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Indigenous Knowledge and Community Empowerment for Sustainable Natural Resource Governance: A Bibliometric Review of Indigenous and Coastal Communities

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Abstract

Indigenous and coastal community knowledge is an important basis for natural resource management, but it has not yet been fully integrated into empowerment practices and decision-making. This study aims to map the development, conceptual structure, theme evolution, and scientific collaboration regarding indigenous knowledge, community empowerment, and sustainable resource governance as the foundation of community service. A total of 121 Scopus documents from the period 1989–2026 were analyzed using OpenRefine, VOSviewer 1.6.19, Biblioshiny, Bibliometrix, and RStudio 4.4.1. The results show an acceleration in publications since 2017 and a shift from an economic-instrumental orientation toward rights-based governance, tenure justice, substantive participation, conservation, and climate resilience. Indonesia has emerged as a key empirical node in the global network. These findings affirm that community service programs for indigenous and coastal communities must be oriented toward knowledge co-production, strengthening local institutions, benefit distribution, management area protection, and community leadership. This approach is necessary so that interventions do not stop at knowledge transfer, but rather strengthen capacity, agency, and socio-ecological sustainability in a fair, adaptive, contextual, and intergenerational manner.

Keywords: Indigenous knowledge, Community empowerment, Natural Resource Governance, Tenurial justice, Conservation

INTRODUCTION

Indigenous knowledge is a locally-based knowledge system formed thru long-term interactions between humans and their environment and passed down thru generations via social and cultural practices within specific communities (V. Reyes-García et al., 2019), (Diaz et al., 2015). This system encompasses a deep understanding of biodiversity, ecosystem dynamics, and resource management practices that are adaptive to environmental changes (V. Reyes-García et al., 2019). Additionally, indigenous knowledge also includes resource classification, ecological calendars, utilization techniques, and social norms that govern the relationship between humans and nature (Garnett et al., 2018). In recent decades, the contribution of this

knowledge has increasingly been recognized as an important element in biodiversity conservation and climate change mitigation (Diaz et al., 2015). However, the integration of indigenous knowledge into policies often remains instrumental and does not provide equal participation space in decision-making (Tengö et al., 2017). Therefore, a governance approach is needed that recognizes the plurality of knowledge systems and ensures epistemic justice and inclusive participation for indigenous communities (Hill et al., 2020).

That context is highly relevant for Indonesia as a country with high biodiversity and cultural diversity, as well as the presence of communities that depend on natural resources for their livelihoods (Myers et al., 2000). Various local practices such as sasi in Maluku demonstrate that indigenous communities have effective resource management mechanisms thru collective rules and social legitimacy (Cinner & Aswani, 2007). However, the existence of customary institutions does not always guaranty justice in governance because local power dynamics can influence the distribution of benefits and access to resources (Agrawal & Gibson, 1999). In the forestry sector, the implementation of community-based policies shows that the delegation of management responsibilities is often not accompanied by adequate strengthening of tenure rights (Ribot et al., 2006). Therefore, community empowerment needs to be understood as a multidimensional process that includes capacity building, access to resources, and increased participation in decision-making (Cleaver, 2012).

The Bangka Belitung Islands provide an important socio-ecological context for understanding the relationship between indigenous knowledge, community empowerment, and natural resource governance. Empirical studies show that indigenous communities in this region maintain resource management practices based on local wisdom, such as customary forest management, traditional farming systems, and agrarian rituals that function to maintain ecosystem balance and social cohesion (Afriyansyah et al., 2020), (Nukraheni et al., 2019)). This knowledge contributes to food security, biodiversity conservation, and environmental risk mitigation. However, the sustainability of this knowledge system faces serious pressure due to the expansion of tin mining, land use changes, and the weak recognition of indigenous territorial rights (Herdiyanti et al., 2020). This condition indicates a tension between sustainable local practices and an extractive development model that tends to overlook the socio-ecological dimension.

In Belitung, coastal communities such as the Sawang people have historically built complex maritime knowledge systems thru direct interaction with marine and coastal ecosystems (Bennett et al., 2016). Social transformations due to relocation, the penetration of extractive economies, and policy changes have shifted livelihoods and weakened the transmission of traditional knowledge (Fabinyi et al., 2014). The loss of access to ecological spaces not only impacts household economies but also threatens the sustainability of cultural identity and local knowledge systems (Berkes, 2012). This phenomenon emphasizes that indigenous knowledge cannot be separated from access to resources, territorial rights, and power structures in environmental governance (Daw et al., 2015).

