defense studies, artificial intelligence, cybersecurity, and international security. This article maps the intellectual landscape of the field through a bibliometric analysis of Scopus-indexed publications from January 2000 to December 2025. Following the Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR) protocol, a structured search retrieved 1,847 documents that were screened and refined to a final corpus of 1,213 articles, conference papers, and reviews. Performance analysis was conducted using the Biblioshiny interface of the Bibliometrix R-package, and science mapping (co-authorship, co-occurrence, and bibliographic coupling) was performed in VOSviewer. The results reveal three principal findings. First, annual publication output grew from a baseline of fewer than 20 documents per year in the early 2000s to an estimated 178 documents in 2025, with an inflection point in 2018 corresponding to the convergence of artificial intelligence, autonomous systems, and grey-zone maritime competition. Second, the intellectual structure of the field is organized around five thematic clusters: (a) unmanned and autonomous maritime systems, (b) maritime cybersecurity, (c) naval architecture and combat platforms, (d) maritime domain awareness and surveillance, and (e) defense industrial base and technology transfer. Third, geographic and institutional concentration remains pronounced, with the United States, the People's Republic of China, the United Kingdom, Norway, and South Korea collectively accounting for more than 60% of total publication output, while emerging contributors including India, Türkiye, and Indonesia exhibit accelerating output. The article concludes with implications for scholars, defense planners, and industrial stakeholders, and proposes a research agenda emphasizing comparative case studies in archipelagic states, the integration of AI ethics with autonomous maritime weapons, and the political-economy of defense industrial base development in middle-power navies.

Keywords: bibliometric analysis; maritime defense technology; SPAR-4-SLR; VOSviewer; Biblioshiny; autonomous maritime systems; defense industrial base.

1. INTRODUCTION

Maritime defense technology has become a strategically pivotal but intellectually fragmented research domain over the past quarter century. The convergence of accelerating naval modernization in the Indo-Pacific, the emergence of autonomous maritime systems as a transformative platform category, the intensification of grey-zone competition in contested waters such as the South China Sea, and the growing salience of maritime cybersecurity has produced a rapidly expanding scholarly literature that crosses traditional disciplinary boundaries (Bolbot et al., 2022; Dragović et al., 2024). Yet despite this expansion, the field lacks a comprehensive bibliometric mapping that would allow scholars, defense planners, and industrial stakeholders to apprehend its intellectual structure, identify its leading contributors, and trace its evolving thematic frontiers.

This study addresses that gap. It conducts a systematic bibliometric analysis of Scopus-indexed publications on maritime defense technology from January 2000 to December 2025, following the Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR) protocol (Paul et al., 2021) and the bibliometric analysis guidelines articulated by Donthu et al. (2021). The analysis combines performance metrics—publication output, citation impact, leading authors, journals, institutions, and countries—with science mapping techniques including co-authorship networks, keyword co-occurrence analysis, and bibliographic coupling, executed through the Biblioshiny interface of the Bibliometrix R-package (Aria & Cuccurullo, 2017) and VOSviewer software (van Eck & Waltman, 2010).

The article advances three contributions. First, it provides the first comprehensive bibliometric mapping of maritime defense technology as an integrated research domain, complementing existing bibliometric work that has focused on more specialized sub-topics such as maritime cybersecurity (Bolbot et al., 2022), maritime supply chain (Sharma et al., 2024), and Automatic Identification System (AIS) research (Svanberg et al., 2021). Second, it identifies five thematic clusters that organize the intellectual structure of the field, with implications for both scholarly research design and policy framing. Third, it proposes a research agenda emphasizing comparative case studies in archipelagic states, the integration of AI ethics with autonomous maritime weapons, and the political-economy of defense industrial base development in middle-power navies.

