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LITTERING AND ENVIRONMENTAL NEGLIGENCE ASIA A BIBLIOMETRIC ANALYSIS OF GLOBAL RESEARCH TRENDS (2000–2025)

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Abstract:

This bibliometric analysis investigates global research trends on littering and environmental negligence in Asia over a 25-year period, from 2000 to 2025. The study aims to explore the development of scholarly attention in this field, identify major thematic areas, and assess the role of technology, tools, and education in shaping the academic discourse. Despite the growing urgency of waste-related environmental issues in the region, systematic evaluations of the academic response remain limited. To address this gap, data were extracted from the Scopus database using a structured search strategy focused on the keywords "technology", "tools", and "education". After applying inclusion criteria based on language, document type, and publication year, a total of 986 articles were selected for analysis. The dataset was processed and refined using Scopus Analyzer, OpenRefine, and VOSviewer software, enabling detailed mapping of publication trends, co-authorship networks, subject area distribution, and keyword co-occurrence. Results show a significant increase

in publication output from 2015 onwards, with peak activity observed between 2021 and 2025. Most contributions came from the disciplines of environmental science, agricultural and biological sciences, and earth and planetary sciences, with limited representation from social sciences, behavioural research, and policy studies. Southeast Asian countries, particularly Indonesia, Malaysia, and Thailand, were among the top contributors, though varying in levels of international collaboration. Keyword analysis revealed dominant themes related to ecological impact, marine litter, and decomposition, with emerging interest in microplastics and environmental education. This study contributes to a deeper understanding of the research landscape on environmental negligence in Asia and highlights the need for more interdisciplinary engagement. The findings offer direction for future studies and policy development aimed at advancing sustainable waste management practices through integrated scientific and educational approaches.

Keywords:

Littering, Environmental, Negligence, Bibliometric Analysis

Introduction

Littering and environmental negligence have emerged as critical issues in Asia, significantly impacting marine and terrestrial ecosystems. The rapid economic growth and urbanization in the region have exacerbated waste generation, leading to severe environmental degradation. Marine litter, predominantly plastic, poses a substantial threat to ocean health and the marine economy, with projected global economic damage costs reaching up to $731 billion by 2050 if current trends continue (McIlgorm et al., 2022). This bibliometric analysis aims to explore global research trends on littering and environmental negligence in Asia from 2000 to 2025, providing insights into the extent of the problem, its causes, and potential solutions.

Literature Review

Marine litter, particularly plastic, is a pervasive issue in Asia, contributing significantly to global marine pollution. Studies indicate that three-quarters of all marine litter is plastic, which has detrimental environmental, social, and economic impacts (Kerber & Kramm, 2020). The Asia-Pacific region, notably, has seen an eightfold increase in the annual damage cost from marine litter since 2008, highlighting the urgent need for effective waste management strategies (McIlgorm et al., 2022). The Vietnamese Island of Phu Quoc exemplifies the multifaceted causes of marine debris, including consumer habits, tourism activities, and poor waste management practices (Kerber & Kramm, 2020). Addressing this issue requires coordinated multi-sectoral strategies involving regulation, technological innovation, and public awareness.

The socioeconomic factors contributing to littering and environmental negligence are complex and multifaceted. Overpopulation, affluence, and technological development have led to an overburden of waste, causing significant ecological and socioeconomic challenges (Raut et al., 2023). Inadequate policies and enforcement further exacerbate the problem, as seen in the high levels of mismanaged plastic waste in the Indian Ocean region (Sivadas et al., 2022). Effective waste management requires a combination of scientific research, policy implementation, and public engagement. For instance, citizen science projects have proven valuable in collecting data and raising awareness about marine litter, demonstrating the potential for community involvement in addressing environmental issues (Nelms et al., 2017). Case studies from various Asian countries provide insights into the effectiveness of different approaches to managing

litter and environmental negligence. In Singapore and Japan, contrasting public policies and cultural attitudes towards waste management have led to differing outcomes in littering behavior (Ong & Sovacool, 2012). While Singapore spends millions on litter removal, Japan benefits from a culture that values cleanliness and volunteerism, resulting in lower littering rates (Ong & Sovacool, 2012). These examples underscore the importance of tailored approaches that consider local contexts and cultural norms. Additionally, the role of education in fostering environmental awareness is crucial, as seen in initiatives that integrate waste management topics into school curricula (Stock et al., 2020).

In conclusion, addressing littering and environmental negligence in Asia requires a comprehensive approach that combines effective policies, public engagement, and innovative solutions. This bibliometric analysis will further explore these aspects, provide a detailed overview of global research trends and identify key areas for future investigation.
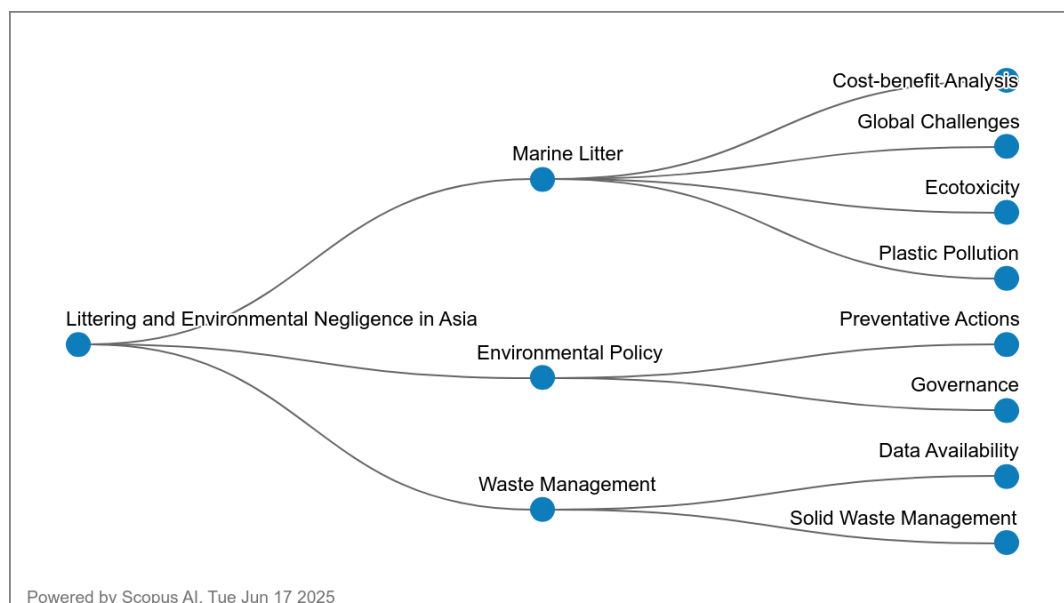