Although research on indigenous knowledge and resource management in Indonesia is advancing, the existing literature remains fragmented and lacks systematic integration. This fragmentation hinders a comprehensive understanding of the intellectual structure, collaboration networks, and research trajectories within the field. Bibliometric analysis provides a systematic method for evaluating publication performance and mapping relationships among researchers, institutions, and research themes (Aria & Cuccurullo, 2017). Through techniques such as co-citation, co-authorship, and keyword co-occurrence, bibliometric analysis facilitates the identification of intellectual foundations and emerging research trends (Donthu et al., 2021). Accordingly, this study seeks to map the development of research on indigenous knowledge, coastal community and community empowerment in sustainable natural resource management in Indonesia, while also identifying research gaps and directions for future inquiry (Zupic & Čater, 2015).

METHODS

This research uses a quantitative bibliometric design to map the development, intellectual structure, and thematic relationships of research on the empowerment of coastal, traditional, small island, and indigenous communities, and on natural resource management. The bibliometric approach integrates publication performance analysis and science mapping to systematically evaluate contributions and relationships among knowledge components (Donthu et al., 2021). Bibliographic data were obtained from the Scopus database on July 13, 2026, through a search in the title, abstract, and keywords using the string: TITLE-ABS-KEY ("empowerment" AND ("coastal communities" OR "traditional communities" OR "small islands" OR "Indonesia" OR "indigenous communities") AND "natural resources"). All relevant documents are exported in CSV and BibTeX format along with author metadata, title, year, affiliation, abstract, keywords, publication source, citation, and DOI (Figure 1).

Preprocessing is carried out using OpenRefine thru text facets, clustering, removal of excess spaces, standardization of capitalization and spelling, consolidation of variations in author names, affiliations, and keywords, as well as duplication checks based on DOI and title. OpenRefine supports the identification of inconsistencies, clustering of value variations, and transparent data transformation. After cleaning, the final corpus comprises 121 documents from 1989–2026, including 71 articles, 27 conference papers, 18 book chapters, and 5 review articles.

The CSV file was analyzed using VOSviewer 1.6.19 to build co-authorship, keyword co-occurrence, citation, bibliographic coupling, and co-citation networks. Network, overlay, and density visualizations are used to identify clusters, relationship strengths, and the temporal development of the research field (van Eck & Waltman, 2010). The emergence threshold and the number of nodes are determined from the frequency distribution to ensure the network remains informative, stable, and easy to interpret.

The BibTeX file was analyzed using Biblioshiny, Bibliometrix on R 4.4.1 thru R-Studio. The analysis includes annual productivity, research trends, relevant words, and thematic maps. Bibliometrix provides an integrated workflow for performance analysis and science mapping (Aria & Cuccurullo, 2017). The validity of the interpretation is strengthened thru the triangulation of results from VOSviewer and Biblioshiny.

