The Economics of Environmental Health: Bibliometric Insights into Cost-Benefit and Public Policy Approaches

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Article Info

ABSTRACT

Environmental health economics has emerged as a necessary interdisciplinary field of research that addresses the complex interaction among environment quality, public health, and economic policy. This study conducts a bibliometric analysis at the world level to map the intellectual landscape of the field, with a particular focus on cost-benefit analysis and public policy measures. Based on the Scopus database between 2000 and 2025 and VOSviewer for visual network analysis, the study identifies the top authors, institutions, countries, and research topics that have been prominent in the field. The findings of the research validate that "environmental health" is a overarching theme that connects clusters that deal with air pollution, healthcare policy, sustainable development, and environmental protection. United States, United Kingdom, China, and Germany are major contributors, and inter-disciplinary studies between public health, economics, and environmental sciences rise. Overlay and density visualizations throw into relief both old and emerging fields of research that hold significant lessons for future study and policy-making. The study adds to theory development in environmental health economics and provides practical guidance on aligning research priorities with global health and sustainability goals.

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1. INTRODUCTION

Over the past few decades, the interlinkage between environmental quality and public health outcomes has gained increasing attention in academic and policy discussions. Environmental degradation has been directly linked to adverse health effects and rising disease burdens, especially in vulnerable populations [1]. The economic costs associated with these health impacts have prompted researchers and policymakers alike to explore sustainable strategies that integrate health protection with environmental stewardship [2], [3]. Consequently, the field of environmental health economics has emerged as a critical domain that bridges the gap between ecological science, public health, and economic decision-making [4]–[6].

Environmental health economics provides tools and frameworks for quantifying the benefits of pollution control, clean energy adoption, waste management, and other environmental interventions [7], [8]. One of its key contributions lies in cost-benefit

analysis (CBA), which evaluates the economic viability of environmental policies by comparing the costs of implementation with the expected health and social benefits. From estimating the healthcare savings of improved air quality to projecting the long-term advantages of climate mitigation strategies, CBA has become a cornerstone of evidence-based environmental policymaking. Additionally, economic valuation techniques such as willingness-to-pay and cost-of-illness assessments are increasingly applied to guide regulatory standards and prioritize interventions [9], [10].

Public policy plays a vital role in translating these economic insights into actionable outcomes. Governments across the world are deploying a variety of instruments to achieve optimal environmental health outcomes [11]. The success of these policies depends not only on political will and institutional capacity but also on a sound understanding of the economic trade-offs involved [12], [13]. Thus, the integration of environmental health economics into policy design has become essential for fostering sustainable development, reducing health disparities, and achieving global goals such as the Sustainable Development Goals (SDGs) [14].

Despite the growing body of literature in this field, the evolution of scholarly attention, research themes, methodological approaches, and policy relevance remains fragmented. Various studies address isolated components of environmental health economics, but often lack a comprehensive mapping of how the field is developing. Moreover, bibliometric studies that provide quantitative insights into research trends, citation patterns, co-authorship networks, and thematic clusters are still relatively limited. As such, there is a need to systematically synthesize the knowledge landscape of this interdisciplinary field. Bibliometric analysis serves as a powerful methodological tool for achieving this purpose [15]. By analyzing large volumes of academic publications through co-citation analysis, keyword co-occurrence, and other

statistical techniques, bibliometric approaches reveal the intellectual structure and evolution of scientific domains. In the context of environmental health economics, such an analysis can identify the dominant research streams, influential scholars, emerging topics, and policy-relevant discourses. This information is crucial for researchers aiming to build on existing work, for policymakers seeking to align research with strategic goals, and for funding bodies targeting areas of high impact.