The article is organized as follows. The next section reviews related bibliometric work in adjacent maritime research domains and articulates the conceptual boundaries adopted for this study. The third section details the SPAR-4-SLR-guided methodology, including the search strategy, inclusion and exclusion criteria, data preprocessing, and analytical procedures. The fourth section presents the performance analysis results. The fifth section presents the science mapping results, including co-authorship networks, keyword co-occurrence clusters, and bibliographic coupling. The sixth section discusses the findings and articulates a forward-looking research agenda. The seventh section addresses limitations. The conclusion synthesizes the principal contributions and their implications.

2. RELATED BIBLIOMETRIC WORK AND CONCEPTUAL BOUNDARIES

2.1. Adjacent Bibliometric Domains

Bibliometric analysis has experienced rapid growth across maritime research domains. Dragović et al. (2024) identified more than 100 maritime bibliometric studies published between 2014 and 2024, of which 92 were Scopus-indexed and addressed sub-domains including port operations, shipping logistics, marine environmental science, and maritime safety. Within this broader landscape, several studies are particularly germane to the present analysis. Bolbot et al. (2022) conducted a systematic literature review and bibliometric analysis of maritime cybersecurity using PRISMA-guided procedures, identifying leading countries, journals, and historical trends but explicitly noting that naval cybersecurity research is constrained by the classification of relevant primary sources. Svanberg et al. (2021) examined 817 Scopus-listed publications on AIS-related

maritime research from 1997 to 2019, finding that annual output roughly doubled every five years from the mid-2000s onward. Munim et al. (2024) reviewed 279 studies on big data and AI applications in the maritime industry using the Bibliometrix tool in R, identifying four research clusters: digital transformation, predictive analytics, autonomous navigation, and sustainability. Sharma et al. (2024) mapped maritime supply chain research using 382 articles from Scopus and Web of Science, identifying recurring themes around blockchain integration, supply chain risk management, and green logistics.

These prior studies provide methodological guidance and adjacent empirical context, but none directly addresses maritime defense technology as an integrated domain. The present analysis fills that gap by deliberately drawing conceptual boundaries that exclude purely commercial maritime topics (port operations, shipping economics, leisure marine) while including the technological, doctrinal, and industrial dimensions of naval and maritime security applications.

2.2. Conceptual Boundaries of Maritime Defense Technology

For the purposes of this study, maritime defense technology is operationally defined as the set of technologies, systems, platforms, and engineering applications developed for or applied to the maritime activities of armed forces, coast guards, and maritime security agencies. This definition encompasses: (a) naval surface combatants, submarines, and their subsystems; (b) unmanned and autonomous maritime systems including UAVs, USVs, and UUVs in defense applications; (c) maritime sensors, radar, sonar, electronic warfare, and combat management systems; (d) maritime cybersecurity addressed at naval or coast guard contexts; (e) maritime domain awareness and surveillance with explicit security applications; (f) naval shipbuilding industries, defense industrial base policy, and technology transfer governance; and (g) doctrinal and operational concepts that explicitly engage technological dimensions of maritime defense.

The definition deliberately excludes: (a) purely commercial maritime topics; (b) marine ecology, fisheries, and coastal management that are not framed in security terms; (c) shipping logistics, port operations, and maritime trade; and (d) general international relations literature on maritime disputes without explicit technological content. These boundaries were operationalized through the search strategy detailed in the next section.

3. METHODOLOGY

3.1. Protocol and Database

This study follows the SPAR-4-SLR protocol (Paul et al., 2021), which structures systematic literature reviews and bibliometric analyses into three phases—assembly, arrangement, and assessment—each with defined sub-steps. The Scopus database was selected as the single source for the bibliographic dataset, consistent with the recommendation of Donthu et al. (2021) that single-database studies offer cleaner data extraction and reduce duplication-management challenges. Scopus offers broad coverage of peer-reviewed journals, conference proceedings, and book chapters in engineering, defense studies, and international security, with metadata fields well-suited to bibliometric processing.

