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Article

Exploring Sustainable Development Goal Research Trajectories in Small Island Developing States

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Abstract: This study investigates the alignment of research on small island developing states (SIDSs) with sustainable development goals (SDGs), identifying key focus areas, interdisciplinary connections, research gaps, thematic clusters, and insights from case studies. By employing a mixed methods research design that combines quantitative scientometric analysis with qualitative case studies, this unique study examines the nexus between SIDS research and its contribution to SDGs. The findings reveal that SDG 13 (climate action) and SDG 14 (life below water) dominate SIDS research, emphasizing the need to address climate challenges and marine biodiversity. Economic aspects are underscored by SDG 8 (decent work and economic growth) and SDG 12 (responsible consumption and production), while urban development and inequality are addressed through SDG 11 (sustainable cities and communities) and SDG 10 (reduced inequalities). Renewable energy and food security are focal points in SDG 7 (affordable and clean energy) and SDG 2 (zero hunger). Moderate research outputs in SDG 3 (good health and well-being) and SDG 15 (life on land) suggest a holistic approach, while lower activity in SDGs 16 (peace), 6 (clean water), 4 (education), and 5 (gender) presents opportunities for further exploration. SIDS research is highly interdisciplinary, as seen through three distinct SDG networks: foundational social goals, economic and environmental objectives, and environmental preservation. The thematic clusters in SIDS research include environmental challenges and adaptation, public health, and socioeconomic development, and energy policy and environmental economics. Case studies from various SIDSs illustrate the complex interplay between environmental sustainability, economic development, and social well-being, highlighting the importance of tailored approaches, international cooperation, and local community engagement. These findings underscore the need for integrated research strategies to address the complex challenges of SIDSs, emphasizing climate action, sustainable economic practices, and comprehensive development approaches to achieve the SDGs effectively.

Keywords: small island developing states; sustainable development goal; climate change; public health; energy policy; environmental pollution; sustainable tourism; marine biodiversity; socioeconomic development



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1. Introduction

Recent research on small island developing states (SIDSs) has focused on their vulnerabilities, which are attributable to their inherent structural weaknesses and affect their existence and sustainability [1–4]. Specific SDGs, such as 13 (climate action), 7 (affordable and clean energy), 14 (life below water), and 11 (sustainable cities and communities), align

closely with the objectives of the “Small Island Developing States Accelerated Modalities of Action (SAMOA) Pathway” [1,5,6], which aims to support the sustainable growth of SIDSs. Despite the apparent alignment of objectives between the SDGs and the SAMOA pathway, few studies have been conducted on how well academic research on SIDSs aligns with SDGs.

The United Nations recognizes 39 states and 18 associated members as SIDSs, distinguished by their limited size and isolation. They encounter numerous obstacles, including natural disasters and climate change, that significantly hinder their economic and sustainable development [7,8]. In 2015, the UN formally adopted 17 SDGs as part of the 2030 Agenda for Sustainable Development, aiming to promote human well-being, environmental conservation, and the sustainable management of natural resources [9,10]. The attainment of the SDGs faces challenges, primarily due to the lack of consistent financial support from international institutions, which tend to focus on socioeconomic rather than solely environmental goals [3,11,12]. To support these goals, innovative funding strategies for cost-effective and renewable energy solutions, such as debt-for-climate swaps, have been recommended for SIDSs [13–16]. However, little research exists on facilitating innovative and sustainable energy solutions for SIDSs to alleviate the threats of climate change. Oceans play major roles in the natural variability of the global climate; thus, research on the oceans and coasts in SIDSs is gaining traction. SIDSs also face enormous challenges due to their limited access to international markets, resulting in elevated transportation costs and economic vulnerability. These constraints necessitate reliance on sectors such as tourism and fishing, which are pivotal for their gross domestic product [17]. Biodiversity is essential for the livelihood of their populations [18], yet this dependency places their marine and terrestrial ecosystems at risk of degradation [19]. For example, Pacific SIDSs’ depleting coastal ecosystems, such as coral reefs, mangroves, and seagrasses, reduces their adaptability to climate and demographic changes. The reliance on imported fossil fuels for energy exacerbates their challenges, straining government budgets, worsening climate conditions, and intensifying existing climate-related hazards [20].

Several studies have illuminated various dimensions of sustainability challenges in SIDSs, including solid waste management [21], energy systems, climate change adaptation [2], strategic environmental assessment [22], mental health [23], and nutrition [24]. A number of case studies on SIDSs have explored various dimensions of sustainability [25–27].

The study by [21] examines solid waste management in SIDSs, noting waste generation rates similar to those in OECD countries, with a large fraction being organics and recyclables. This study underscores the need for improved waste management to align with the SDGs, highlighting a significant scope for enhancing environmental sustainability and social inclusivity in SIDSs. Ref. [2] scrutinized 208 publications on climate change adaptation in SIDSs, assessing shifts in research focus before and after the IPCC Fifth Assessment Report (AR5) in 2014. The analysis reveals that while SIDSs are acutely vulnerable to climate impacts, the bulk of knowledge production stems from the developed world, highlighting a disparity in research and development investment. A study by [22] analyzed the role of strategic environmental assessment (SEA) in enhancing sustainability within small islands, confronting unique socioeconomic and environmental challenges. Examining the literature within the frameworks of the Barbados Programme of Action and the Mauritius Strategy reveals an ambiguity in defining sustainability for small islands and identifies three crucial elements for its enhancement: a shift in decision-making paradigms, the promotion of good governance and community empowerment, and the fostering of resilience. This study advocates for the customization of SEA frameworks to small island contexts. The paper by [23] provides a critical overview of the literature on mental health and well-being in the context of climate change within SIDSs. This study identified a significant gap in research, with mental health and well-being impacts due to climate change being underreported despite SIDS vulnerability. The study suggested that climate change discussions could offer an opportunity to address mental health issues in SIDSs, given the inadequate health systems and prevalent stigmatization of mental health. Evaluating the effectiveness of

nutrition-based interventions on nutritional and metabolic health in SIDSs, [24] noted rising nutrition-related public health challenges due to nutrient-poor, energy-dense diets. By analyzing 50 interventions involving 37,591 participants, this study highlights the effectiveness of a multifaceted approach for improving metabolic health and nutritional outcomes. Despite some success, there remains insufficient evidence for the impact of broad, policy-driven measures on nutrition and metabolic health. This review stresses the need for culture-appropriate interventions and broader, population-level strategies to address the dual burden of over- and undernutrition. Further development, evaluation of interventions, and adaptation of evidence to policies that are sensitive to the unique challenges of SIDSs are needed.

While each study provides crucial insights into its respective focus area, they collectively lack a direct examination of the interconnections between their findings and the SDGs. This gap underscores the necessity of a comprehensive study aimed at mapping SIDS research to the SDGs.

This proposed study makes several contributions through research questions (RQs), as listed below.

- First, by employing a mixed methods research design [25] that combines quantitative scientometric analysis with qualitative case studies, we examine the nexus between SIDS research and its contribution to SDGs. Exclusive reliance on literature reviews typically does not suffice to fully grasp the intricate dimensions of real-world applications, particularly in interdisciplinary areas such as sustainable development. Consequently, the adoption of a mixed methods approach in this research significantly strengthens the analysis by connecting theoretical frameworks with empirical case studies.
- Second, our research is the first to map (RQ1) and investigate the interdisciplinarity of SIDS research (RQ2) through the lens of the SDG framework. It employs innovative machine learning algorithms designed to map publications more accurately to the 17 SDGs, enhancing our ability to identify SDG-related research.
- Third, we adopted a proven scientometric keyword co-occurrence strategy to identify and map the prevailing themes within the field (RQ3).
- Fourth, we examined case studies that demonstrated the intricate connections between environmental sustainability, economic development, and social well-being (RQ4).
- Finally, we take a systematic approach by applying the prominence percentile metric, which evaluates both research productivity (number of publications) and research influence (citations) to pinpoint and examine promising directions for future research.

2. Methods

2.1. PRISMA Framework

We structured our scientometric analysis using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework [28] and used a checklist of quality control for scientometric analyses in the literature, as shown in Figure 1. This involved formulating clear research questions to guide the investigation. To ensure a comprehensive search, we searched the Scopus database, a widely utilized resource for bibliometric studies [29,30]. We performed the search on 2 January 2024 with the following search terms in the title and abstract, ("*Small Island* Develop* State**") OR ((*sids AND (island AND small)*)), covering the years 2012 to 2023. The search terms were selected to determine their relevance to our macro research on SIDSs. This timeframe coincided with significant developments following the initial adoption of the SDGs at the Rio+20 summit in 2012.