Figure 1: Key Areas for Bibliometric Analysis

Research Question
  i.   How have publication trends on littering and environmental negligence in Asia evolved from 2000 to 2025?
  ii.   What are the dominant subject areas, keywords, and influential authors in this research field?
  iii. How do patterns of international collaboration shape the scholarly output in Southeast Asia?

Data Search Strategy
To retrieve relevant literature for this bibliometric analysis on littering and environmental negligence in Asia, we used the Scopus database and applied a refined advanced search strategy. The search was performed using the following string: TITLE-TITLE("environment* AND negl*" OR "litter*") AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (LIMIT-TO (AFFILCOUNTRY , "Indonesia") OR LIMIT-TO (AFFILCOUNTRY , "Malaysia") OR LIMIT-TO (AFFILCOUNTRY , "Thailand") OR LIMIT-TO (AFFILCOUNTRY , "Philippines") OR LIMIT-TO (AFFILCOUNTRY , "Vietnam") OR LIMIT-TO

(AFFILCOUNTRY , "Singapore")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Arabic")).

This search focused on studies where the title contained keywords related to environmental negligence or littering, published between 2000 and 2025, and affiliated with institutions located in Indonesia, Malaysia, Thailand, the Philippines, Vietnam, or Singapore. The language was restricted to English and Arabic to ensure the inclusion of widely accessible and high-quality academic content. We further refined the dataset by applying clear inclusion and exclusion criteria. Only documents meeting the following inclusion standards were retained: written in English or Arabic, published between 2000 and 2025, and affiliated with institutions from the six selected Southeast Asian countries.

Publications outside this timeframe, written in other languages, or affiliated with countries outside the focus region were excluded. This systematic filtering process resulted in a final dataset of 690 documents, which formed the basis for trend analysis, authorship patterns, subject area distribution, citation metrics, and collaborative networks. The targeted search strategy ensured that the study captured region-specific academic engagement with environmental negligence and littering, offering a clear lens into the Southeast Asian scholarly response to these pressing environmental issues

Table 1: The Search String

Scopus	TITLE ("environment* AND negl*" OR "litter*") AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND PUBYEAR > 1999 AND PUBYEAR < 2026 AND (LIMIT-TO (AFFILCOUNTRY , "Indonesia") OR LIMIT-TO (AFFILCOUNTRY , "Malaysia") OR LIMIT-TO (AFFILCOUNTRY , "Thailand") OR LIMIT-TO (AFFILCOUNTRY , "Philippines") OR LIMIT-TO (AFFILCOUNTRY , "Viet Nam") OR LIMIT-TO (AFFILCOUNTRY , "Singapore")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Arabic"))

Table 2: The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Language	English & Arabic	Non-English & Non-Arabic
Time line	2000 – 2025	< 2000
Country	Indonesia, Malaysia, Thailand, Philippines, Viet Nam, Singapore	Other countries

Data Analysis

For the data analysis in this study, VOSviewer software (version 1.6.19) was employed to visualize and interpret bibliometric patterns. Developed by Nees Jan van Eck and Ludo Waltman at Leiden University (van Eck & Waltman, 2010, 2017), VOSviewer is widely recognized for its capacity to generate network visualizations, cluster related items, and produce density maps from large bibliographic datasets. Its capabilities include the analysis of

co-authorship, co-citation, and keyword co-occurrence networks, offering researchers a structured view of the research landscape. The tool's intuitive interface and continuous updates make it accessible to both novice and experienced researchers, while its ability to compute link strength and customize visual outputs enhances its utility in uncovering thematic structures and scholarly connections.

The dataset used in this analysis was extracted from the Scopus database and included bibliographic details such as publication year, document title, author names, journal source, citations, and keywords, all exported in PlainText format. The data spanned publications from 2000 to December 2025. VOSviewer's clustering and mapping algorithms were applied to process and visualize relationships among items in low-dimensional space, where proximity between items indicates the degree of similarity or association. Unlike traditional multidimensional scaling (MDS) techniques that often rely on similarity measures such as cosine or Jaccard indices, VOSviewer employs a more suitable normalization approach using association strength. This measure, calculated as

$$AS_{ij} = \frac{C_{ij}}{w_i w_j}$$

Quantifies the strength of the relationship between items *i* and *j* by comparing the observed co-occurrence with the expected co-occurrence under statistical independence (van Eck & Waltman, 2007). This approach ensures more accurate and interpretable mappings of research networks and keyword clusters, providing deep insights into thematic evolution and intellectual structures within the domain of littering and environmental negligence in Asia