Although environmental health economics continues to expand as an interdisciplinary field of study, a comprehensive understanding of its research structure, knowledge evolution, and policy integration remains elusive. Prior studies have typically focused on singular environmental risks, isolated health impacts, or narrow cost analyses without considering the broader bibliometric landscape. This fragmentation hinders the ability of scholars and practitioners to identify influential works, synthesize key themes, or trace the intellectual progression of the field. As environmental crises and health disparities become more pronounced globally, it is imperative to map how academic efforts in this domain have responded and where critical knowledge gaps persist.

This study aims to conduct a bibliometric analysis of the literature on the economics of environmental health, with a specific focus on cost-benefit analysis and public policy approaches.

2. METHODS

This study employed a quantitative bibliometric analysis to systematically map the landscape of academic research on the economics of environmental health, with a particular focus on cost-benefit analysis and public policy implications. Bibliometric analysis is a well-established method for evaluating the structure, productivity, and dynamics of scholarly literature across various disciplines. It enables the identification of core research areas, key contributors, citation impacts, and emerging

trends. By applying this method, the study aimed to reveal the intellectual evolution, thematic orientation, and geographic distribution of scientific publications within this interdisciplinary domain.

The bibliographic data were retrieved from the Scopus database, one of the largest and most reliable abstract and citation databases of peer-reviewed literature. The search was conducted using a combination of keywords, including: "environmental health", "health economics", "cost-benefit analysis", "economic evaluation", "public policy", and "environmental regulation". Boolean operators and truncation symbols were used to optimize the search strategy (e.g., "environment* AND health AND econom*"). The inclusion criteria focused on journal articles, conference proceedings, and reviews

published in English between 2000 and 2025. The raw data were exported in .CSV format for further analysis, including metadata such as authors, titles, abstracts, keywords, affiliations, sources, and citation counts.

To analyze the data, the study utilized VOSviewer, a specialized software for constructing and visualizing bibliometric networks. VOSviewer was applied to perform co-authorship analysis, co-occurrence analysis of author keywords, and citation analysis. Clustering techniques were used to group related keywords and publications into thematic areas, allowing the identification of dominant research streams and intellectual structures. Furthermore, citation-based mapping was conducted to highlight the most influential authors and publications within the field.

3. RESULTS AND DISCUSSION

Co-Authorship Analysis
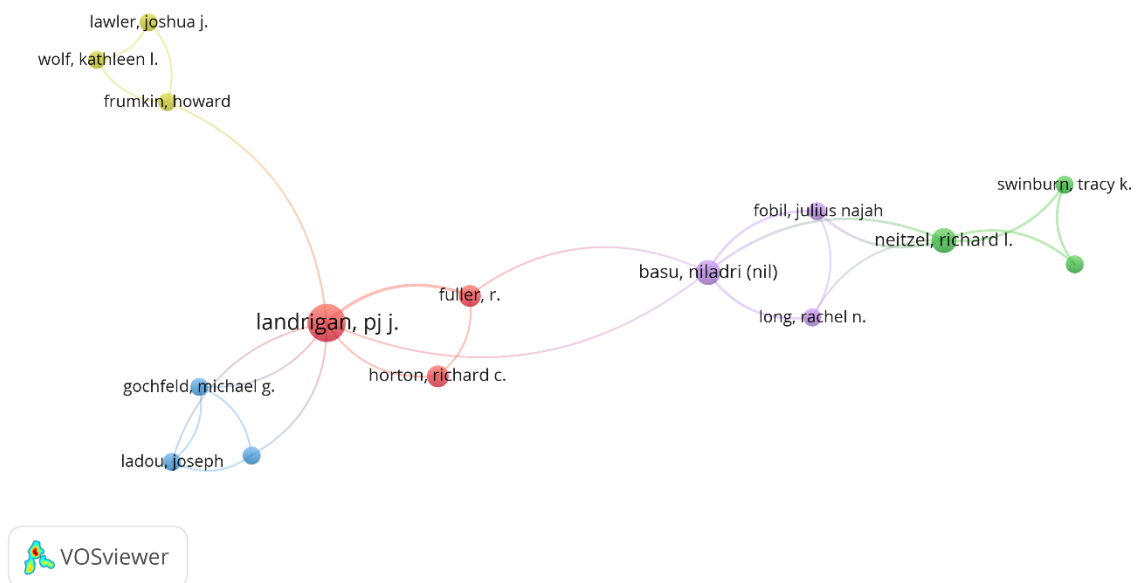
Figure 1. Author Visualization
Source: Data Analysis