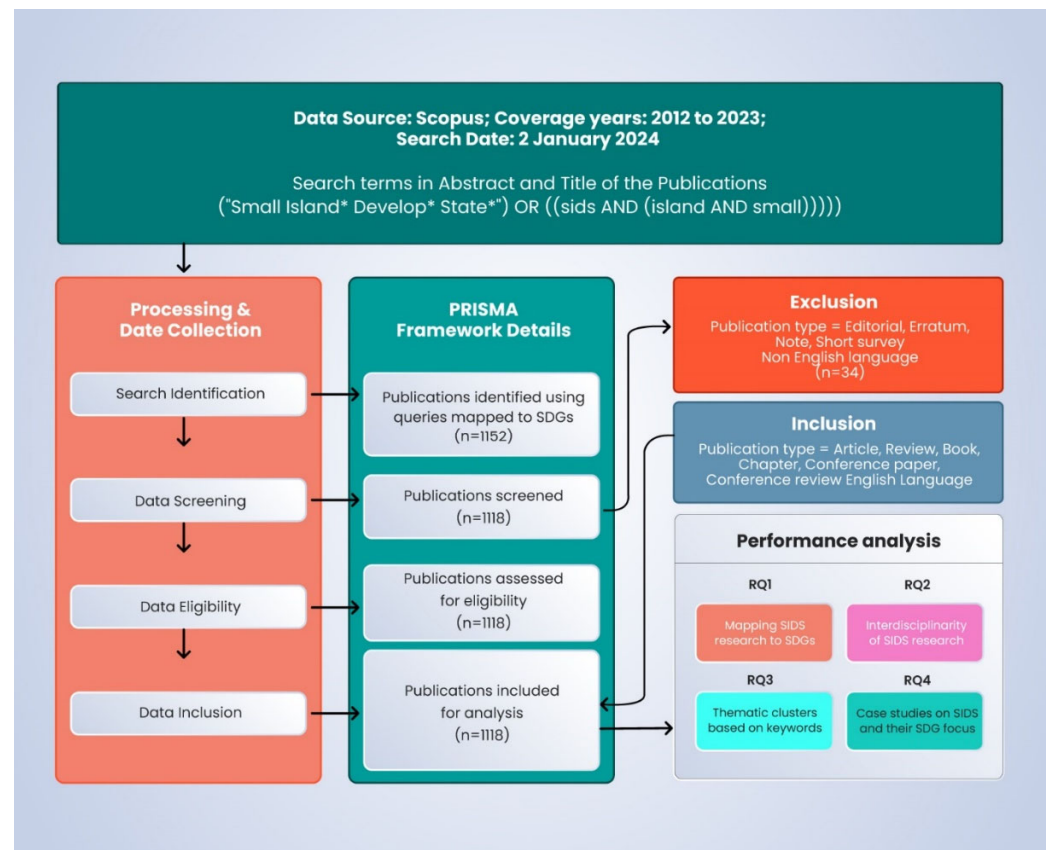


Figure 1. Research framework.

2.2. SDG Mapping Framework

During the eligibility phase, publications directly mapped to the SDGs were identified using proprietary algorithms within the Scopus database. This selection was informed by several SDG mapping initiatives, including the Aurora Universities Network’s SDG queries [31], the University of Auckland’s SDG mapping [32], and Elsevier’s SDG Mapping Initiative [33]. The Elsevier SDG Mapping Initiative was chosen for its direct integration with Scopus, offering preset search queries for each SDG and leveraging a machine learning model refined through expert review. Elsevier maps research to the SDGs through a two-step process [34]. Initially, they used curated SDG search queries containing relevant keywords and phrases for each SDG and its targets, allowing for publications to be linked to multiple SDGs. These queries are run on databases such as Scopus to identify potentially related publications, although keyword searches might not catch all pertinent works. To address this issue, a machine learning model was used to analyze Scopus publications’ titles, keywords, descriptor terms, journal subject areas, and abstracts. After training on a dataset categorized by experts, the model learns to distinguish patterns related to specific SDGs. This methodology, which combines keyword searches with machine learning, effectively categorizes vast research quantities, enhancing the identification of SDG-related publications.

The SDG mapping model leverages several key input elements derived from Scopus records to perform its analysis. These inputs include the article’s title, keywords, key descriptor terms extracted directly from the full text, journal subject areas (referred to as “fields”), and the abstract. To train the model, target values are sourced from Science-Metrix queries. Specifically, 1.4 million records were sampled by running the queries against the Scopus database, creating a training set of approximately 1 million records. This dataset included around 70,000 records per Sustainable Development Goal (SDG), with fewer records for Goals 1 and 5. The model assigns an integer value, known as the “sdg_id”, to

each record. This value, ranging from 1 to 16, corresponds to one of the SDGs. For instance, a target value of 1 aligns with Goal 1, “End poverty in all its forms everywhere”, while a target value of 16 aligns with Goal 16, “Promote peaceful and inclusive societies. . .” Notably, Goal 17, “Strengthen the means of implementation and revitalize the global partnership for sustainable development”, is excluded from the model.

The model itself is built using a Scikit-learn (Sklearn) pipeline comprising two main components. First, a Tf-Idf vectorizer is used as the feature engineering component. This vectorizer processes the input text by building bigrams, converting all text to lowercase, and selecting the 50,000 most frequent tokens and bigrams. Second, logistic regression is employed as the classifier. The model uses a multinomial strategy for multi-class classification, resulting in a 16-element vector that provides predicted scores for each of the 16 SDGs. The model’s performance is evaluated using a holdout set containing a subset of five SDGs, where it achieves a precision of 91.6% and a recall of 93%. The model effectively learns specific words and bigrams associated with each SDG. The top 10 key phrases for each SDG are visualized, and when the model detects these phrases within an article’s text, it increases the probability of assigning the corresponding SDG label to that article.

Numerous studies have employed precise SDG mapping techniques to analyze research trends in emerging topics. For instance, [35] investigated green hydrogen, while [36,37] studied fake news and the dark web. These studies highlight the application of SDG mapping to understanding the alignment and impact of publications on SDGs within these novel areas. This phase identified 1152 publications as mapped to SDGs. After applying stringent inclusion criteria to ensure the quality of the assessment, which included English-language research publications, reviews, book chapters, and conference papers and excluded editorial, erratum, note, short survey, and non-English publications, we included 1118 publications for the final detailed analysis.

To illustrate the interconnectedness and relationships of SDGs in SID research, we constructed a co-citation map using the visualization tool VOSviewer 1.6.19 [38]. This network highlights the semantic links between different SDGs, with the closeness of SDGs on the map indicating a greater likelihood of related publications being cited together. The size of each node on the map corresponds to the frequency of an SDG mentioned in publications, and the edge thickness between nodes reflects the frequency of co-citation of these SDGs. In our analysis, we began by extracting 31,677 keywords from the dataset. To focus on the most relevant terms, we applied a filtering criterion where only keywords with a minimum of 5 occurrences were considered. This step was essential to ensure that our analysis concentrated on terms that played a significant role in the literature. Initially, VOSviewer was used with the default resolution parameter set at 1.0, which generated seven thematic clusters. However, we recognized that a finer resolution was necessary to capture more detailed insights. Therefore, we adjusted the resolution parameter to 0.8. This adjustment allowed us to form more distinct and meaningful clusters, providing a clearer representation of the various themes within the research landscape. To further refine our analysis, we set a minimum citation threshold of 5, focusing on publications that had a significant impact within the field. Additionally, we applied a co-citation threshold of 10, meaning that only items co-cited at least 10 times were included in the network. This ensured that the connections between publications were strong and meaningful, reducing the noise from less relevant relationships. After applying these thresholds, the number of keywords was reduced to 2127. These keywords were then organized into three primary clusters.