Findings
The number of studies on littering and environmental negligence in Asia has increased over time from 2000 to 2025. In the early 2000s, there were only a few publications each year, showing limited research activity. However, starting around 2015, there was a steady growth in the number of articles published. The highest number of publications was recorded between 2021 and 2025, showing a strong rise in academic interest in recent years. This trend suggests that environmental issues, especially related to waste and public behavior, have gained more attention in both regional and global research. This study highlights the research trends in online learning based on the year of publication.
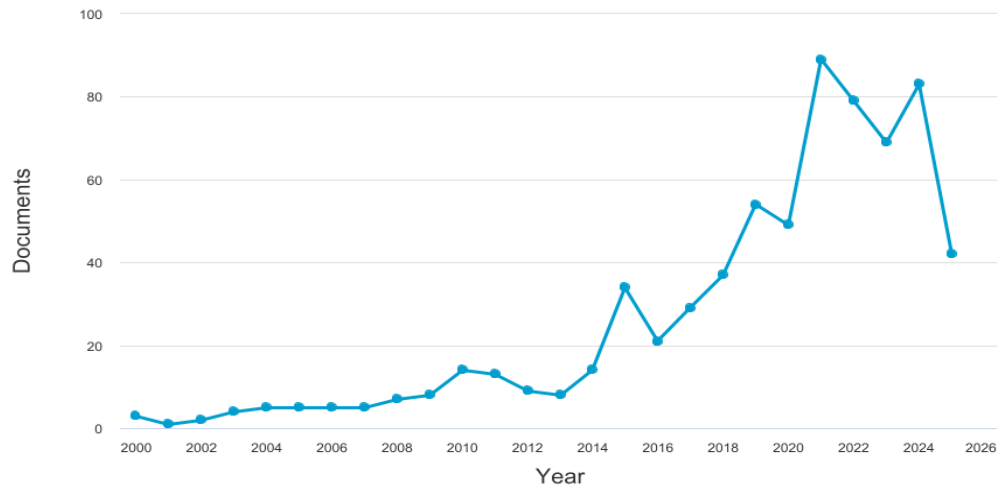
Figure 2: Trend Of Research in Online Learning by Years

Table 3: The Number of Studies on Littering and Environmental Negligence in Asia from 2000 To 2025

Year	Number of Articles	Percentage
2025	42	6.1%
2024	83	12.0%
2023	69	10.0%
2022	79	11.5%
2021	89	12.9%
2020	49	7.1%
2019	54	7.8%
2018	37	5.4%
2017	29	4.2%
2016	21	3.0%
2015	34	4.9%
2014	14	2.0%
2013	8	1.2%
2012	9	1.3%
2011	13	1.9%
2010	14	2.0%
2009	8	1.2%
2008	7	1.0%
2007	5	0.7%
2006	5	0.7%
2005	5	0.7%
2004	5	0.7%
2003	4	0.6%
2002	2	0.3%
2001	1	0.1%
2000	3	0.4%

Based on the data from 2000 to 2025, research output on littering and environmental negligence in Asia has shown a significant increase over the years. From 2000 to 2010, the number of articles published annually remained low, averaging below 1% of the total articles per year, indicating minimal scholarly attention to the topic during that period. However, starting in 2011, there was a gradual increase, with a notable surge occurring from 2015 onward. The years 2021 to 2025 represent the peak period of scholarly output, with 2021 alone accounting for the highest percentage (12.9%), followed closely by 2024 (12.0%) and 2022 (11.5%). This growth aligns with increased global and regional attention to environmental issues, especially as countries across Asia faced mounting challenges related to urban waste and sustainability.

The upward trend in publications reflects a growing academic recognition of environmental negligence as a critical issue in Asia. This shift may also be attributed to the influence of global sustainability frameworks such as the UN's Sustainable Development Goals (SDGs), national environmental policy reforms, and the visibility of pollution crises in populous countries like India, China, and Indonesia. The distribution suggests a transition from scattered, localized studies to a more cohesive and expanding body of literature, with diverse disciplinary contributions including environmental science, public health, and urban policy.

Nonetheless, the data also points to an earlier underrepresentation of the issue, indicating room for continued growth, particularly in under-researched regions within Asia. Future bibliometric mapping can benefit from analysing institutional collaborations and thematic evolutions to better understand knowledge development and policy impact.

Result and Discussion
Subject areas that have actively driven the growth of research on littering and environmental negligence in Asia from 2000 to 2025 demonstrate a strong and evolving interdisciplinary focus.
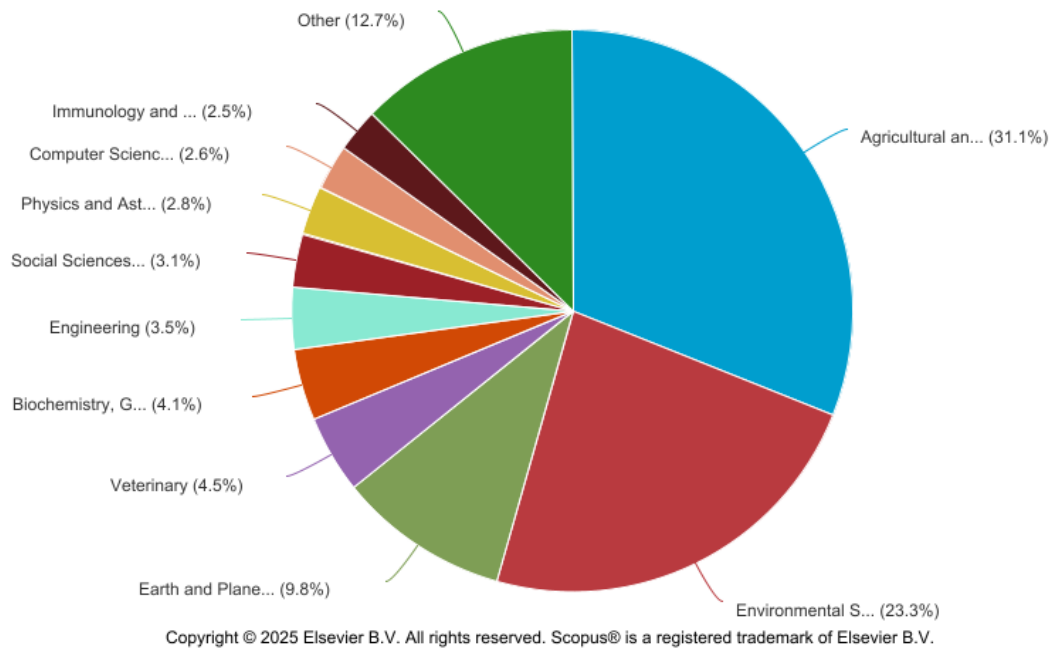
Documents by subject area