Figure 1 above shows a co-authorship network in the field of environmental health economics, with key authors and their co-authorship relationships. At the center of the network is Landrigan, P.J., a central hub, demonstrating high centrality and influence. Landrigan is directly connected to several other prolific researchers, including Fuller, R., Horton, Richard C., and Frumkin, Howard,

indicating continued collaborative productivity in environmental policy and health research. Author clusters are color-coded to represent thematic or institutional collaborations. The green cluster, for instance—Neitzel, Richard L. and Swinburn, Tracy K.—is a putative subgroup with expertise in such areas as occupational health or public health nutrition. Meanwhile, the

purple team with Basu, Niladri (Nil) and Fobil, Julius N., suggests regional or subject

matter-specific alliances, possibly in global environmental exposure and public health.

Figure 2. Affiliation Visualization
Source: Data Analysis

The second figure shows the institutional collaboration map for environmental health economics. Each node is an institution or university, and the edges represent co-authorship or co-published between them. Elite institutions such as University of Washington, University College London, Harvard T.H. Chan School of Public Health, University of Toronto, and Organisation Mondiale de la Santé (World Health Organization) are the epicentre of this collaborative world, indicating their fulcrum role in furthering research and policy discourse. Interestingly, one of the main actors is also the United States Environmental Protection Agency (EPA), underlining the importance of government agencies in applied environmental health research. International partnerships—e.g., University of Chinese Academy of Sciences—underline the international scope of research in this area.
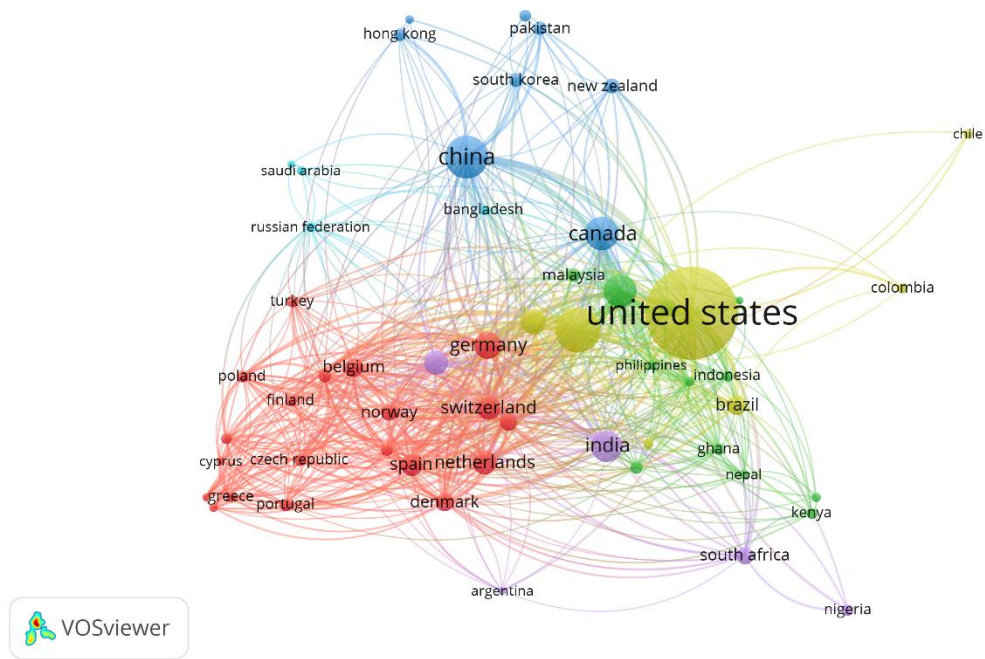
Figure 3. Country Visualization
Source: Data Analysis