The clustering process was conducted using the Louvain algorithm, which optimizes the modularity of the network. This algorithm groups items into clusters based on their connections, with each cluster representing a distinct thematic area. In the visualization produced by VOSviewer, each cluster is represented by a distinct color, and the size of the nodes within each cluster corresponds to the frequency of keyword occurrences. Larger nodes indicate more frequently occurring keywords, highlighting their centrality within the theme. The distance between nodes reflects the strength of their relationships; closely

positioned nodes are more frequently co-occurring, indicating a strong thematic connection, while those further apart are less connected. The color of the clusters visually distinguishes the thematic areas, with each color representing a different research theme. The distance between clusters in the visualization represents the degree of relatedness between different themes—clusters that are closer together share more common ground, while those that are further apart are more distinct. Finally, we assessed the modularity and density of the clusters to ensure they were both coherent and meaningful. High modularity indicates well-defined clusters that are internally cohesive but distinct from other clusters, allowing for us to clearly delineate the different research trends and collaboration networks within the field.

For the qualitative approach, we identified seven case studies specific to SIDSs from Samoa, the Maldives, Vanuatu, Fiji, Seychelles, Barbados, and the Solomon Islands. This choice is grounded in the recognition of the unique socioeconomic, environmental, and political challenges faced by these SIDSs, which necessitate an in-depth, contextual understanding unattainable through quantitative metrics alone. This choice also ensures a geographically represented SIDSs across various oceanic regions, including the Pacific Ocean, Indian Ocean, and the Caribbean. To ensure a balanced understanding, we deliberately selected SIDSs from across various socioeconomic spectra. This includes high-income tourist destinations such as Seychelles and low-income destinations reliant on subsistence agriculture such as the Solomon Islands. Similarly, Fiji's abundant natural resources are contrasted by the Maldives' limited resource base. This range, evident from their rankings on the UN's Human Development Index (HDI), for instance, allows for us to capture the full spectrum of challenges and opportunities faced by SIDSs. Case study research not only fosters the creation of innovative theoretical frameworks by examining specific contexts [39] but also enables the effective compilation of extensive data through the integration of multiple data sources and methodologies [40].

3. Results

3.1. Mapping SIDS Research to SDGs (RQ1)

Table 1 shows the SDGs and the number of publications and citations related to SIDS research.











Enhanced Focus on Climate Action and Marine Biodiversity: SDG 13, "Climate Action", remains at the forefront with 528 publications and 8117 citations, underscoring the critical emphasis on addressing climate-related challenges within SIDSs. This highlights the ongoing concern over climate impacts, such as sea level rise and extreme weather events, and reaffirms the importance of this research field. Similarly, SDG 14, "Life Below Water", with 408 publications and 5220 citations, emphasizes the importance of marine biodiversity and the conservation efforts required in these island states.

Economic Growth and Sustainable Consumption: Notably, SDG 8, "Decent Work and Economic Growth", with 364 publications and 5077 citations, and SDG 12, "Responsible Consumption and Production", with 248 publications and 3455 citations, reflect significant research activities addressing the economic aspects and sustainable resource management in SIDSs. These areas are crucial for fostering sustainable economic development and efficient resource use.

Urban Development and Inequality: Research related to SDG 11, "Sustainable Cities and Communities", and SDG 10, "Reduced Inequalities", has shown notable engagement, with 206 publications and 2864 citations and 174 publications and 2004 citations, respectively. This indicates a growing awareness of the need for sustainable urban planning and addressing inequalities within SIDSs.

Renewable Energy and Food Security: SDGs 7, "Affordable and Clean Energy", and 2, "Zero Hunger", show focused research efforts with 143 publications and 1318 citations and 133 publications and 1860 citations, respectively. These areas are key to ensuring energy security through renewable sources and addressing food security challenges.

Table 1. SIDS research mapped to SDGs based on publications.

Publications	Citations	SDG
528	8117	
408	5220	
364	5077	
248	3455	
206	2864	
174	2004	
143	1318	
133	1860	
128	1091	
122	995	
112	1536	
111	1884	
92	1341	
74	1033	
68	430	
27	282	

Emerging Areas and Potential Gaps: Other SDGs, such as SDG 3, “Good Health and Well-being”, and SDG 15, “Life on Land”, although having moderate research outputs, indicate a holistic consideration of health and terrestrial ecosystems in SIDSs. Moreover, areas such as SDG 16, “Peace, Justice, and Strong Institutions”; SDG 6, “Clean Water and Sanitation”; SDG 4, “Quality Education”; and SDG 5, “Gender Equality”, although lower in research activity, present opportunities for further exploration to address comprehensive sustainable development challenges in SIDSs.

3.2. Interdisciplinarity of SIDS Research (RQ1)

In analyzing the intricate web of SDGs, it becomes evident that the success of one goal is often intertwined with advancements in others. Network analyses by [41] reveal a varied landscape of interconnections among the SDGs, with some demonstrating strong links across numerous targets while others show less pronounced connections. The co-citation map using the visualization tool VOSviewer revealed three distinct SDG networks (Figure 2).

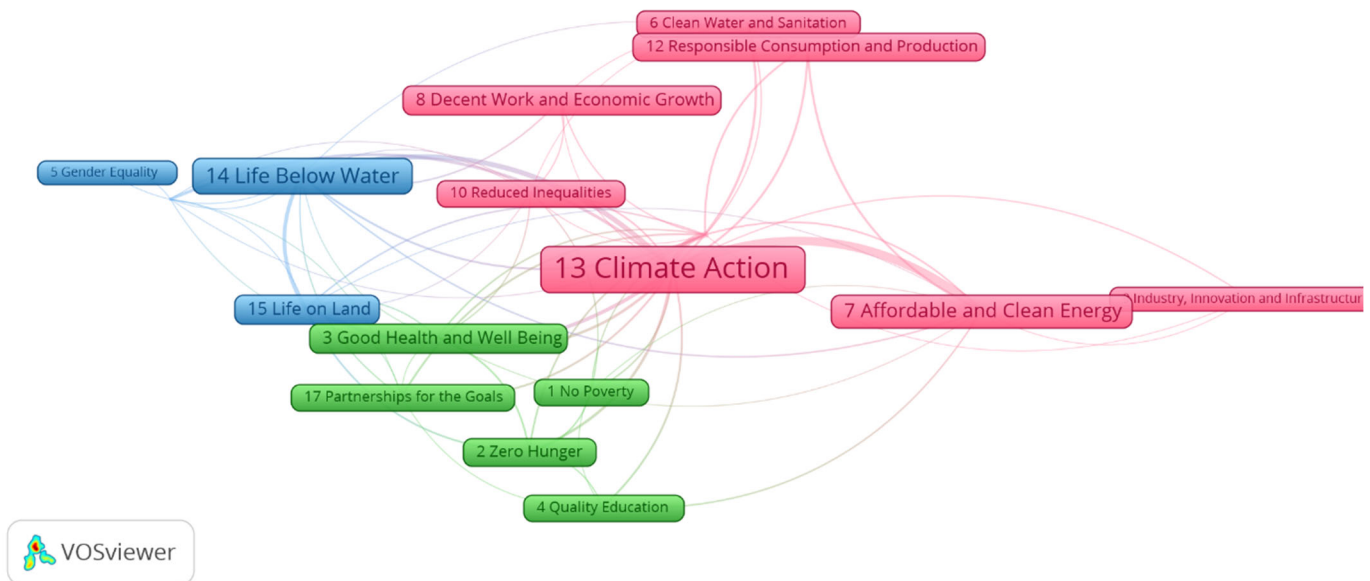


Figure 2. Interdisciplinary SIDS research using a co-citation map of SDGs.

SDG-network1 (green) focuses on foundational social goals, which are particularly crucial for SIDSs. It encompasses SDG 1 (no poverty), SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 4 (quality education), and SDG 17 (partnerships for the goals). These goals address the pressing needs of SIDSs, such as poverty alleviation, food security, healthcare access, and quality education, which are vital for sustainable development. SDG 17 highlights the importance of global partnerships, which are essential for SIDSs to overcome unique challenges posed by their geographical and economic situations.

SDG-network2 (red) represents a blend of economic and environmental objectives pivotal for SIDSs. Led by SDG 12 (responsible consumption and production), SDG 7 (affordable and clean energy), and SDG 11 (sustainable cities and communities), it includes SDG 8 (decent work and economic growth), 6 (clean water and sanitation), and 9 (industry, innovation, and infrastructure). This cluster addresses the critical balance that SIDSs must maintain between economic development and environmental sustainability. It emphasizes the importance of sustainable resource management, clean energy, and infrastructure development, ensuring that economic growth in these states does not come at the expense of their natural resources and ecological balance.