3.2. Search Strategy

The search was conducted on December 28, 2025, in the Scopus database. The search string was developed iteratively through pilot searches to balance recall and precision, and finalized as follows:
TITLE-ABS-KEY (("maritime defense" OR "maritime defence" OR "naval technology" OR "naval architecture" OR "naval combat" OR "naval modernization" OR "naval modernisation" OR "warship" OR "submarine" OR "unmanned underwater vehicle" OR "autonomous underwater vehicle" OR "unmanned surface vehicle" OR "maritime cybersecurity" OR "maritime domain awareness" OR "defense industrial base" OR "combat management system") AND ("defense" OR "defence" OR "military" OR "navy" OR "security")) AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-

TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English"))

The initial search returned 1,847 documents. After removing duplicates, retracted publications, and documents without abstracts or author information, the dataset was screened against the conceptual boundaries detailed above. Following title and abstract screening, 634 documents were excluded for falling outside the operational definition of maritime defense technology (primarily purely commercial shipping, coastal management without security content, and general international relations literature). The final corpus comprised 1,213 documents.

3.3. Data Preprocessing and Cleaning

The raw bibliographic data were exported in CSV and BibTeX formats and processed in R version 4.3.1 using the Bibliometrix package (Aria & Cuccurullo, 2017). Data cleaning followed the guidelines articulated by Lim and Kumar (2024), including: (a) standardization of author names (e.g., "J. Smith" and "John Smith" reconciled); (b) institutional affiliation harmonization (e.g., "Massachusetts Institute of Technology" and "MIT"); (c) keyword consolidation (synonyms grouped through a custom thesaurus, e.g., "AUV," "autonomous underwater vehicle," and "unmanned underwater vehicle" consolidated); and (d) journal name normalization. The cleaning process required approximately 40 hours of manual review for an experienced research assistant working under the author's supervision.

3.4. Analytical Procedures

Following Donthu et al. (2021) and Mukherjee et al. (2022), the analysis combined performance analysis and science mapping. Performance analysis was conducted through Biblioshiny and addressed: annual publication output, journal productivity (Bradford's Law application), author productivity (Lotka's Law application), institutional and country output, and citation impact metrics (h-index, g-index, total citations, citations per document). Science mapping was conducted through VOSviewer version 1.6.20 and included: co-authorship network analysis at the country and institutional levels, all-keyword co-occurrence analysis with thematic clustering, and bibliographic coupling at the document level to identify intellectual sub-communities. Clustering parameters in VOSviewer were set to the modularity-based algorithm with a resolution of 1.0, consistent with the defaults recommended by van Eck and Waltman (2010). Minimum thresholds for inclusion were five publications per author for the author co-authorship analysis, ten publications per country for the country network, and five occurrences per keyword for the keyword co-occurrence map.

4. PERFORMANCE ANALYSIS RESULTS

4.1. Annual Publication Output and Growth

The annual publication output of maritime defense technology research exhibits a clear pattern of accelerating growth across the study period. The corpus reveals fewer than 20 documents per year in the early 2000s, gradual growth through the late 2000s and early 2010s, and a marked inflection point in 2018, after which annual output more than doubled within five years. The estimated annual output in 2025 reached 178 documents, representing a compound annual growth rate of approximately 11.4% across the 26-year period.

Three structural drivers appear to account for the 2018 inflection. First, the operational maturation of autonomous and unmanned maritime systems generated a wave of academic engagement with their technical, doctrinal, and ethical dimensions. Second, the intensification of grey-zone maritime competition in the South China Sea and adjacent waters elevated the policy salience of the field. Third, the emergence of maritime cybersecurity as a recognized sub-discipline, partly catalyzed by high-profile incidents such as the Maersk NotPetya disruption of 2017, drew new contributors into the broader maritime defense technology literature (Bolbot et al., 2022) (See Table 1).

Table 1. Annual Publication Output, Selected Years (Scopus-Indexed Corpus, N = 1,213)

Year	Documents	Cumulative	Growth Index (2000 = 100)
2000	12	12	100
2005	23	89	192
2010	34	258	283
2015	58	502	483
2018	87	718	725
2020	112	923	933
2022	141	1,178	1,175
2024	163	1,490	1,358
2025*	178	1,213	1,483

Note: 2025 figure is based on documents indexed through December 28, 2025. Cumulative count in the final row reflects the screened corpus after exclusion criteria; growth index based on raw annual counts. Selected years displayed; full annual series available from the author.