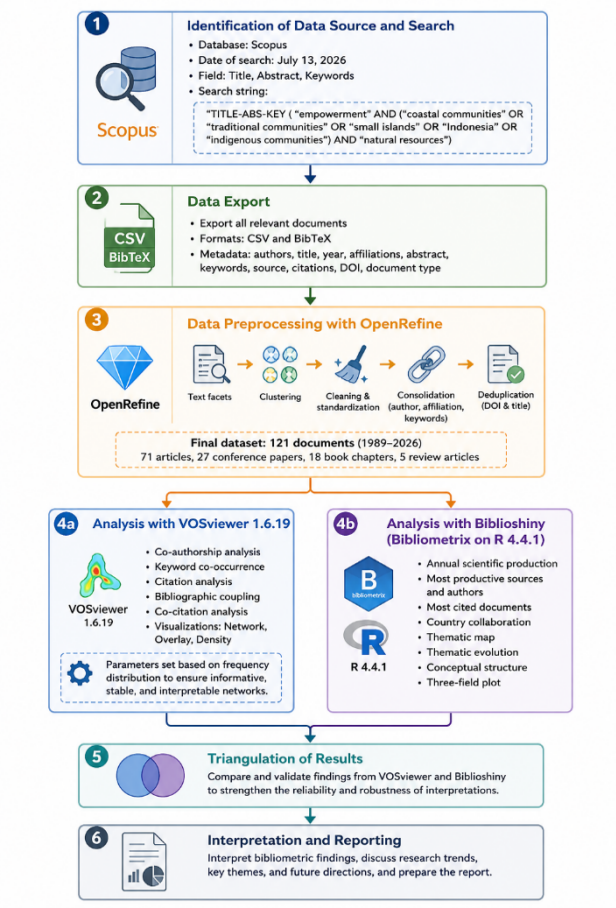


Figure 1. Research flow

RESULTS & DISCUSSION

Results

Research Trends and Number of Documents per Year

Both images show the field's transformation from a marginal phase to an increasingly established socio-ecological agenda. Publication dynamics show an embryonic period from 1989 to 2010, when only 9 documents were published, and annual output was almost always between 0 and 2 articles. This pattern indicates that community empowerment and natural resource management initially did not develop into an independent field of study, but remained tied to economics, development, and resource exploitation. Consolidation began in 2011–2016, when publications rose to 16, and annual output gradually increased from 2 to 4 documents. This phase reflects a shift in focus from resource availability to governance, participation, and community capacity in decision-making. In this section, describe how the activities were carried out to achieve the objectives. Each step/stage that has been explained in the implementation method section must be explained in this section.

There was a significant increase in publications from 2017 to 2021, reaching a total of 45, with the highest number, 11, in 2019. The number of publications dropped in 2022 and 2023, but then increased again to 15 in 2024 and 16 in 2025, showing renewed activity. The count of 10 publications in 2026 does not indicate a decline, since the data only covers up to July 13, 2026. Substantively, the growth since 2017 underscores the urgency of linking empowerment with sustainability, conservation, livelihoods, and environmental justice (Figure 2). This change aligns with the literature, which asserts that conservation outcomes are more effective and equitable when indigenous and local communities have real influence in decision-making and when their institutions and tenure rights are recognized (Dawson et al., 2021).

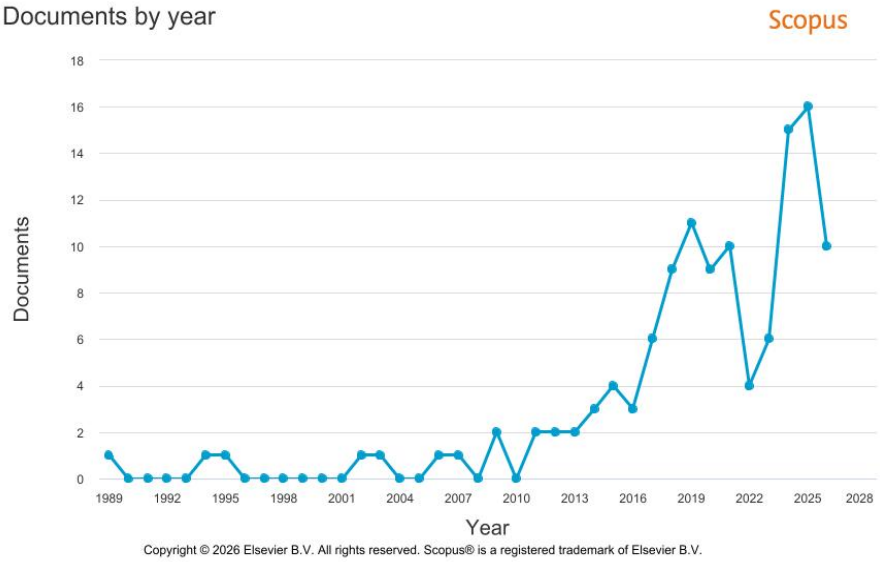
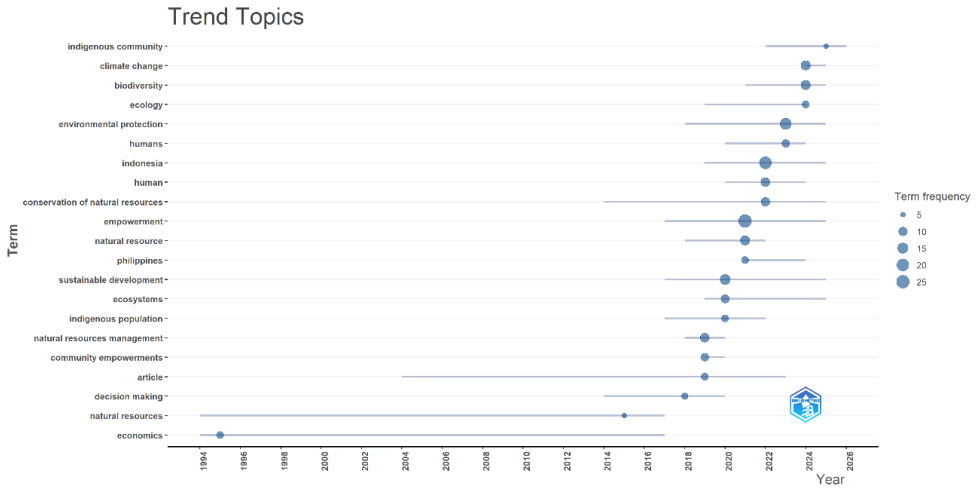