The **SDG-network3 (blue)** focuses on the SDGs related to environmental preservation, which is a significant area of concern for SIDSs. It includes SDG 14 (life below water), SDG 15 (life on land), and SDG 5 (gender equality). This cluster underscores the critical need for SIDSs to protect and sustainably manage their marine and terrestrial ecosystems, which are vital to their economies and way of life. SDG 5 adds an important dimension, emphasizing the role of gender equality in ensuring effective environmental governance and inclusive participation in conservation efforts. In SIDSs where communities are closely tied to their natural environment, integrating gender perspectives is crucial for the success of environmental policies and initiatives.

3.3. Thematic Clusters of SIDS Research and Their SDG Mappings (RQ2)

We identified three main clusters in our analysis, each containing numerous publications (Figure 3). Each cluster appears to center on a distinct theme relevant to the challenges and characteristics of SIDSs. To provide a comprehensive overview, we selected three highly cited articles from each cluster for a detailed content analysis and SDG mapping. This approach ensures that we focus on the most influential works within each thematic cluster, offering a representative sample of the research landscape. By analyzing these key articles, we can effectively highlight the central themes and contributions of each cluster, as

well as their alignment with the SDGs. This method provides a robust understanding of the research impact and its relevance to broader social and environmental objectives.

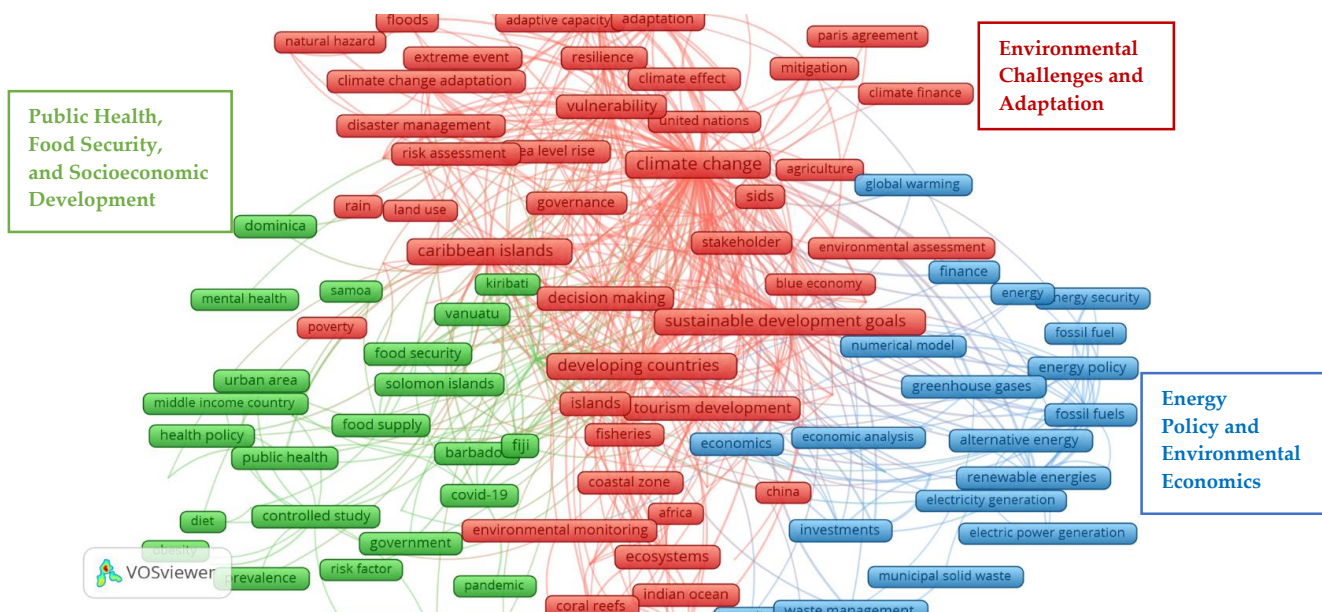












Figure 3. Thematic clusters of SIDS research.

3.3.1. Environmental Challenges and Adaptation in SIDSs (Cluster 1, Red)

Cluster 1 emphasizes the acute environmental challenges of SIDSs due to their geographical and ecological characteristics. The prominence of terms such as “climate change”, “sustainable development goals”, “vulnerability”, “sea level rise”, “hurricanes”, and “biodiversity” indicates a focus on the environmental challenges faced by SIDSs. These terms suggest a need for research on the impact of climate change on these regions and the development of strategies for adaptation and resilience. The presence of “adaptive management”, “disaster management”, “environmental policy”, and “policymaking” emphasizes governance and strategic responses to environmental issues. Research under this theme likely investigates the impact of global climate change, such as rising sea levels in coastal areas [42] and increased frequency of extreme weather events. It covers the biodiversity unique to these regions and the need for protective measures. This cluster highlights the importance of adaptive strategies, policymaking, and governance structures informed by environmental science and risk assessment to enable SIDSs to navigate and mitigate these challenges effectively. The top three articles (Table 2) in cluster 1 were further analyzed.

With climate hazards expected to increase in frequency and intensity in the warming world [43], research on climate change is progressing in diverse ways. Linking research progress with environmental concerns on the islands and the UN’s effort to meet the SDGs in SIDSs, the framework in the most cited article, by [9], elaborates on the vital role of the oceans in SDG 14, “Life Below Water”, which advocates for enhanced ocean-related research in SIDSs. Furthermore, [44] explored the transition of the ocean to a blue economy paradigm, which is driven by ocean industries. Inclusive research shows the United Nations Environment Programme (UNEP) and other Institutions connecting SIDSs to SDG 8, “Decent Work and Economic Growth”; SDG 14, “Life Below Water”; and SDG 15, “Life on Land”, fostering shared visions for sustainable practices and economic prosperity. Climate change research by [45] has shown remarkable research linking SDG 1, “No Poverty”; 2, “Zero Hunger”; and other SDGs in SIDSs, validating a livelihood vulnerability index (LVI) tailored for agricultural and natural resource-dependent communities. Using this index, a comparative study of two wetland communities in Trinidad and Tobago facing severe climate change impacts explored sociodemographic, health, water security, food security [46], and climate factor vulnerabilities.









Table 2. Highly cited articles and their SDG mappings in Cluster 1.

Citations	Author	SDG Focus
252	Singh, G. G. et al. (2018) [9]	
251	Silver, J. J. et al., (2015) [44]	  
243	Shah, K. U et al., (2013) [45]	     

3.3.2. Public Health, Food Security, and Socioeconomic Development in SIDSs (Cluster 2, Green)

In Cluster 2, the focus shifts to the intersection of public health and socioeconomic development within SIDSs. Keywords such as “COVID-19”, “food security”, “public health”, “health care delivery”, “nutrition”, “epidemiology”, and “noncommunicable diseases” point to public health concerns. Additionally, the socioeconomic dimensions are represented by “socioeconomics”, “urban area”, “education”, and “economic aspects”. This suggests that research should focus on how health outcomes are intertwined with socioeconomic factors in the context of SIDSs. The impacts of pandemics such as COVID-19, food security challenges, and healthcare delivery are critical issues compounded by the unique socioeconomic contexts of these islands. This research delves into how socioeconomic factors impact health outcomes, addresses challenges in healthcare provision in island settings, and explores the role of education and urban planning in improving health and socioeconomic conditions. Table 3 shows the highly cited articles from this cluster.

Table 3. Highly cited articles and their SDG mappings in Cluster 2.

Author	SDG Focus
Verschuur et al. (2021) [47]	  
Gibson et al. (2022) [48]	 
Nunn and Kumar (2018) [18]	  

Ref. [47] conducted a notable study using vessel tracking data to analyze the effect of COVID-19 on global maritime trade. They found substantial trade losses, particularly in manufacturing, up to 11.8% at the port level. This underscores the importance of real-time economic indicators for crafting effective policies. Ref. [48] explored the psychological impacts of climate change on Tuvalu residents, a vulnerable small island state. Their work administered psychological methods for evaluating distress in people from local environmental damage. Their findings revealed significant distress, urging mental health integration into climate policies, aligning with SDG 8, signifying the crucial intersection of environmental challenges and psychological well-being, and advocating a focus on mental health within climate change initiatives. Ref. [18] examined the intricate interplay of climate change and human activities in SIDSs linking SDG 13, showing multifaceted challenges posed by climate change on the existing vulnerability and resilience of island communities, stressing the significance of coastal zones, social cohesion, and spiritual ties in crafting sustainable climate adaptation strategies essential for supporting SDGs 2 and 14 in island environments. In terms of vulnerability, extreme weather events are known to affect poorer and more minoritized communities disproportionately. The synergies between related goals and climate justice seem to receive less attention [49], which must be addressed.