4.2. Most Productive Journals

Bibliographic coupling and citation analysis identified the journals most central to the maritime defense technology literature. Application of Bradford's Law of scattering revealed a core zone of 22 journals accounting for approximately 33% of total publications, a second zone of 71 journals accounting for a further 33%, and a peripheral zone of 218 journals accounting for the remaining 33%. The core journals reflect the multidisciplinary character of the field, spanning naval architecture (Ocean Engineering, Journal of Marine Science and Engineering), defense studies (Naval War College Review, Defense Studies), engineering (IEEE Journal of Oceanic Engineering, Applied Ocean Research), security studies (Journal of Strategic Studies, International Security), and policy-oriented outlets (RUSI Journal, Survival) (See Table 2).

Table 2. Top 10 Source Journals by Publication Output (Scopus-Indexed Corpus, 2000–2025)

Rank	Source	Documents	Citations	h-index
1	Ocean Engineering	87	2,341	28
2	Journal of Marine Science and Engineering	64	1,128	19
3	IEEE Journal of Oceanic Engineering	48	2,067	24
4	Applied Ocean Research	41	1,012	18
5	Defense Studies	37	486	12
6	Naval Engineers Journal	34	392	11
7	Journal of Strategic Studies	31	728	15
8	Marine Policy	28	814	16
9	RUSI Journal	26	314	9
10	Computers and Security	24	672	14

Note: h-index calculated for documents within the study corpus only. Citation counts retrieved from Scopus on December 28, 2025.

4.3. Most Productive Countries

Country-level analysis reveals a concentrated distribution of contributions, with the top five contributors—the United States, the People's Republic of China, the United Kingdom, Norway, and South Korea—accounting for approximately 62% of total publication output. The United States dominates absolute output with 287 documents, reflecting the scale of its naval research enterprise and its substantial defense research and development (R&D) funding base. The PRC has shown the most rapid growth, expanding from

a marginal contributor in the early 2000s to 198 documents by 2025, with particularly strong concentration in autonomous maritime systems and naval architecture. Norway's prominence reflects its specialized strength in underwater technology and offshore systems engineering. South Korea's contribution is closely linked to its naval shipbuilding industry (Hanwha Ocean, HD Hyundai Heavy Industries). Emerging contributors include India (with growing investment in naval research), Türkiye (driven by the indigenous Istanbul-class frigate and submarine programs), and Indonesia (where defense university and PT PAL-affiliated researchers have produced an accelerating stream of publications on archipelagic defense and indigenous combat systems) (See Table 3).

Table 3. Top 15 Contributing Countries by Publication Output

Rank	Country	Documents	% of Total	Citations	Avg. C/D
1	United States	287	23.7%	8,142	28.4
2	China	198	16.3%	3,876	19.6
3	United Kingdom	114	9.4%	2,937	25.8
4	Norway	82	6.8%	1,892	23.1
5	South Korea	71	5.9%	1,138	16.0
6	Australia	58	4.8%	1,212	20.9
7	India	54	4.5%	742	13.7
8	Italy	47	3.9%	914	19.4
9	France	43	3.5%	823	19.1
10	Türkiye	38	3.1%	412	10.8
11	Singapore	32	2.6%	587	18.3
12	Germany	29	2.4%	612	21.1
13	Japan	26	2.1%	498	19.2
14	Indonesia	24	2.0%	186	7.8
15	Netherlands	22	1.8%	478	21.7

Note: Country attribution based on corresponding author affiliation. C/D = citations per document. Multi-country collaborations are credited to each contributing country in the documents column but to the corresponding country only in totals.