Figure 3 above illustrates the research collaboration network at the country level in the field of environmental health economics, with a focus on international co-authorship and research collaboration. The United States is seen to be the most central and prominent node, reflecting its leading role in the world's research production and collaborative intensity in this specialty. The U.S. is enveloped by other major contributors such as Germany, Canada, China, India, and the United Kingdom, each with high

interconnections, indicating high rates of multinational research collaborations. European countries—Netherlands, Switzerland, Belgium, Spain, and Denmark— are clustered together, indicating intense intra-European research collaborations. Emerging economies such as Brazil, South

Co-Occurrence Keyword Analysis

Africa, Indonesia, and Philippines are also visible, which indicates growing involvement in environmental health research. The color-coded clusters represent regional or language-based patterns of collaboration, and the thick network of lines illustrates a highly interconnected global research system.

Figure 4. Network Visualization
Source: Data Analysis

Figure 4 visualization shown above gives a whole thematic map of the research topic in environmental health economics and its related areas. The most representative keyword "environmental health" is the center figure, occupying the largest and most interactive node, indicating its role as the core theme holding various directions of research together. Its occurrence rate in the literature is shown by the node's size, and its closely knit network of links illustrates the multi-dimensional relationships it has with other themes. The word is surrounded by clusters of a number, representing a particular field of interest among environmental health studies. The red cluster, located in the lower-left quadrant, has primarily been concerned with health economics, policy, and cost of health care.

The appearance of words such as "health care policy", "health economics",

"cost", "health promotion", and "health policy" confirms intense concentration on measuring the cost implications of public health interventions on policy making. This cluster documents the economic evaluation dimension of the discipline that applies cost-effectiveness analysis, cost-benefit analysis, and related methods to inform environmental health programs' resource allocation. The presence of the keyword "epidemiology" and "health service" also indicates an interdisciplinarity that associates economics with clinical outcomes as well as public health. The blue cluster at the top-left quadrant focuses on air pollution and exposure-related hazards. Common terms are "air pollution", "air quality", "environmental exposure", "mortality", and "health risks". This category captures research that measures the direct impact of environmental toxins— especially air contaminants—on human

health. It is consistent with empirical studies that model morbidity and mortality caused by exposure to pollution, typically using environmental epidemiology and risk assessment methodologies. This category is indicative of the scientific basis on which cost-benefit analysis and policy decisions are formulated. The green cluster, which is on the right of the map, is centered on sustainable development, environmental management, and protection themes.

These include terms such as "environmental management," "sustainable development," "environmental protection," "ecosystem," and "conservation of natural resources." This cluster addresses the intersection of environmental sciences and policy into health language, where the significance of ecosystem services, agricultural systems, and environmental