3.3.3. Energy Policy and Environmental Economics in SIDSs (Cluster 3, Blue)

Cluster 3 is concerned with the energy landscape in SIDSs, exploring the transition from traditional fossil fuels to renewable energy sources and the economic policies that govern this shift. This highlights the importance of investments in renewable technologies, energy efficiency, and emissions and waste management. The prevalence of terms such as “renewable energies”, “economics”, “fossil fuels”, “greenhouse gases”, “energy policy”, “carbon dioxide”, “global warming”, and “energy efficiency” suggests a concentration on energy sources and their economic and environmental implications. The keywords “investment”, “municipal solid waste”, “recycling”, and “geothermal energy” imply a focus on sustainable economic practices and alternative energy to combat the adverse effects of traditional energy sources on the environment. This research will likely assess the economic viability of alternative energy sources in SIDSs, their role in sustainable development, and the broader economic impacts of environmental policies designed to mitigate climate change effects.

Table 4 shows the prominent work by [21], assessing solid waste management in SIDSs, which reveals varied waste generation rates and compositions. The challenges include outdated infrastructure and inaccessible roads, highlighting the necessity for tailored waste management practices to achieve SDG 11 and the interconnected SDGs within SIDSs. A systematic review by Kang et al. (2020) [50] analyzing 1184 articles assessed the nexus of climate change and energy systems. The study focuses on the energy supply and end-use sectors in SIDSs, with limited research on traditional oil and gas exploration. Geographic disparities exist, marking the need for interdisciplinary collaboration to address climate change and achieve SDG 7. Authors of [51] observe that SIDSs exhibit both opportunities and challenges for low-carbon development, encompassing economic, social, and environmental dimensions. Despite aspirations for low-carbon economic paths, inadequate energy infrastructure, financial constraints, and policy gaps impede renewable energy adoption. Addressing these hurdles necessitates bolstering information networks, innovative financing mechanisms, and robust policy frameworks to facilitate sustainable energy transitions in SIDSs. This study proposes that policymakers foster RE adoption to alleviate the dangers of climate change.














Table 4. Highly cited articles and their SDG mappings in Cluster 3.

Citations	Author	SDG Focus		
137	Mohee et al. (2015) [21]	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	14 LIFE BELOW WATER
123	Kang, J.-N. et al. (2020) [50]	7 AFFORDABLE AND CLEAN ENERGY	12 RESPONSIBLE CONSUMPTION AND PRODUCTION	13 CLIMATE ACTION
62	Timilsina and Shah (2016) [51]	7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH	13 CLIMATE ACTION

3.4. Case Studies of SIDSs and Their SDG Focus (RQ3)

The seven case studies on SIDSs illustrate the complex interplay between environmental sustainability, economic development, and social well-being (Table 5). They underscore the importance of tailored, innovative approaches to achieve the SDGs, considering the unique vulnerabilities and strengths of SIDSs. Importantly, these examples highlight the critical role of international cooperation, local community engagement, and integrated policy frameworks in supporting SIDSs on their path toward sustainable development. Through multiple case studies, [52] explore and critically examine the 17 Sustainable Development Goals (SDGs) of the “2030 Agenda for Sustainable Development”, aimed at balancing economic progress with environmental protection, addressing global disparities, and assessing the potential of SDGs in addressing present and future sustainability challenges.

Table 5. Case studies on SIDSs and their SDG focus based on the year of publishing.

Country	Paper Title	SDG Focus	Authors
Maldives	The challenge of sustainable tourism development in the Maldives: Understanding the social and political dimensions of sustainability. Asia-Pacific Viewpoint	Sustainable tourism in the Maldives  	Scheyvens (2011) [26]
Solomon Islands	A Cultural Landscape Approach to Community-Based Conservation in Solomon Islands. Ecology and Society	Conserving biodiversity through community-based conservation projects 	Walter and Hamilton (2014) [53]
Barbados	Sustainable Use of the Littoral by Traditional People of Barbados and Bahamas.	Promotion of sustainability in coastal areas 	Stoffle et al. (2020) [54]
Samoa	Quantifying the trade-off between percentage of renewable supply and affordability in Pacific island countries: Case study of Samoa. Renewable and Sustainable Energy Reviews	Renewable energy transition 	Vaiaso and Jack (2021) [21]
Vanuatu	Integrating music and sound into efforts to advance the sustainable development goals in the Asia-Pacific: case studies from Indonesia, Vanuatu and Australia, International Journal of Cultural Policy	Using music and sound to implement the SDGs      	Grant et al. (2022) [55]
Fiji	Tourism partnerships: localizing the SDG agenda in Fiji, Journal of Sustainable Tourism	Catalyzing partnerships in Fiji 	Movono and Hughes (2020) [56]
Seychelles	Oceans justice: Trade-offs between Sustainable Development Goals in the Seychelles. Marine Policy	Conserve and sustainably use marine resources 	Baker and Constant (2023) [57]

Ref. [26] critically examines the sustainability of tourism in the Maldives, emphasizing the importance of government-led initiatives for achieving SDG8 (decent work and economic growth) and SDG14 (life below water). The study revealed that the acclaimed quality tourism model faces challenges due to environmental degradation, socioeconomic disparities, and political issues. This highlights the need for a holistic approach to sustainable tourism that integrates environmental protection with social justice and equitable economic growth. Ref. [26] further argues for inclusive tourism planning that considers all stakeholders' interests, advocating for policies that ensure equitable benefit distribution and genuine sustainability.

Ref. [53] underscores the importance of embedding indigenous knowledge within global conservation efforts, particularly in the context of SDG15 (life on land). Their pioneering work in the coastal regions of Melanesia advocates for a cultural landscape approach, which seeks to align the objectives of international conservation initiatives with the deeply held values and ecological understandings of indigenous communities. This method integrates the conservation of biodiversity with the preservation of cultural, spiritual, and ideational values, thereby ensuring that conservation strategies are culturally relevant and supported by those most affected by them.

The study by [54] highlights the significance of integrating traditional ecological knowledge into sustainable urban development, aligning with SDG11 (sustainable cities and communities). The sustainable practices of Barbados and the Bahamas' traditional communities, which utilize both marine and terrestrial ecosystems, provide insightful lessons for urban sustainability efforts. Their environmental multiplicity model underscores the value of resilience and learning from historical practices, offering guidance for urban initiatives such as community gardening. These projects embody the goals of SDG11 by promoting sustainable urban environments through local involvement and the prudent management of resources.

The study by [27] discusses the challenges and opportunities for Pacific islands, especially Samoa, regarding SDG 7's goal for affordable, clean energy. Affected by climate change and expensive fossil fuel imports, these nations aim for 100% renewable energy. Samoa is highlighted as an example, showing the feasibility of transitioning to over 90% renewable energy with solar, hydro, and storage technologies. This move is both technically feasible and economically sensible, offering insights into Samoa's energy policy and other Pacific islands planning similar shifts. The research stresses the importance of tailored research to develop effective energy strategies that help achieve SDG7.

Emphasizing the critical role of cultural integration, particularly through music and sound, in advancing the SDG research highlighted in [55] explores the impact of cultural integration, through music and sound, on the SDGs in the Asia-Pacific region. In Indonesia, efforts to preserve indigenous marapu music support health (SDG3), reduce inequalities (SDG10), and enhance community sustainability (SDG11). Vanuatu's Leweton Cultural Village contributes to climate justice (SDG13), gender equality (SDG5), economic growth (SDG8), and health resilience (SDG3). These examples emphasize the importance of embedding cultural practices in sustainable development policies, highlighting culture's role in achieving a broad spectrum of SDGs.

Ref. [56] delves into the pivotal role of tourism in advancing SDGs with a particular focus on SDG17, which emphasizes partnerships for achieving these global objectives. The study, set in Fiji, explored how collaboration between the tourism sector and local communities can foster development aligned with SDG targets. The research reveals that while tourism is seen as a vehicle for meeting the SDGs, a balance must be struck to ensure that the pursuit of economic growth does not overshadow community needs and priorities. It introduces the concept of "slow growth" in tourism as a means to cultivate meaningful partnerships that respect local cultures, environmental sustainability, and social values. This approach challenges conventional rapid development strategies, suggesting that a more deliberate pace of growth can enhance the effectiveness of partnerships in contributing to the SDGs.