Figure 2. Number of published documents

The evolution of the theme shows a clear conceptual shift. Early themes, such as economics and natural resources, show a dominance of the instrumental perspective, in which resources are primarily understood as production capital and as means to growth. Around 2018–2020, the focus shifted toward decision-making, natural resources management, the indigenous population, community empowerment, ecosystems, and sustainable development. The shift marks the entry of institutional dimensions, participation, and human-environment relationships into the mainstream of research. In 2021–2022, empowerment emerged as the most prominent theme, closely intertwined with Indonesia, environmental protection, and the conservation of natural resources. In this context, empowerment means more than just improving skills or income. It also involves sharing authority, encouraging people to work together, valuing local knowledge, and giving communities control over resources. In Indonesia, social forestry efforts have faced challenges like fragmented bureaucracy, strong administrative control, and limited real participation (Maryudi et al., 2022), (Sirimorok et al., 2024).

Since 2023, the severity of climate change, biodiversity loss, ecological degradation, and challenges faced by indigenous peoples has increased. These interconnected issues demonstrate that indigenous communities are increasingly recognized not only as recipients of interventions but also as rights holders, knowledge producers, and key contributors to both social and ecological resilience. Local knowledge can enrich the understanding of contextual climate impacts, including changes in productivity, water, biodiversity, and livelihoods (V. Reyes-García et al., 2024). At the same time, the increasing attention to biodiversity

indicates a shift from a single economic value to a plural, relational, and just value of nature (Pascual et al., 2023). Thus, current research is moving toward integrating empowerment, justice, conservation, and climate adaptation into resource governance grounded in rights and community knowledge. These findings indicate that future agendas need to assess not only ecological success but also the quality of representation, distribution of benefits, tenure security, and the community's ability to maintain identity and intergenerational knowledge in a fair and sustainable manner. Documentation can include images of the implementation process, product



prototypes, tables, graphs, and so on (Figure 3).

Figure 3 Research trends

Co-occurrence Network and Overlay Average Publication Year

Co-occurrence network analysis indicates that scholarship on community empowerment and natural resource management is structured around five overlapping thematic clusters. The green cluster focuses on "sustainable development" and its connections to "natural resources," "environmental policy," "knowledge," "inclusive development," and "poverty." This configuration highlights a research emphasis on integrating environmental policies, local knowledge, and development justice. The blue cluster links "empowerment" with "community participation," "economic empowerment," and "ecotourism," thereby framing empowerment as a process involving capacity strengthening, participation, and livelihood diversification.

The red cluster includes terms like "participation," "community," "community empowerment," "management," "development," and "Indonesia," highlighting the focus on community-based governance. The yellow cluster groups "indigenous peoples," "conservation," "protected area," and "land rights," pointing to a move toward rights-based conservation that recognizes tenure and indigenous leadership (Figure 4). This is important because secure rights and traditional governance can improve conservation results, though the socio-economic benefits are not always shared equally (Qin et al., 2023), (den Braber et al., 2024). The purple cluster connects the concepts of climate change, resilience, and employment, highlighting the importance of integrating indigenous knowledge with adaptation strategies, socio-ecological resilience, and green jobs (Dorji et al., 2024). Future research should investigate the causal relationships among rights, participation, economic empowerment, climate resilience, and conservation outcomes in Indonesia through cross-regional comparative longitudinal studies employing participatory mixed-method designs.