planning is central to human well-being. Research in this cluster seeks to examine how sustainable environmental action leads to better long-term public health outcomes, with an emphasis on preventive rather than reactive interventions. Cross-cluster bridging are words like "environmental pollution", "international cooperation", "environmental factor", and "priority journal", which are thematic convergence and interdisciplinary integration. Such bridge words capture where environmental health is situated at the nexus of natural sciences, health sciences, economics, and policy studies. The linked character of the clusters tells us that solving environmental health issues requires an integrative response that brings together scientific investigation, economic sense, and good policy framework.
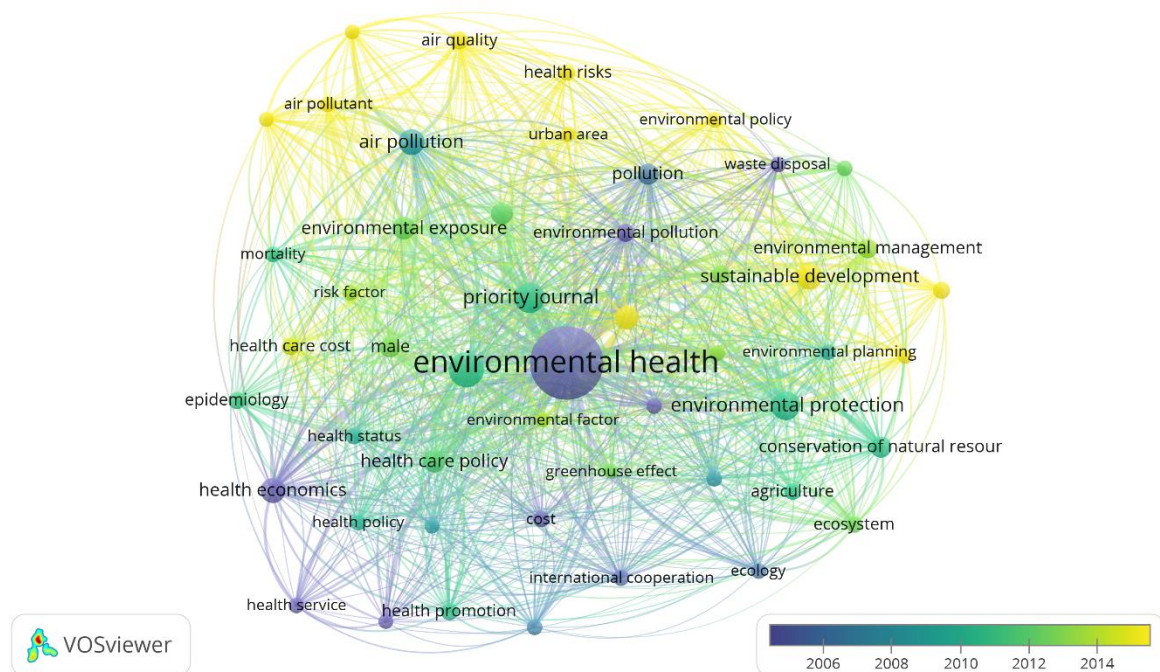
Figure 5. Overlay Visualization
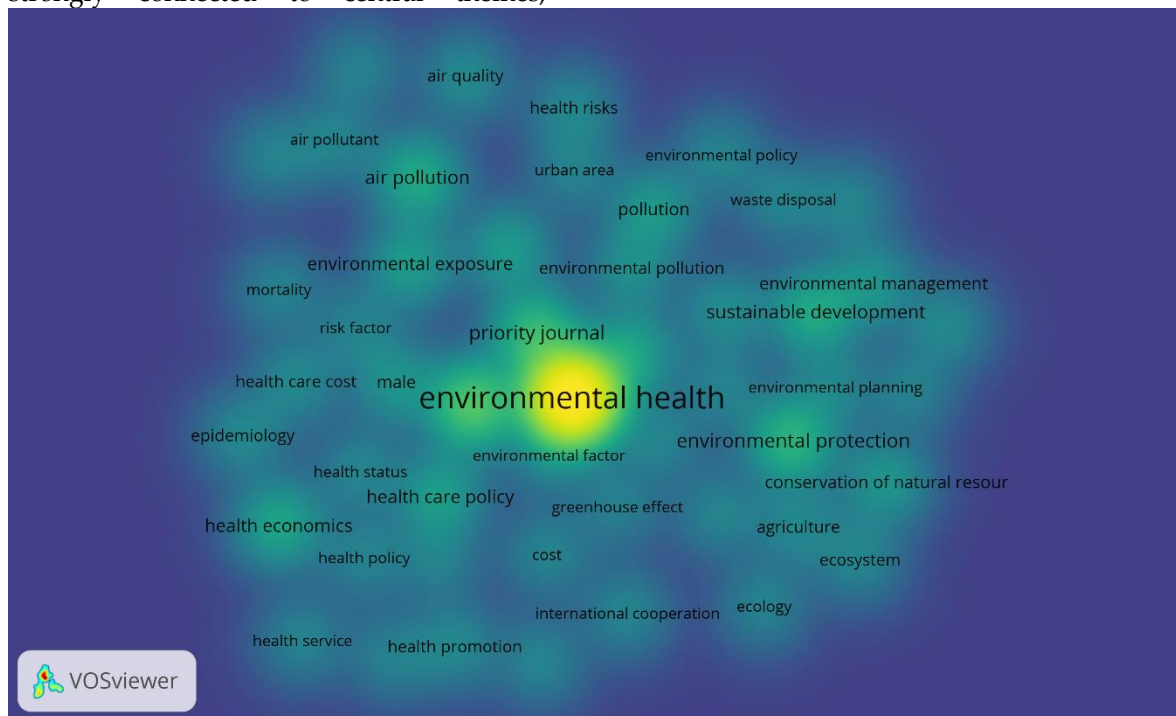**Source: Data Analysis**