Ref. [57] explored the delicate balance between economic development and environmental sustainability, particularly under SDG14, and discussed the tension between economic growth and environmental protection under SDG14, focusing on how MSP and the blue economy can limit artisanal fishers' access to essential fishing zones. This restriction threatens their income, food security, and well-being, illustrating the conflict between conservation efforts and socioeconomic requirements. The study emphasizes the necessity of justice mechanisms to mitigate these conflicts, advocating for distributive and procedural justice to achieve fair outcomes. By analyzing the Seychelles' attempts to balance economic and conservation goals, the research highlights the complexities of fulfilling SDG14 in a manner that honors local communities' needs.

The sustainability of tourism in the Maldives is critically dependent on government-led initiatives that aim to balance environmental protection with socioeconomic development. However, challenges such as environmental degradation, socioeconomic disparities, and political issues persist, necessitating a more holistic approach that integrates social justice and equitable economic growth. Embedding indigenous knowledge within global conservation efforts is essential, particularly in regions like Melanesia, where aligning conservation strategies with local values ensures cultural relevance and community support. The integra-

tion of traditional ecological knowledge into sustainable urban development offers valuable lessons, as seen in the practices of Barbados and the Bahamas, where historical practices guide modern urban sustainability efforts. For Pacific islands, transitioning to renewable energy sources is both technically feasible and economically sensible, with countries like Samoa leading by example in achieving high renewable energy targets. Cultural integration, such as the preservation of indigenous music in Indonesia and community initiatives in Vanuatu, plays a pivotal role in advancing various SDGs, emphasizing health, gender equality, and climate justice. Tourism, especially when developed through meaningful partnerships with local communities, can foster sustainable development, although a balance must be struck to ensure that economic pursuits do not overshadow community needs. Finally, balancing economic development and environmental sustainability, particularly through marine spatial planning, requires justice mechanisms to ensure fair outcomes for local communities, as illustrated by the complex dynamics in the Seychelles. These insights underscore the need for integrated, context-specific research strategies that address the multifaceted challenges faced by SIDSs and contribute effectively to achieving the SDGs.

4. Discussion on Future Research Directions (RQ4)

Our study reveals several promising avenues for future research, guided by Scopus's prominence percentile [6]. This metric, acting as a barometer of a research topic's "momentum", considers a combined force of factors: the number of citations, views on related publications, and the average CiteScore of those publications. By analyzing topics with high prominence percentiles (top 1%), we gain valuable insights into the latest hotspots within a field [6]. We further performed an analysis for each of the topics using the top 50 key phrases from the topic [58]. Scopus uses text mining to extract and standardize key phrases from titles and abstracts. The size of the key phrases represents their relevance or the number of times they occurred in the publications. Emerging topics (Figure 4) are discussed below.

4.1. Combatting Plastic Pollution in Aquatic Environments

"Marine Debris" and "Small Island Developing States" are highlighted as critical concerns (Figure 4a), underscoring the urgent need to address marine pollution in these areas, closely linked with SDG 14 (life below water) for conserving oceans and marine resources. "Microplastics" and "Microplastic Pollution" connect to SDG 12 (responsible consumption and production), emphasizing the reduction of waste. The "Caribbean Region" and the "South Pacific" are identified as key locations facing significant marine litter challenges, impacting "Coastal Water" management, which is essential for biodiversity, local livelihoods, and tourism, aligning with SDG 15 (life on land). "International cooperation" and "collaborative" approaches are vital for addressing marine debris and supporting SDG 17 (partnerships for the goals). Additionally, "Food Security", "Tourism", "Economic Diversification", and "Fishing Community" highlight the socioeconomic impacts of marine debris and plastic pollution, linking to SDGs 1 (no poverty) and 2 (zero hunger) by focusing on economic stability and food supplies endangered by environmental harm.



Figure 4. Key phrases for emerging topics (a–j): (a) Combatting plastic pollution in aquatic environments. (b) Harmonizing cultural values with environmental conservation. (c) Boosting climate resilience with carbon reduction. (d) Innovative climate adaptation measures for urban areas. (e) Advancing sustainable energy solutions in SIDSs. (f) Promoting sustainable tourism for eco-conservation. (g) Fostering action on climate change. (h) Optimizing solid waste reduction and recycling. (i) Empowering communities for ecological and social resilience. (j) Fostering renewable and accessible energy for all.

4.2. Harmonizing Cultural Values with Environmental Conservation

SIDSs represent unique communities where cultural identity and economic well-being are deeply intertwined with their surrounding natural environment. Key phrases such as “ecosystem services” and “SDGs” point to the critical role that healthy ecosystems play in supporting these communities (Figure 4b), echoing the principles of SDG 14 (life below water) and SDG 15 (life on land). However, key phrases such as “Urbanization” and the specific mention of the “Caribbean Region” raise concerns about balancing development with natural capital preservation, aligning with SDG 11 (sustainable cities and communities). The lower relevance of key phrases such as “coast”, “ecotourism”, and “livelihoods” still highlights the importance of coastal environments in providing cultural services that support tourism, local well-being, and overall health (SDGs 3 and 8). Additionally, “forest”, “land use change”, and “soil erosion” emphasize the interconnectedness of natural systems and the need for sustainable management practices in line with SDG 15. The inclusion of specific locations such as “Fiji” and “The Dominican Republic” reflects regional efforts to leverage natural capital for sustainable development while navigating challenges such as “Cyclonic Storms” and climate change scenarios. Addressing these challenges through effective “coastal management” is crucial for protecting cultural heritage and building resilience (SDG 13).

4.3. Boosting Climate Resilience with Carbon Reduction

The acute vulnerability of SIDSs to climate change necessitates the development and implementation of robust “Integrated Assessment Models” (IAMs) to guide mitigation and adaptation strategies, contributing directly to SDG 13 (climate action). The specific island nations mentioned above, such as “Fiji”, “Barbados”, and “Mauritius”, highlight the need for tailored approaches within these models (Figure 4c). Key phrases such as “Climate Change Mitigation”, “Greenhouse Gas Mitigation”, and “Energy Conservation” reflect the importance of carbon management and a transition toward renewable energy sources, aligning with SDGs 7 (affordable and clean energy) and 9 (industry, innovation, and infrastructure). The reference to the “Paris Agreement” emphasizes the global commitment to limiting global temperature increases, which resonates with the specific targets outlined in SDG 13. Additionally, terms such as “Socioeconomic Impact” and “Tourism Demand” raise concerns about the economic consequences of climate change for these tourism-dependent regions, highlighting the need for sustainable economic practices aligned with SDG 8 (decent work and economic growth). Finally, the inclusion of “Systematic Review” suggests the importance of comprehensive research methodologies to analyze the wide-ranging effects of climate change and assess the effectiveness of various mitigation actions.

4.4. Innovative Climate Adaptation Measures for Urban Areas

The key phrases identified for this topic underscore the critical need for SIDSs to implement tailored strategies to address their unique vulnerabilities. The high relevance of “Small Island Developing States” and “Climate Change Adaptation” (Figure 4d) reiterates the urgency of action, aligning with SDG 13 (climate action). Additionally, mentioning the “Caribbean Region” and specific island nations such as “Vanuatu” and “Trinidad and Tobago” highlights the regional focus on addressing climate impacts through adaptation measures, echoing the importance of protecting marine and terrestrial ecosystems (SDGs 14 and 15). Key phrases such as “Resilience”, “Climate Resilience”, and “Ecosystem Resilience” further emphasize the need to strengthen the ability of SIDSs to withstand and recover from climate-related hazards, contributing to SDG 9 (industry, innovation, and infrastructure) by fostering resilient infrastructure. The inclusion of “Disaster Risk Reduction” and “Financial Management” indicates the importance of integrating risk reduction strategies and financial planning into adaptation efforts, which are essential aspects of SDG 1 (no poverty) and SDG 17 (partnerships for the goals). The specific challenge of “sea level rise” necessitates proactive “national planning” and “policy planning” to incorporate mitigation measures, further emphasizing the relevance of SDG 13. Finally, references to “Governance” and the

“Intergovernmental Panel on Climate Change” suggest the role of national and international frameworks in facilitating and guiding adaptation efforts.