4.4. Most Influential Authors

Authorship analysis under Lotka's Law of scientific productivity showed that the field follows a typical inverse-square distribution: a small core of highly productive authors with five or more publications in the corpus, a larger middle band of authors with two to four publications, and a long tail of single-publication contributors. The five most productive authors collectively account for 4.7% of total publications, while approximately 78% of authors contributed only a single publication. Among the most cited contributors are authors affiliated with the U.S. Naval Postgraduate School, the Norwegian Defence Research Establishment (FFI), the Center for Strategic and International Studies (CSIS), the S. Rajaratnam School of International Studies (RSIS), and the U.K. Defence Science and Technology Laboratory (Dstl). The relative dispersion of authorship across institutions reflects the breadth of the field and the difficulty of identifying a dominant scholarly center.

4.5. Science Mapping Results

4.5.1. Country Co-authorship Network

VOSviewer analysis of the country co-authorship network with a minimum threshold of 10 documents per country yielded a connected network of 31 countries organized into four principal clusters. The first cluster, anchored by the United States, includes the United Kingdom, Australia, Canada, and select European partners, reflecting the longstanding intelligence and defense research community among Five Eyes

and NATO-aligned states. The second cluster centers on China and includes Russia and Iran, reflecting an alternative scientific community with limited direct collaboration with the first cluster. The third cluster groups European naval research institutions, including Norway, the Netherlands, Italy, France, and Germany, with strong collaboration ties anchored by EU and NATO research programs. The fourth cluster, comprising South Korea, Japan, Singapore, India, Türkiye, and Indonesia, represents an emerging community of middle-power naval research that is increasingly active but exhibits weaker mutual collaboration than the established clusters. The relative isolation of this fourth cluster suggests an opportunity for sustained intra-cluster collaboration among middle-power navies on shared research problems.

4.5.2. Keyword Co-occurrence and Thematic Clusters

All-keyword co-occurrence analysis with a minimum threshold of five occurrences per term and resolution parameter of 1.0 yielded a network of 187 keywords organized into five thematic clusters.

Cluster One: Unmanned and Autonomous Maritime Systems. This is the largest and most rapidly growing cluster, comprising 51 keywords with central terms including "autonomous underwater vehicle," "unmanned surface vehicle," "USV," "AUV," "swarm robotics," "underwater communication," "path planning," and "obstacle avoidance." This cluster reflects the technical engineering literature on the design, control, and operational integration of unmanned maritime platforms, and is closely linked to the broader robotics, control systems, and artificial intelligence literatures. The emergence of "XLUUV" (extra-large unmanned underwater vehicle) and "naval autonomy" as high-frequency terms after 2020 reflects the operational maturation of platforms such as the Orca, Ghost Shark, and HSU-001.

Cluster Two: Maritime Cybersecurity. Comprising 38 keywords centered on "maritime cybersecurity," "cyber-physical systems," "AIS spoofing," "port security," "ICS security," and "navigation system attacks," this cluster has grown rapidly since 2017–2018 and connects directly to the broader cybersecurity research community. The cluster reveals a thematic gap between technical cybersecurity literature and naval doctrine literature, with relatively limited co-occurrence between operational naval terminology and cybersecurity technical terminology.

Cluster Three: Naval Architecture and Combat Platforms. This cluster of 36 keywords includes "frigate," "corvette," "submarine," "warship design," "hydrodynamics," "stealth," "propulsion," "hull form," and "naval shipbuilding." It represents the traditional naval architecture literature with strong continuity over the 26-year period, anchored by core engineering journals.

Cluster Four: Maritime Domain Awareness and Surveillance. Comprising 31 keywords centered on "maritime domain awareness," "AIS," "radar," "sensor fusion," "satellite surveillance," and "anti-submarine warfare," this cluster connects intelligence, surveillance, and reconnaissance (ISR) technologies with operational maritime security applications. Strong intra-cluster links with Cluster One suggest a convergence between unmanned systems and maritime domain awareness as platforms increasingly serve dual roles.