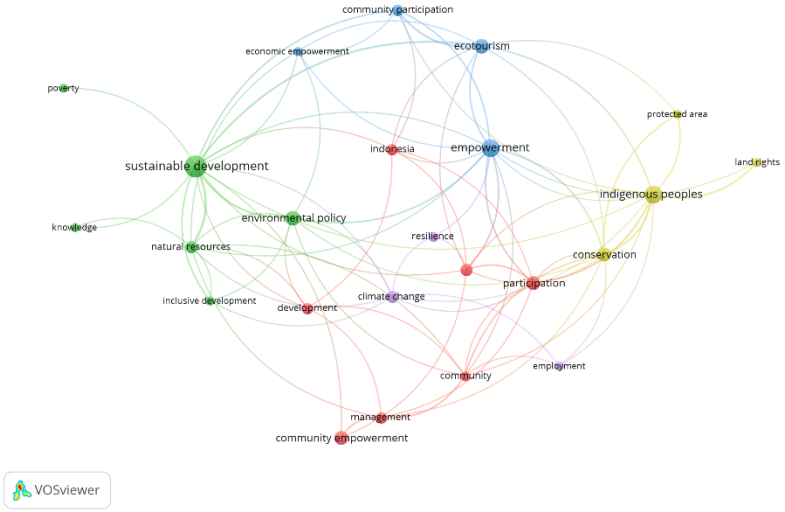


Figure 4. Co-occurrence Network

The Overlay Average Publication Year indicates a distinct epistemic shift from a focus on rights recognition to an emphasis on community-based transformative governance. Early themes, represented in blue and purple, including empowerment, indigenous peoples, land rights, protected areas, natural resources, and development, constitute the foundational phase. This phase establishes access, tenure, and the legitimacy of indigenous communities as essential prerequisites for effective conservation. Furthermore, the emergence of sustainable development, environmental policy, conservation, participation, ecotourism, and employment in Indonesia indicates an expansion of focus toward integrating ecological goals, public policy, and livelihood diversification. In the most recent phase, the yellow-themed topics—community participation, community empowerment, climate change, management, knowledge, and inclusive development—mark the transition from procedural participation to knowledge co-production, redistribution of authority, and community leadership in decision-making.

The network consists of four primary conceptual clusters: governance of sustainable resources; empowerment and rights of indigenous populations; participatory conservation and ecotourism; and resilience to climate change with inclusive development (Figure 5). The study's originality lies in integrating indigenous wisdom, tenure equity, benefit distribution, and adaptive co-governance within a single analytical framework. This methodology is consistent with existing literature that emphasizes the importance of indigenous agency, the integration of local knowledge, and the protection of community-managed areas for socio-ecological sustainability (Ogar et al., 2020), (V. E. Reyes-García et al., 2022), (Sze et al., 2022). However, the principal limitation is the lack of empirical validation of the model among coastal and small-island populations in Indonesia.