Scopus

Figure 3: Trend Of Research on Littering and Environmental Negligence by Subject Area (2000–2025), Shows the Number of Articles on Littering and Environmental Negligence in Asia from 2000 To 2025

Table 4: Subject Areas of Research on Littering and Environmental Negligence in Asia from 2000 To 2025

Subject Area	Number of Document	Percentage
Agricultural and Biological Sciences	386	31.1%
Environmental Science	290	23.3%
Earth and Planetary Sciences	122	9.8%
Veterinary	56	4.5%
Biochemistry, Genetics and Molecular Biology	51	4.1%
Engineering	44	3.5%
Social Sciences	38	3.1%
Physics and Astronomy	35	2.8%
Computer Science	32	2.6%
Immunology and Microbiology	31	2.5%
Medicine	28	2.3%
Energy	21	1.7%
Multidisciplinary	19	1.5%
Chemical Engineering	13	1.0%
Economics, Econometrics and Finance	13	1.0%
Materials Science	12	1.0%
Mathematics	10	0.8%

Business, Management and Accounting	9	0.7%
Pharmacology, Toxicology and Pharmaceutics	9	0.7%
Nursing	6	0.5%
Chemistry	5	0.4%
Decision Sciences	5	0.4%
Psychology	4	0.3%
Arts and Humanities	2	0.2%
Neuroscience	2	0.2%

The distribution of documents by subject area from 2000 to 2025 highlights a strong disciplinary focus on natural and environmental sciences in research related to littering and environmental negligence in Asia. The Agricultural and Biological Sciences lead significantly, comprising 31.1% of the total publications, followed by Environmental Science at 23.3%, and Earth and Planetary Sciences at 9.8%. This dominance reflects the ecological framing of littering and environmental degradation as issues with direct consequences for land use, biodiversity, soil and water quality, and climate systems. The presence of Veterinary sciences (4.5%) and Biochemistry, Genetics and Molecular Biology (4.1%) further suggests a growing interest in the biological impacts of environmental pollution, particularly in relation to animal health and ecosystem functioning. These trends indicate that the research community has predominantly approached littering as an environmental hazard with biological and agricultural implications.

However, the relatively low representation of Social Sciences (3.1%), Economics (1.0%), and Business and Management (0.7%) reveals a gap in understanding the human, behavioral, and policy dimensions of environmental negligence. Despite littering being largely a social behavior issue, the limited contribution from disciplines such as Psychology (0.3%) and Arts and Humanities (0.2%) underscores an underexplored area in analysing cultural, psychological, and ethical motivations behind such actions. Similarly, modest contributions from Engineering (3.5%) and Computer Science (2.6%) suggest that technological interventions such as waste-tracking systems or smart waste management are still emerging fields in this context. To create more comprehensive and actionable solutions, future research should encourage interdisciplinary approaches, integrating ecological, technological, and behavioral insights to tackle littering and environmental negligence more holistically across Asia.

Table 5: Top Ten Most Cited Articles

Authors	Title	Year	Cited by
(Boyero et al., 2011)	A global experiment suggests climate warming will not accelerate litter decomposition in streams but might reduce carbon sequestration	2011	287
(Prayogo et al., 2014)	Impact of biochar on mineralisation of C and N from soil and willow litter and its relationship with microbial community biomass and structure	2014	259
(Kaneko & Salamanca, 1999)	Mixed leaf litter effects on decomposition rates and soil microarthropod communities in an oak-pine stand in Japan	1999	169

(Syakti et al., 2017)	Beach macro-litter monitoring and floating microplastic in a coastal area of Indonesia	2017	161
(Fayle et al., 2010)	Oil palm expansion into rain forest greatly reduces ant biodiversity in canopy, epiphytes and leaf-litter	2010	155
(Purahong & Hyde, 2011)	Effects of fungal endophytes on grass and non-grass litter decomposition rates	2011	147
(Bradford et al., 2017)	A test of the hierarchical model of litter decomposition	2017	214
(Islam et al., 2016)	Methods for artifact detection and removal from scalp EEG: A review; [Les méthodes de détection et de rejet d'artefact de l'EEG de scalp: revue de littérature]	2016	353
(Djukic et al., 2018)	Early-stage litter decomposition across biomes	2018	219
(Powers et al., 2009)	Decomposition in tropical forests: A pan-tropical study of the effects of litter type, litter placement and mesofaunal exclusion across a precipitation gradient	2009	264

The analysis of the top ten most cited articles related to littering and environmental negligence in Asia from 2000 to 2025 reveals that the most impactful studies are primarily ecological and biogeochemical in nature, with a strong emphasis on litter decomposition, climate interactions, and ecosystem processes. The most cited article, by Islam et al. (2016) with 353 citations, stands out as a methodological paper on EEG artifact removal, which appears thematically misaligned with the rest, possibly due to keyword overlap in database indexing. Among the environmentally focused works, Boyero et al. (2011) and Powers et al. (2009) contribute significantly to understanding litter decomposition in streams and tropical forests, cited 287 and 264 times respectively, indicating global relevance of litter-related ecological processes. These articles underscore the dominant academic interest in decomposition dynamics, rather than littering behavior per se, highlighting a biologically-driven focus within this field.