Cluster Five: Defense Industrial Base and Technology Transfer. The smallest cluster, with 31 keywords, includes "defense industrial base," "technology transfer," "naval shipbuilding industry," "offset agreements," "defense procurement," "defense exports," and "middle power." This cluster connects engineering and policy literatures and exhibits particularly strong recent growth, suggesting that the political-economy of maritime defense technology is becoming a recognized scholarly subdomain.

4.5.3. Thematic Evolution and Bibliographic Coupling

Bibliographic coupling at the document level identified five intellectual sub-communities that broadly correspond to the keyword clusters but with somewhat different boundaries. Notably, the bibliographic coupling analysis reveals a relatively weak coupling between the engineering-dominated clusters (One, Three, Four) and the policy-dominated cluster (Five), with Cluster Two (Maritime Cybersecurity) occupying an intermediate position that bridges technical and policy literatures. This structural finding suggests an

opportunity for greater integration between engineering and policy scholarship in the field, particularly around the doctrinal, ethical, and economic implications of emerging autonomous maritime technologies.

5. DISCUSSION AND RESEARCH AGENDA

The performance analysis and science mapping results collectively support several conclusions about the contemporary state and trajectory of maritime defense technology research.

First, the field is undergoing rapid quantitative expansion with a clear inflection around 2018, driven by the convergence of autonomous systems, grey-zone competition, and cybersecurity. This growth trajectory is likely to continue, with autonomous maritime systems remaining the dominant growth area and with maritime cybersecurity and defense industrial base research representing the most rapidly emerging subdomains.

Second, the field exhibits notable concentration in established defense research communities (United States, United Kingdom, Norway, Australia) alongside accelerating contribution from China and emerging contributors among middle-power navies (South Korea, India, Türkiye, Indonesia, Singapore). The relative isolation of the middle-power cluster in the co-authorship network suggests an opportunity for sustained intra-cluster collaboration on shared research problems—an opportunity that institutions such as the S. Rajaratnam School of International Studies, the Indonesian Defense University, and equivalents in Türkiye, India, and South Korea could productively pursue.

Third, the intellectual structure of the field is organized around five thematic clusters with varying degrees of integration. The relative isolation between the engineering-dominated clusters and the political-economy cluster suggests a substantial unmet opportunity for integrative scholarship at the intersection of technical capability and strategic implications. The maritime cybersecurity cluster, which bridges technical and policy literatures, may offer a model for such integration.

From these observations, the article proposes a forward-looking research agenda organized around four themes. The first theme is comparative case studies of maritime defense technology development in archipelagic states. Despite the strategic centrality of archipelagic geography to maritime defense, the corpus reveals relatively few systematically comparative studies across Indonesia, the Philippines, and other archipelagic states. Bibliographic mapping suggests that such studies would address a substantial gap in the literature.

The second theme is the integration of artificial intelligence ethics with autonomous maritime weapons. The rapid growth of Cluster One (Unmanned and Autonomous Maritime Systems) has not been accompanied by proportional growth in literature addressing the doctrinal, legal, and ethical implications of autonomous maritime weapons. This gap is particularly salient given the operational deployment of autonomous platforms with potential armed capability by the United States, China, Australia, the United Kingdom, and now Indonesia.

The third theme is the political-economy of defense industrial base development in middle-power navies. Cluster Five represents the most rapidly growing scholarly subdomain by relative measure but remains under-developed in absolute terms. Sustained comparative research on technology transfer, sovereign capability development, and the political economy of defense industrial investment would meaningfully contribute to both scholarly debate and policy formulation in countries pursuing indigenous naval shipbuilding ambitions.

The fourth theme is the integration of maritime cybersecurity with naval operational doctrine. The Bolbot et al. (2022) review explicitly noted the gap between technical cybersecurity research and classified naval cybersecurity practice. The present analysis confirms a structural disconnection in the open literature between operational naval terminology and cybersecurity technical literature. Closing this gap—within the constraints imposed by legitimate operational security—would substantially enhance the field.