4.5. Advancing Sustainable Energy Solutions in SIDSs

SIDSs face a pressing need to shift from fossil fuels to sustainable energy sources, aligning with SDGs 7 and 13. “Energy Policy”, “Fossil Fuel”, and “Kerosene” highlight the current reliance on non-renewables and the need for comprehensive policies (Figure 4e). Solar energy has emerged as a promising solution, contributing to SDG 7’s access goals. The “pollution control” and “public policy” dimensions underscore the environmental and governance dimensions impacting SDG 11. Locations such as “Vanuatu” and “Cabo Verde” represent unique challenges and innovation opportunities. “Security of Supply” and “Supply Chain Disruptions” raise concerns about vulnerable energy systems, emphasizing resilient infrastructure (SDG 9). Finally, “Global Justice” and “Justice Climate” introduce an ethical dimension, resonating with SDGs 10 and 16 and emphasizing fair and equitable transitions. Beyond source changes, SIDSs’ energy transition requires innovative systems, supportive public policies, and a holistic approach considering demographic, economic, and environmental aspects for an inclusive and equitable shift toward sustainable energy.

4.6. Promoting Sustainable Tourism for Eco-Conservation

“Sustainable Tourism” (Figure 4f) dominates as a key driver of inclusive and sustained economic growth (SDG 8), intersecting with SDG 12 (responsible consumption). While “Small Islands” show a decline, they maintain relevance, connecting to marine ecosystems (SDG 14) and coastal development (SDG 11). The rise of “sustainable tourism development” reflects an alignment with SDG 8 and the need for sustainable business practices to foster local development and employment. Although “Capacity” and “Collaborative” have declined, they still resonate with SDG 17, highlighting the need for revitalized partnerships and capacity-building. The enduring relevance of “destination management” underscores the ongoing importance of SDG 11 in making tourism-oriented cities and settlements sustainable. Finally, terms such as “Coastal Water”, “Ecotourism”, and “Conservation of Resources” emphasize balancing economic development with marine conservation for future generations, aligning with SDG 14.

4.7. Fostering Action on Climate Change

“Climate change” dominates the discourse, urging action aligned with SDG 13. “Adaptive Management”, “Environmental Psychology”, “Health Impact”, “Traditional Knowledge”, and “Small Island Developing States” underscore the need for a multifaceted approach (Figure 4g). These key phrases are linked to SDGs 3 and 11, emphasizing health impacts and resilient communities incorporating traditional knowledge. The “Pacific Islands” and “Fiji” highlight vulnerable regions, demanding focused efforts aligned with SDGs 14 and 15. The relevance of “Food Security” and “Mental Health” illustrates broader implications for SDGs 2 and 3, as food systems and mental health are directly influenced by climate variability. “Intergovernmental Relations” and “United Nations” point to the crucial role of international governance (SDG 17), with the UNFCCC serving as a key platform. “Marginalization” necessitates attention to SDG 10 to ensure that vulnerable populations are not disproportionately affected. The “political development” and “participatory approach” suggest the importance of inclusive governance and diverse perspectives, even those skeptical of mainstream narratives, to inform comprehensive policy measures and robust intergovernmental cooperation to navigate and mitigate climate risks effectively.

4.8. Optimizing Solid Waste Reduction and Recycling

This factor has the highest relevance, highlighting these nations’ unique challenges in managing solid waste effectively (Figure 4h). This issue is closely related to SDG 11 (sustainable cities), which aims to ensure sustainable urbanization and management of municipal solid waste to minimize the ecological footprint. The moderate relevance

of “gas emissions” and “ecological footprint” underscores the environmental impact of improper waste management, reflecting the importance of SDG 13 (climate action) in reducing emissions through better waste practices. The relevance of “Renewable Energy” and “Waste-to-energy” indicates a shift toward utilizing waste as a resource to generate energy, thus contributing to SDG 7 (clean energy) by promoting renewable energy sources and increasing energy access through innovative waste management strategies. “Solid Waste Management” and “Waste Disposal Facilities” are central to SDG 12 (responsible consumption), which focuses on reducing waste generation through prevention, reduction, recycling, and reuse. The inclusion of “Seychelles” suggests a case study or a specific regional focus within the broader context of SIDSs, where innovative waste management solutions are being explored or need to be developed. “Swiss”, although geographically and contextually different from SIDSs, may indicate technology transfer, international cooperation, or benchmarks in waste management practices that could be relevant to island states, aligning with SDG 17 (partnerships for the goals).

4.9. Empowering Communities for Ecological and Social Resilience

The critical need for resilience in SIDSs is underlined by the high relevance of terms such as “Small Island Developing States” (Figure 4i), echoing the urgency for action outlined in SDG 13 (climate action) and SDG 11 (sustainable cities). The economic dependence on resilient social–ecological systems becomes clear with “Tourism”, highlighting its connection to SDG 8 (decent work). The interconnectedness of society and ecology is emphasized by “social-ecological systems”, which are relevant to both SDG 15 (life on land) and SDG 3 (good health). Managing natural resources, particularly in coastal zones, is underscored by “Coast”, “Coastal Water”, and “Water Management”, aligning with SDG 14 (life below water) and SDG 6 (clean water). Building ecological resilience in SIDSs is crucial for both environmental and socioeconomic well-being. The Advocacy Coalition Framework can facilitate collaboration between diverse stakeholders, including technical specialists and policymakers, which is essential for achieving transformative change and ensuring resilience.

4.10. Fostering Renewable and Accessible Energy for All

The high relevance of “Energy Policy”, “Hydropower”, “Renewable Energy”, and “Geothermal Energy” in Figure 4j reflects a shift toward clean and sustainable energy sources (SDG 7), which are crucial for both reducing greenhouse gas emissions (SDG 13) and enhancing energy independence (SDG 11), emphasizing the criticality of energy issues for SIDSs. “Access” highlights the ongoing challenge of energy poverty, a condition where communities lack access to energy services, impacting SDG 1 (no poverty) and SDG 3 (good health). Specific geographic needs are emphasized by the “Caribbean Region” and “Pacific Islands.” The “institutional framework” and “governance framework” suggest the importance of robust policies to facilitate the transition to sustainable energy systems, aligning with SDG 16 (peace, justice, and strong institutions). Overcoming “barriers”, such as economic or technical constraints, is vital for SDG 9 (industry, innovation, and infrastructure).

Future research should also prioritize interdisciplinary approaches that integrate social, economic, and environmental dimensions to address the multifaceted challenges faced by SIDSs. For instance, examining the socioeconomic impacts of marine debris on local communities and industries, such as fishing and tourism, can provide insights into effective mitigation strategies. Moreover, exploring the role of international cooperation and policy frameworks in supporting sustainable practices can help identify best practices and scalable solutions. Research should also investigate the potential of emerging technologies, such as renewable energy innovations and waste-to-energy systems, to enhance sustainability and resilience in SIDSs. Additionally, there is a need to understand the implications of climate change on public health and food security, particularly in vulnerable regions. By fostering collaborative research efforts and engaging with local stakeholders, future studies can

contribute to the development of tailored, context-specific solutions that align with global sustainability goals and enhance the overall resilience and well-being of SIDS communities.

Moreover, there is a growing need to explore the impacts of digital technologies and data analytics on sustainable development in SIDSs. Research could focus on how digital tools, such as remote sensing, GIS, and big data analytics, can enhance environmental monitoring, disaster management, and resource optimization. The integration of these technologies can provide real-time data and predictive insights, aiding in more effective decision-making and policy formulation. Additionally, the role of digital platforms in promoting sustainable tourism, enhancing energy efficiency, and facilitating community engagement should be investigated. By leveraging the potential of digital innovation, future research can contribute to building smarter, more resilient, and sustainable island communities, aligning with global sustainability goals.

Furthermore, leveraging data and insights from United Nations studies and reports can significantly enhance the depth and breadth of future research. The United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the Intergovernmental Panel on Climate Change (IPCC) provide extensive data and analyses on various aspects of sustainable development, climate change, and environmental protection. These resources can inform research on the socioeconomic impacts of climate change, the effectiveness of international cooperation, and best practices for sustainable development. Additionally, the UN's Sustainable Development Goals (SDGs) framework offers a comprehensive set of targets and indicators that can guide research priorities and measure progress in SIDSs. By integrating these valuable sources of information, future studies can contribute to a more robust understanding of the pathways to achieving sustainable and resilient island communities.