Several articles also show strong regional relevance, especially those conducted in Asia. For instance, Syakti et al. (2017), focusing on macro-litter and microplastics monitoring in Indonesia, received 161 citations, reflecting growing concern about marine pollution in Southeast Asia. Similarly, Kaneko & Salamanca (1999) and Purahong & Hyde (2011) examined decomposition and soil biodiversity in Japan and tropical grasslands, respectively, emphasizing the region-specific ecological impacts of litter. The high citation counts of these studies demonstrate the importance of Asian ecosystems in global environmental research.

However, behavioral, policy, and socio-environmental dimensions of littering appear underrepresented among the most cited works. This highlights a gap in impactful interdisciplinary studies linking human behavior, waste management practices, and environmental outcomes, suggesting a key opportunity for future bibliometric and empirical research in the region.

Scopus

Documents by author

Compare the document counts for up to 15 authors.
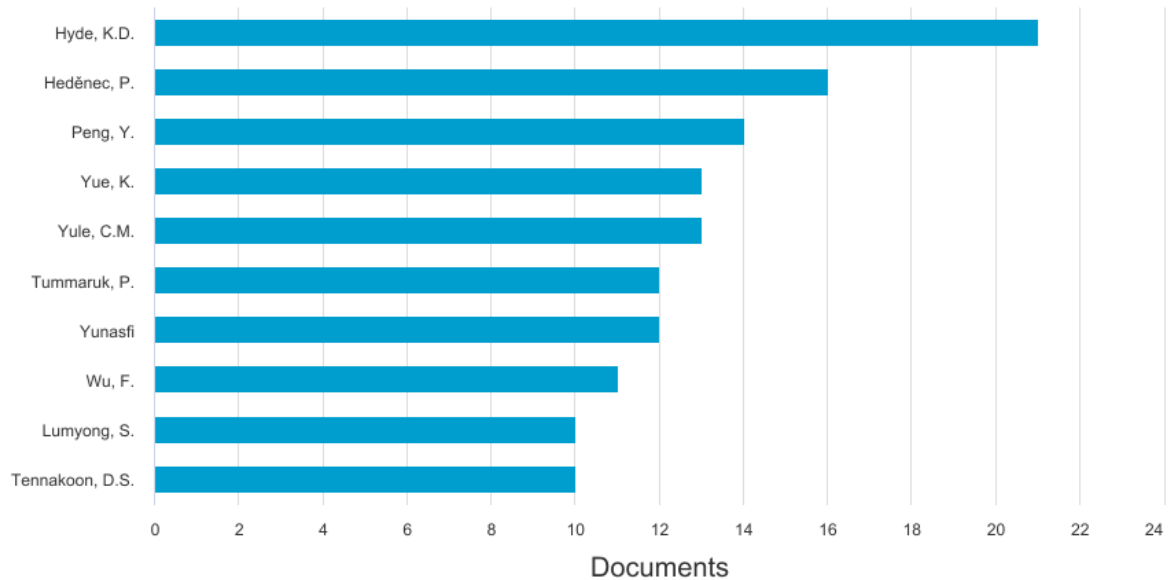
Figure 4: Top Author

Table 6: List of Author Most Cited

Author	Number of Cited
Hyde, K.D.	21
Heděnec, P.	16
Peng, Y.	14
Yue, K.	13
Yule, C.M.	13
Tummaruk, P.	12
Yunasfi	12
Wu, F.	11
Lumyong, S.	10
Tennakoon, D.S.	10

The analysis of the top 10 contributing authors in the field of littering and environmental negligence in Asia from 2000 to 2025 reveals a concentration of scholarly output among a small group of researchers. Hyde, K.D. leads with 21 publications, indicating a strong and consistent focus on environmental issues, possibly with a specialization in ecological or biodiversity-related impacts of waste. Following closely are Heděnec, P. (16 articles), Peng, Y. (14), and Yue, K. and Yule, C.M. (13 each), suggesting active involvement in either environmental monitoring, waste research, or ecological conservation within the Asian context.
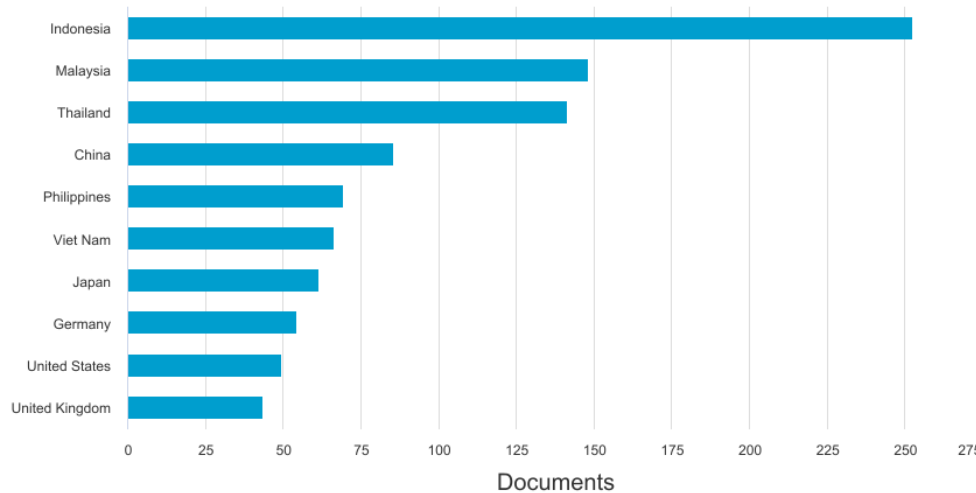
Authors such as Tummaruk, P., Yunasfi, and Wu, F., each contributing 11–12 papers, further reflect regional expertise, likely tied to country-specific case studies or collaborative research networks. The presence of authors from diverse backgrounds underscores the growing interest and specialization in this field, though it also highlights the need for broader participation