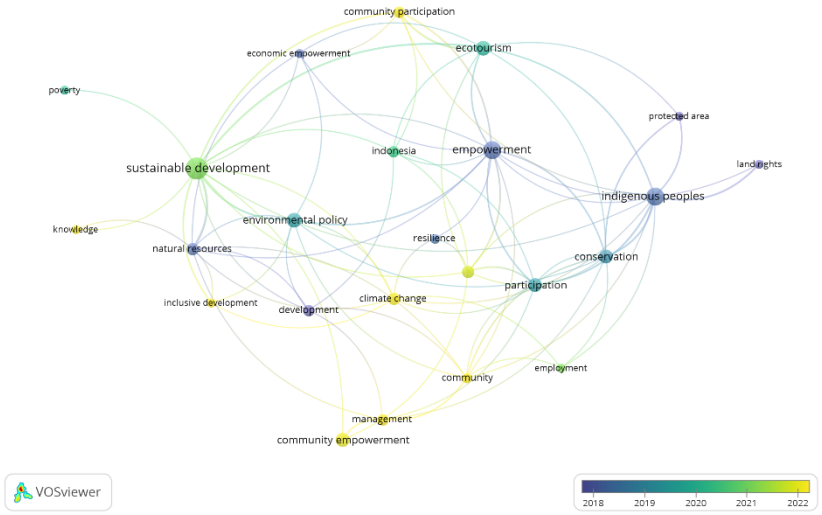


Figure 5. Average Publication Year

Thematic Map

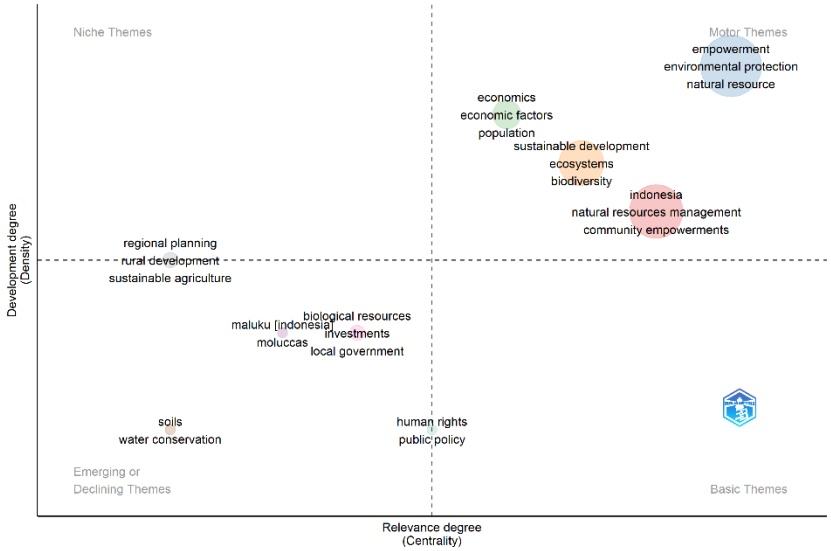


Figure 6. Theme priorities

The thematic map shows how governance has shifted from sectoral fragmentation to a more integrated approach that connects society and the environment. In the motor quadrant, themes such as empowerment, environmental protection, natural resources, sustainable development, ecosystems, biodiversity, and community empowerment comprise the core group (Figure 6). These themes are closely linked, suggesting that empowerment is now seen not just as a tool for development but also as a means to bring together conservation, welfare, and flexible resource management (Ostrom, 2009), (Díaz et al., 2019). The niche quadrant includes regional planning, rural development, and sustainable agriculture. These areas

have strong internal links but are not yet well connected to other themes. The emerging or declining quadrant covers topics such as soils, water conservation, Maluku, biological resources, investments, and local government. This group has not yet formed a clear agenda, which could mean it is either new to the context or possibly losing relevance. Meanwhile, human rights and public policy in the basic quadrant function as normative foundations, but have not yet received adequate empirical elaboration. The inter-quadrant relationships indicate that strengthening this field requires translating basic rights-based themes into public policy, integrating specific themes into the main agenda, and developing local issues into a multiscale governance model. Thus, the novelty of the research lies in the synthesis of community rights, local knowledge, land and water conservation, and empowerment within an integrated socio-ecological framework that is responsive to power imbalances, island contexts, and ecological changes (McElwee et al., 2020).

Country collaboration

The country collaboration map shows that Indonesia is at the center of knowledge production, supported by an uneven network across regions. The collaboration matrix indicates that Indonesia works with nine partners, with a total relationship strength of 15. The strongest ties are with Malaysia and the United Kingdom, each with three publications, followed by Australia and the United States, each with two. Indonesian-affiliated authors play a key role, not only by providing research sites but also by connecting the experiences of coastal communities, indigenous peoples, small islands, and natural resource management to international discussions. Because the map does not show authors' names or document-specific keywords, this country-level analysis should be seen as a broad summary of the network, not as a precise record of individual contributions (Figure 7).