Researchers should foster interdisciplinary collaboration to address the multifaceted challenges faced by SIDSs, integrating insights from environmental science, economics, sociology, and public health to develop holistic strategies for sustainable development. Emphasis should be placed on under-researched SDGs, such as peace, justice, and strong institutions (SDG 16); clean water and sanitation (SDG 6); quality education (SDG 4); and gender equality (SDG 5), to ensure comprehensive development approaches. Engaging local communities in the research process is crucial to ensure culturally appropriate and relevant solutions.

However, several obstacles and limitations need to be considered. Access to reliable and comprehensive data can be a significant challenge, hindering thorough analyses and the development of evidence-based solutions. Financial and logistical constraints often limit research activities, making it essential to secure adequate funding and resources. Geopolitical and economic instability in some SIDSs can pose additional challenges, requiring researchers to develop adaptive strategies to ensure the continuity of their work. Additionally, the high vulnerability of SIDSs to climate change impacts can disrupt research activities and pose significant risks, necessitating the development of resilient research frameworks. By incorporating these recommendations and acknowledging these challenges, future research on SIDSs can be more impactful and contribute effectively to achieving the SDGs.

Our study has limitations, including the potential for incomplete research coverage due to the specific database selection, which might exclude certain journals, conferences, or languages. Although effective, thematic clustering can oversimplify complex topics. The interpretation of key phrases, despite advanced modeling, is subjective and may introduce biases, underscoring the need for expert review. Using citation counts as impact indicators carries citation analysis limitations, such as affirmative citation bias, possibly perpetuating misconceptions [59], and citation misattribution risks [60]. Our methodology's reliability also depends on data quality, with inaccuracies possibly skewing the results. Additionally, the interconnections between different SDGs are complex, and our analysis recognizes the limitations of capturing these interconnections through a single SDG mapping approach [61]. For future research, comparing our findings with those from multiple SDG mapping initiatives (e.g., Aurora Network's SDG Queries, University of Auckland's SDG

mapping) could provide a broader perspective and enhance the robustness of future studies, although this comparison is beyond the scope of the current review. Language barriers in accessing and analyzing research articles could lead to the exclusion of valuable data, impacting the comprehensiveness of this study. The limited sample size of case studies may not offer a comprehensive understanding of all SIDSs, as each island nation has unique challenges and characteristics that could be overlooked.

5. Recommendations

By combining the key themes of climate resilience, economic diversification, debt management, community empowerment, institutional strengthening, and innovative financing, we propose the following recommendations for a holistic strategy to address the challenges faced by SIDSs in achieving the SDGs. Recommendations may not be universally applicable to all SIDSs, as differences in resources and capacities among nations could impact their feasibility.

Proposition 1. Advance climate resilience through innovation: *Toward this, innovative strategies that incorporate adaptive management, disaster risk management, and proactive policymaking are essential. These strategies should address the broad impacts of climate change, including sea level rise and the increased frequency of extreme weather events, by emphasizing the development and deployment of nature-based solutions and green infrastructure. Nature-based solutions and green infrastructure offer replacements or complement traditional infrastructure approaches, providing long-term holistic adaptation and mitigation success with additional benefits to ecosystem services [62–64].*

Proposition 2. Promotion of economic diversification for resilience: *Supporting studies and policies that promote diversification help SIDSs mitigate economic vulnerabilities against global market fluctuations [65] and environmental disasters. The policy implications of economic diversification in SIDSs for sustainable development and resilience include the need for policy enablers to positively impact renewable energy goals, energy efficiency, and climate change [51]. Researching the economic viability of renewable energy and evaluating environmental policy impacts is crucial for the shift of SIDSs toward sustainable economic models. This includes probing new industries and trade opportunities and integrating sustainable practices to foster resilient economic growth in SIDSs.*

Proposition 3. Develop comprehensive financial and debt management strategies: *To fortify the economic foundations of SIDSs, developing comprehensive financial and debt management strategies is paramount [66,67]. By enhancing debt sustainability and exploring innovative financial mechanisms, promoting foreign direct investment and industrialization under a strong public–private sector institutional partnership are strategies for SIDSs to better mitigate their inherent economic vulnerabilities, particularly their exposure to economic shocks and natural disasters [68]. Improving access to bank loans and overdraft facilities can enhance profit reinvestment by SMEs. Ensuring a fair judiciary and addressing government expropriation are crucial. Adopting effective working capital and financing management practices can significantly boost the financial and organizational performance of agro-enterprises [69,70].*

Proposition 4. Empower communities for inclusive development: *This is the cornerstone for achieving inclusive development in SIDSs. This entails a committed approach to promoting gender equality, social inclusion, and active community engagement. The unique characteristics of SIDSs require environmental protection actions to be local, contextual, and small-scale, under the coordination of regional strategic frameworks, emphasizing the importance of community-based local solutions [71]. Recognizing the intricate connection between health outcomes and socioeconomic factors paves the way for equitable societies, emphasizing the importance of inclusive governance and development practices [72].*

Recommendations include forming a regional network of small island experts and promoting sustainable development through policy briefings by island specialists [73]. Over-tourism in small island economies can lead to environmental decay, social inequality, and institutional failures, stressing the need for community-driven development to enhance resilience [74].

Proposition 5. Strengthen institutional frameworks and statistical capacities: *This step is essential for SIDSs to achieve effective governance and informed policymaking. The lack of localized data on climate change hampers research initiatives in tertiary institutions in small island nations, highlighting the need for improved coordination and capacity building for research efforts [6]. Constructing a blue economy architecture can provide a structured approach to managing marine resources effectively, underscoring the importance of comprehensive governance frameworks [75]. Enhancing these capacities is foundational, as it enables data-driven decision-making, which is critical for the successful implementation of sustainability initiatives. By improving their data capabilities, SIDSs can ensure that their policies and strategies are based on accurate and timely information, facilitating more responsive and effective governance.*

6. Conclusions

This study delves into the critical research trajectories and emerging themes critical for addressing the unique challenges faced by SIDSs and makes several important contributions.

First, our mixed methods research design illuminated the complex interplay between SIDS challenges and SDG achievements through seven case studies. These studies vividly showcase how context-specific approaches, including indigenous knowledge integration and sustainable energy exploration, are crucial for SDG progress. The qualitative insights revealed the significance of balancing marine sustainability (SDG 14) with climate action (SDG 13) and underscored the roles of international cooperation, community engagement, policy adaptation, and ethical considerations in sustainable development [76].

Second, SIDS research mapping to the SDGs demonstrates a concerted effort toward addressing climate change (SDG 13) and conserving marine biodiversity (SDG 14), reflecting urgent environmental concerns. Research on renewable energy (SDG 7) and food security (SDG 2) indicates a commitment to addressing energy and food challenges. Emerging areas suggest the potential for broader, holistic, sustainable development efforts in SIDSs.

Third, our scientometric keyword co-occurrence analysis identified three main research themes: environmental challenges and adaptation, public health and socioeconomic development, and energy policy and environmental economics. These themes highlight the need for comprehensive research on climate resilience, environmental protection, and innovative mitigation strategies. Highlighting the socioeconomic dimensions, our findings advocate addressing climate finance disparities, enhancing research in underexplored areas such as gender equality, and addressing challenges such as invasive species for sustainable development [77].

Fourth, the case studies from SIDSs underscore the multifaceted challenges and opportunities in achieving sustainable development. These examples highlight the importance of integrating environmental sustainability, economic development, and social well-being, emphasizing the need for innovative, context-specific approaches. They illustrate how international cooperation, local community engagement, and integrated policy frameworks are crucial in addressing the unique vulnerabilities of SIDSs. The studies also emphasize the value of traditional knowledge, cultural practices, and inclusive planning in fostering sustainability. Overall, the research underscores the complexity of balancing economic progress with environmental protection and social equity, providing valuable insights for achieving the SDGs in SIDSs.

Finally, our future research direction highlighted critical concerns such as “Marine Debris” and “Microplastics”, aligning with SDGs 14 and 12, respectively. We pinpointed the “Caribbean Region” and “South Pacific” as key areas for marine conservation efforts, em-

phasizing the socioeconomic impacts of marine debris on “Food Security” and “Tourism.” Our findings stress the importance of “international cooperation” and “collaborative” efforts in combating environmental challenges, showcasing the essential pathways toward achieving a harmonious balance between cultural values, climate resilience, and sustainable energy solutions within SIDSs.

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