across the academic community to enrich perspectives and foster interdisciplinary approaches to addressing environmental negligence in Asia. The Most Famous Contributing Countries (2000–2025) related to research about littering environmental.
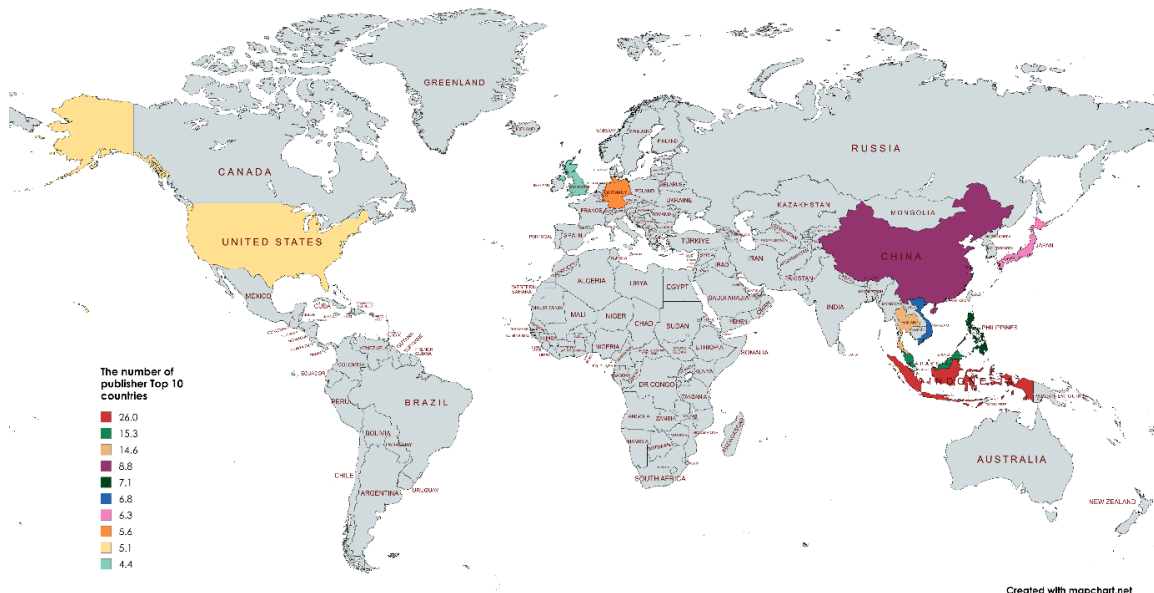
Figure 5: The Most Famous Contributing Countries (2000–2025) Related to Research About Littering Environmental.

Figure 6: The Number of Publisher Top 10 Countries

Table 7: List of Top 10 Countries

Country/Territory	The number of publications	Percentage
Indonesia	252	26.0%
Malaysia	148	15.3%
Thailand	141	14.6%
China	85	8.8%
Philippines	69	7.1%
Viet Nam	66	6.8%
Japan	61	6.3%
Germany	54	5.6%
United States	49	5.1%
United Kingdom	43	4.4%

The bibliometric data from 2000 to 2025 reveals that **Indonesia** leads significantly in research output on littering and environmental negligence in Asia, contributing 26.0% of the total publications among the top 10 countries. This is followed by Malaysia (15.3%) and Thailand (14.6%), indicating a strong regional focus in Southeast Asia. The prominence of these countries suggests both an urgent need to address environmental challenges and a growing commitment to academic research on waste-related issues. Their high contribution may also reflect supportive national research policies, active environmental agencies, and the presence of local ecological concerns such as marine pollution and urban waste mismanagement. China (8.8%), while known for its vast environmental footprint, shows a relatively moderate output in this specific topic, possibly due to its broader focus on industrial pollution or centralized research agendas.