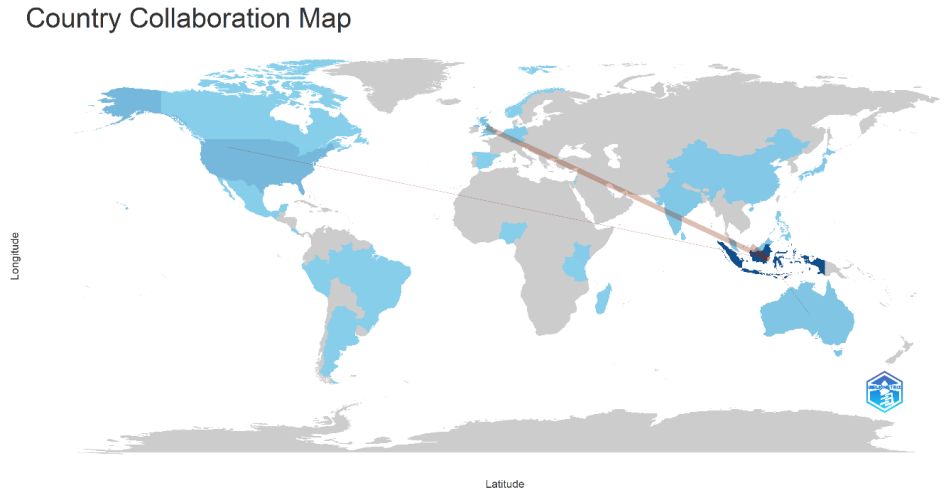


Figure 7. Country Collaboration Map

Indonesian scholarship predominantly investigates the relationships among empowerment, local ecological knowledge, customary institutions, community-based conservation, and livelihood sustainability. This approach is important because local community knowledge serves as both cultural data and a foundation for land management, ecological monitoring, and resistance to inequitable resource exploitation (Brondízio et al., 2021). Collaborative research between Indonesia and Malaysia facilitates comparative studies in the Malay Archipelago, focusing on small-scale fisheries, coastal household adaptation, resource access, and community institutions. In comparison, collaboration with the Philippines highlights community-based coastal

management, marine protected areas, and secure access for small-scale fishers. Issues of spatial access remain central to economic sustainability, food security, and the protection of coastal community rights (Basurto et al., 2024).

England serves as a significant partner in both policy development and theoretical frameworks. The authors expand the analysis of Indonesia by examining environmental justice, the political economy of conservation, indigenous rights, and multiscale governance. In contrast, Australia emphasizes social-ecological systems, climate resilience, adaptive management, and coastal co-management. Both countries contribute to connecting local evidence with governance theories that address not only conservation outcomes but also recognition, participation, and equitable benefit sharing (Dawson et al., 2021), (Crosman et al., 2022).

The United States has the largest network of partners, working with twelve countries and serving as a global connector across Asia, Africa, Europe, and Latin America. Their main interests include institutional design, comparative conservation, access rights, policy evaluation, and cross-case methods. Japan created the Asia–Africa corridor to focus on biodiversity, monitoring technology, fisheries management, and supporting island communities. In tropical Africa, Kenya, Tanzania, Madagascar, the Seychelles, and Congo work together on issues such as dependence on natural resources, coastal conservation, maritime space conflicts, and food insecurity. Peru focuses on artisanal fishing and access rights, while Belgium, Israel, and Germany mainly offer analytical and methodological support.

Isolated relationships, such as those between Argentina and Spain or Australia and Germany, show that remembrance exchanges are still limited to bilateral projects and have not been integrated into the Indonesia axis or the African subnetwork. This fragmentation limits cross-case learning and hinders the development of a comprehensive global comparative agenda. Current collaboration patterns risk reinforcing a division of epistemic labor, where Southern countries mainly provide cases, communities, and data, while Northern partners dominate theoretical abstraction and publication visibility. Future agendas should prioritize positioning local authors as conceptual leaders, promoting knowledge co-production, and evaluating collaboration based on procedural justice, recognition, and equitable benefit distribution, rather than focusing only on the number of joint publications (Bennett et al., 2021), (Penca et al., 2025).

Discussion

The number of publications has grown since 2017, which shows that the community empowerment in natural resource management has moved from a marginal theme to a consolidated socio-ecological agenda. It is a passage from the perception of resources as capital for production to the perception of resources as living space, constructed by power relations, identity, knowledge and rights. So empowerment is more than skills and income. Empowerment is the ability to set priorities, allocate assets and make decisions in public. These findings are consistent with the work of argue that conservation is more effective and equitable when indigenous peoples and local communities have a meaningful voice in governance (Dawson et al., 2021)

The proximity between the themes of empowerment, community participation, indigenous peoples, land rights, and conservation places participation at the center of this field. However, participation is not always synonymous with the redistribution of power. Consultation remains symbolic if the determination of territory, budget, technology, and distribution of benefits is controlled by external actors. Therefore, the quality of empowerment is assessed through the recognition of rights, representation, access to information, bargaining capacity, and accountability mechanisms. Studies on protected areas have found that positive conservation outcomes are more likely in the presence of local governance and enhanced community well-being (Oldekop et al., 2015). Rights-based conservation is not, therefore, a supplement to environmental policies, but a precondition for long-term sustainability.