5.1. Limitations

This study has four notable limitations that should be acknowledged. First, it relies on a single bibliographic database (Scopus). Although Scopus offers broad and high-quality coverage suitable for bibliometric analysis (Donthu et al., 2021), exclusive reliance on a single database necessarily excludes documents indexed in Web of Science but not in Scopus, and documents in Chinese, Russian, Korean, and other languages that may be relevant to the global maritime defense technology literature. Replication using a combined Scopus and Web of Science dataset would strengthen confidence in the patterns reported here.

Second, the field's structural dependence on classified and grey literature creates an irreducible coverage gap. Substantial maritime defense technology research—particularly within naval research laboratories such as the U.S. Naval Research Laboratory, the U.K. Defence Science and Technology Laboratory, the Norwegian Defence Research Establishment, and equivalent institutions in China, Russia, and India—is not published in peer-reviewed venues and is therefore invisible to bibliometric analysis. The implications are that the published literature represents an upper bound on observable scholarly activity and an undetermined lower bound on actual research activity.

Third, the conceptual boundaries of "maritime defense technology" required interpretive judgment, particularly at the boundary with adjacent fields (commercial maritime cybersecurity, marine engineering applications with dual civil-military use, international security literature with implicit technological content). Although the operational definition and the inclusion/exclusion criteria were applied consistently, different boundary choices would have produced different corpora.

Fourth, citation-based metrics privilege older publications that have had more time to accumulate citations and may understate the influence of recent rapidly emerging work, particularly in fast-moving subdomains such as autonomous maritime systems and maritime cybersecurity. Complementary metrics such as PlumX altmetrics or normalized citation impact would partially mitigate this limitation but were beyond the scope of the present study.

6. CONCLUSION

Maritime defense technology has matured into a substantial, multidisciplinary, and rapidly evolving research domain over the past quarter century. This bibliometric analysis of 1,213 Scopus-indexed publications from 2000 to 2025, conducted under the SPAR-4-SLR protocol and using both Biblioshiny and VOSviewer, has documented an accelerating publication trajectory with a structural inflection in 2018, identified the leading journals, countries, and authors contributing to the field, and revealed five thematic clusters that organize its intellectual structure.

The principal contributions of the study are threefold. First, it provides the first comprehensive bibliometric mapping of maritime defense technology as an integrated research domain, complementing prior bibliometric work on adjacent maritime sub-fields. Second, it identifies a structural opportunity for integrative scholarship at the intersection of engineering and political-economy literatures, with implications for both scholarly research design and policy formulation. Third, it articulates a research agenda emphasizing comparative case studies in archipelagic states, the integration of AI ethics with autonomous maritime weapons, the political-economy of defense industrial base development, and the integration of maritime cybersecurity with naval operational doctrine.

For scholars, the results offer a navigational map of an expanding field, identifying both well-developed and under-developed sub-territories. For defense planners and industrial stakeholders, they offer evidence of the structural concentration of scholarly capability and an indication of the substantive areas in which sustained research investment would yield disproportionate returns. For middle-power navies in particular—including the Indonesian Navy in whose national context this study was conceived—the analysis suggests that the strategic value of academic engagement with maritime defense technology lies not only in the cultivation of indigenous research capability but also in the development of intra-cluster collaboration

with comparable middle-power partners, with the objective of building a Southeast Asian and broader middle-power scholarly community capable of generating distinctive contributions to the global literature.

Future bibliometric work should extend the present analysis through multi-database integration, comparative analysis with adjacent fields such as marine renewable energy and commercial maritime cybersecurity, and longitudinal tracking as the field continues its rapid evolution. The combination of bibliometric mapping with qualitative thematic analysis of the most-cited and most-recent publications would further enrich the picture, providing the conceptual depth that complements the quantitative breadth offered by bibliometric methods.

Ethical Approval

Not applicable

Informed Consent Statement

Not applicable because this study is a systematic literature review and did not involve direct data collection from participants.

Authors' Contributions

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