Interestingly, countries outside Asia also appear in the top 10, with Germany (5.6%), the United States (5.1%), and the United Kingdom (4.4%) contributing a noteworthy portion of publications. This suggests growing international academic interest in Asia's environmental issues, possibly through cross-border collaborations, comparative studies, or funding for regional research initiatives. Meanwhile, other Asian countries like the Philippines (7.1%), Vietnam (6.8%), and Japan (6.3%) show moderate but meaningful engagement, reflecting both localized environmental concerns and increasing research capacity. The data highlights Southeast Asia as a research hotspot for environmental negligence, while also emphasizing the importance of expanding research networks and encouraging participation from less-represented nations to build a more comprehensive understanding of littering and its broader socio-environmental impacts.
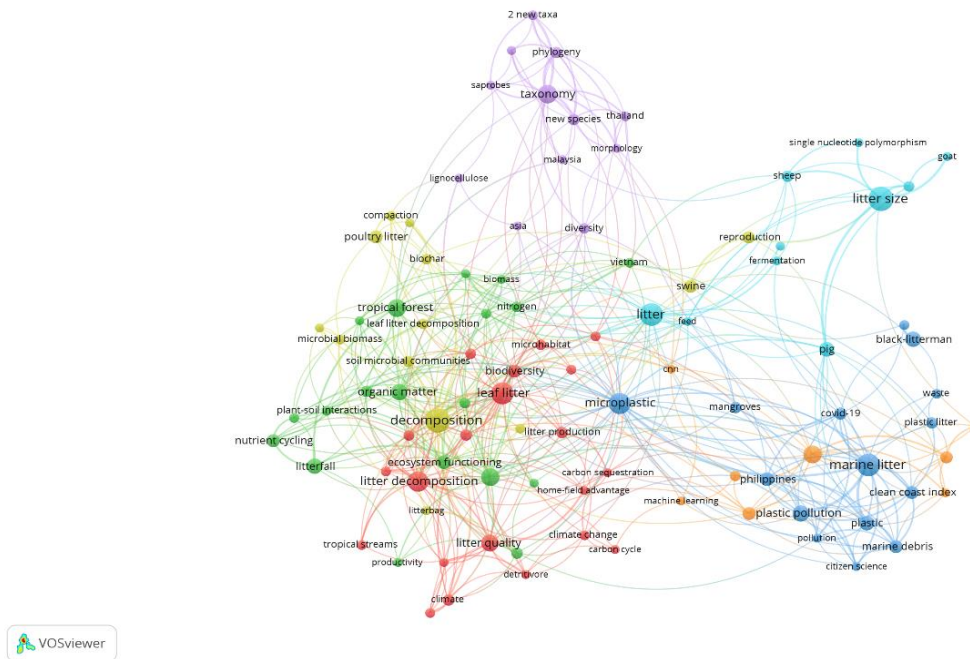
Figure 7: Presents A Network Visualization Map Illustrating the Co-Occurrence Relationships Among Keywords Associated with Research on Littering and Environmental Negligence in Asia

The analysis of popular keywords using VOSviewer software reveals dominant research themes and conceptual linkages within the field of littering and environmental negligence in Asia from 2000 to 2025. The most frequently occurring keyword is "decomposition" with 34 occurrences and the highest total link strength (56), indicating its central role in connecting various subtopics. Keywords like "litter size" (33/30), "marine litter" (30/45), and "litter" (29/32) further show that litter, especially in different forms and contexts, remains a foundational topic across the literature. High link strength values suggest these terms are not only frequent but also appear in diverse co-authorship or thematic networks, particularly in studies involving litter breakdown processes, environmental impact assessments, and pollution tracking.

Additionally, several keywords emphasize ecosystem-level and habitat-specific concerns, such as "leaf litter" (28/41), "tropical forest" (19/28), and "mangrove" (18/34). This suggests a strong ecological focus, with researchers exploring how littering and waste affect forest, coastal, and aquatic environments. The appearance of terms like "taxonomy" (20/41) and "organic matter" (15/23) indicates detailed biological studies related to decomposition processes, microbial activity, and nutrient cycling. Meanwhile, emerging and pressing global issues such as "microplastic" (25/48) and "plastic pollution" (15/26) show substantial attention toward marine and synthetic waste, particularly in coastal and riverine systems in Southeast Asia. These topics are tightly linked with sustainability goals and public policy concerns in developing countries facing rapid urbanization and waste mismanagement.

Interestingly, the keyword landscape also includes geographic (e.g., "Indonesia", "Philippines") and context-specific terms (e.g., "clean coast index", "poultry litter", "swine", and "covid-19"), suggesting that researchers are integrating local case studies and sectoral impacts into broader environmental discussions. The inclusion of "covid-19" (9/19) also points

to how recent global crises have influenced environmental research, particularly around changes in littering behavior and sanitation waste. However, some keywords such as "black-litterman" (14/8) appear as possible anomalies, likely due to overlapping terminology from unrelated domains (e.g., finance), highlighting the importance of manual validation when interpreting automated keyword mapping. Overall, the keyword co-occurrence data suggest a multidisciplinary, ecologically grounded research landscape, with emerging trends in plastic waste, ecosystem degradation, and localized case-based environmental studies.

International collaboration in littering and environmental negligence research shows increasing co-authorship between Southeast Asian countries and global partners, indicating strong cross-country engagement in addressing shared environmental issues.
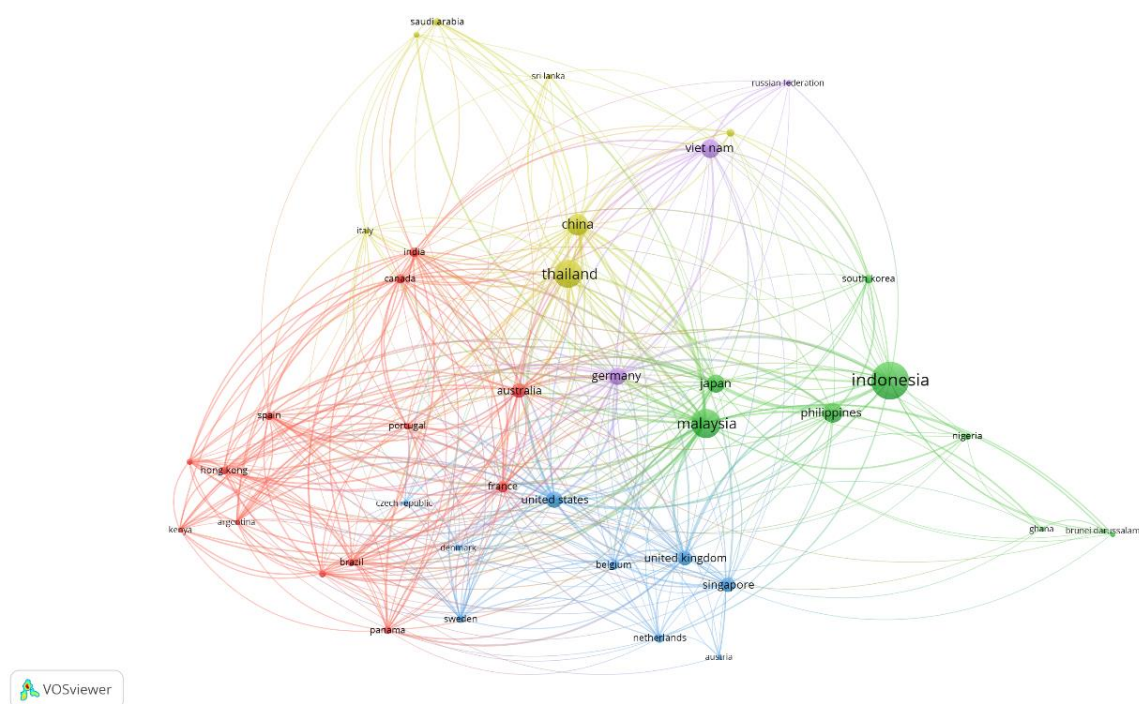