The convergence of welfare and ecological aspects is the position of empowerment, environmental protection, biodiversity and sustainable development as driving themes. This convergence is important to coastal communities dealing with climate change, declining fish stocks, habitat degradation and spatial conflicts. Income can be increased through ecotourism diversification or local resource use. But if investors or local elites concentrate markets, capital and profits then the programme is not transformative. The blue justice approach reminds us that the expansion of the marine economy may lead to increased marginalisation if the rights of small-scale fishers, coastal women and indigenous communities are not protected (Bennett et al., 2021). Therefore success must be measured by tenure security, distribution of benefits, representation of vulnerable groups and adaptive capacity.

The reinforcement of the themes of climate change, knowledge and inclusive development since 2023 indicates a shift from procedural participation towards the production of shared knowledge. Local knowledge must not be put in the position of being secondary data for formal science. That knowledge is created through intergenerational experience, practice of livelihoods, seasonal readings and cultural relationships with land and sea. Significant overlaps between the territories of Indigenous peoples and areas of high conservation value (Garnett et al., 2018). But, integration of knowledge is fair only when it is accompanied by consent, attribution, protection of sensitive information and benefit-sharing. Joint knowledge production should be contextual, plural, goal-oriented and interactive (Norström et al., 2020). This principle turns society into a producer of knowledge and a decision maker, not only a source of information.

In Indonesia, the relevance of social forestry and community based coastal management exemplify the links between empowerment, management and conservation. It provides legal access but permits do not automatically provide independence. Complex administration, competing claims, weak local organizations, dependence on facilitators, and poor access to markets may transform empowerment into a burden shifting, without redistribution of authority. In Indonesia, social forestry needs to be evaluated through the link of recognition, livelihoods and conservation (Fisher et al., 2018). The same framework applies to coastal communities, where institutional strengthening, ecosystem protection and enhanced bargaining power in the value chain should support rights to marine space. Policies should take into account the instrumental, intrinsic and relational values of nature, so that decisions are not taken only on the basis of economic benefits (Pascual et al., 2023).

The collaboration patterns place Indonesia as a hub for knowledge production, but the concentration of ties with a few countries indicates an imbalance in the network. The collaboration matrix between countries is not enough to determine what thematic contributions each author is making, but it does indicate the possibility of an epistemic imbalance. The Global South is at risk of contributing only sites, people and data, while theory, authorship and publication visibility The Global South risks becoming merely a source of sites, people and data, with Northern institutions dominating theory, authorship and publication visibility. by Northern institutions. A change in research practices that marginalise diverse ways of knowing, and constrain recognition of local knowledge. Hence, collaboration should be assessed according to the conceptual leadership of local researchers, engagement with the community from the problem formulation, data sovereignty, equitable authorship, and return of research benefits (Trisos et al., 2021).

Overall, the findings suggest that the future of the field lies in transformative governance that consistently links rights, knowledge, livelihoods, conservation and climate resilience. The next research agenda should explore causal linkages between dimensions, using longitudinal studies, cross-regional comparisons and participatory mixed methods. Empowerment is not about the number of activities or help, but about real

changes in authority, distributional justice, socio-ecological resilience and the ability of the community to maintain identity and intergenerational knowledge.

CONCLUSION

The way people think about indigenous knowledge, coastal community and community empowerment has moved away from focusing only on economics. Now, there is greater attention to rights-based resource management, genuine participation, and building social and ecological resilience. Recent documents show that sustainable development, conservation, empowerment, indigenous rights, and climate change are key topics in this area. Indonesia is an important place for research and international cooperation. However, there are still knowledge gaps between countries that provide case studies and those that create theoretical frameworks. One of the main strengths of this study is that it uses both VOSviewer and Biblioshiny, along with temporal, conceptual, and collaborative analyses. Still, using only one database and its metadata makes it harder to interpret the results. Future studies should use longitudinal, comparative, and participatory methods to better understand how tenure security, knowledge co-production, benefit sharing, local leadership, and adaptive capacity affect conservation and environmental justice in Indonesia's coastal and small island communities, especially within a more inclusive and sustainable governance framework.

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