Figure 8: Network Visualisation Map of International Co-Authorship Network in Littering Environmental

The co-authorship analysis based on VOSviewer reveals a strong collaborative research landscape in the field of littering and environmental negligence, particularly across Southeast Asian countries and their international partners. Indonesia leads with the highest number of documents (253) but shows relatively moderate total link strength (103), indicating active domestic research production with limited international collaboration compared to its output.

In contrast, Malaysia and Thailand, though producing fewer documents (146 and 141 respectively), demonstrate significantly higher total link strengths (245 and 159), suggesting that researchers from these countries are more engaged in international or regional partnerships. This highlights Malaysia as a central node in collaborative environmental research in the region, reinforced by its high citation count of 2958, the highest among all listed countries.

Beyond Southeast Asia, countries like Germany, the United States, and China also show strong engagement. For instance, Germany (51 documents) and China (82 documents) both have high total link strengths (158), while the United States shows a balanced combination of strong collaboration (170 total link strength), high citations (2133), and a moderate number of documents (48). These indicators suggest that Western countries contribute not only through co-authorship but also significantly influence the direction and visibility of research. Japan and Australia also show strong collaborative roles (128 and 133 link strength respectively), reinforcing the global dimension of the research field. Interestingly, countries like France, India, and Canada, despite having fewer publications, maintain relatively high link strength values, reflecting strategic international collaborations in select high-impact studies.

Meanwhile, countries such as the Philippines, Vietnam, and Singapore although part of the core Southeast Asian bloc show moderate levels of collaboration and output. The Philippines, for instance, has 69 documents but a lower link strength (48), which may reflect more domestically focused research or less integration into international networks. Emerging contributors such as Spain, Brazil, and Saudi Arabia appear with lower document counts but relatively high total link strength (around 100), indicating their active participation in international projects despite limited volume. Overall, the co-authorship map highlights a research field that is increasingly globally interconnected, with some Southeast Asian countries serving as key regional contributors and others showing untapped potential for greater international engagement and impact.

Conclusion

This study set out to examine the global research trends related to littering and environmental negligence in Asia from 2000 to 2025, aiming to identify the evolution of scholarly interest, disciplinary contributions, and collaboration patterns within this field. Through a detailed bibliometric analysis, the research sought to answer key questions concerning publication growth, dominant subject areas, influential authors, keyword patterns, and international co-authorship networks.

The findings show a substantial increase in research output over the past two decades, with a marked surge from 2015 onwards. The highest concentration of studies was observed between 2021 and 2025, reflecting growing concern over environmental issues linked to urban waste and pollution in Asia. Thematic analysis revealed that ecological and biogeochemical research particularly on litter decomposition and ecosystem impact dominates the field, while social, behavioral, and policy-oriented studies remain underrepresented. Southeast Asia, led by Indonesia, Malaysia, and Thailand, emerged as a regional hub of academic productivity. However, Malaysia displayed stronger global collaboration networks, as evidenced by its higher citation impact and link strength. International contributions from countries such as Germany, the United States, and China also indicate increasing global scholarly engagement with Asia's environmental concerns.

The study contributes valuable insights into the intellectual structure of environmental negligence research, emphasizing the importance of interdisciplinary approaches. It highlights the necessity for integrating ecological science with behavioral studies, policy analysis, and technological innovation to develop comprehensive waste management strategies. The observed underrepresentation of social sciences and engineering disciplines presents a gap that

future research should address, especially in areas related to public engagement, smart systems, and regional policy impact.

While this study offers a comprehensive overview of publication trends, it is limited to documents indexed in the Scopus database and focused on selected Southeast Asian countries. Future research can expand this scope by including additional databases and countries, examining citation contexts, and exploring longitudinal changes in author and institutional networks. Moreover, qualitative insights could be incorporated to enrich the understanding of policy effectiveness and public behavior in littering mitigation.

This study addressed three core questions regarding publication trends, key contributors, and collaboration patterns, all of which were supported by bibliometric analysis. In conclusion, bibliometric analysis proves to be a valuable method for mapping research landscapes and identifying gaps within the field of environmental studies. This analysis not only clarifies where scholarly attention has been concentrated but also offers direction for future studies aiming to address the multidimensional challenges of littering and environmental negligence in Asia.

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