Figure 5 illustrates the trend of research topics in environmental health economics over time based on keyword co-occurrence. The color of each node indicates the average year of publication of papers associated with the keyword, based on the color gradient indicated by the bottom-right legend (darkest blue = oldest topics ~2006, to yellow = most recent topics ~2014).

Leadership is the term "environmental health," shown in a deep blue, suggesting it has been a core topic area within the field for over a decade. In close proximity are earlier established fields like "health care policy," "health economics," and "international cooperation," suggesting economic and policy concerns of environmental health were initially pursued. Conversely, however,

several of the keywords of brilliant yellow—i.e., "air pollution", "air quality", "health risks", "waste disposal", and "sustainable development"—reflect newer or more recent research topics beginning sometime around 2010.

These terms mark a shift of scholarly attention toward more contemporary issues of the environment, especially those surrounding city pollution, risk minimization, and sustainability. The emergence of "environmental policy", "urban area", and "pollution" in lighter shades of color also suggests growing interest in applying research to useful, policy-oriented ends. These newer themes are not isolated but are strongly connected to central themes,

illustrating that current work continues to draw on and build on existing foundations. This visualisation demonstrates that the field of environmental health economics is dynamic and in flux, and the thematic breadth is expanding. While economic and health service problems remain important, the field has grown to encompass environmental management, planning, and ecosystem-level sustainability, increasingly linking public health and environmental science. The colour sequence also implies that interdisciplinary incorporation is becoming more penetrating with time, particularly as issues of sustainability and global health require more integrated policy interventions.

Figure 6. Density Visualization
Source: Data Analysis

Figure 6 illustrates frequency and keyword density within environmental health economics

The darker and more yellow the area, the higher the co-occurrence density and studies about those words. Placed at its center, "environmental health" burns brightest yellow, confirming the term to be the most researched and used notion within this research space. Circumventing this are relatively active regions in green with words like "health care policy", "health economics",

"environmental protection", and "sustainable development" that point to significant, albeit slightly lower relative attention compared to the central theme. Conversely, the darker blue regions on the periphery, where terms like "health service", "agriculture", "ecosystem", and "international cooperation" are found, imply issues either new or not well explored in the existing literature. These peripheral topics might be options for future growth in research or interdisciplinary integration. In general, the heatmap shows central

dominance of health-economic-policy intersections complemented with increased interest in broader environmental sustainability topics.

Practical Implication

This study has practical application for policymakers, environmental health officials, and public health planners by providing a specific map of how economic considerations are being integrated into environmental health policy. By identifying the most productive authors, institutions, countries, and subjects, decision-makers can better target collaborative partnerships and funding to areas of demonstrated impact. The salience of such themes as air pollution, health spending, and sustainable development helps guide public agencies in setting priorities with both environmental and economic justification. Furthermore, the shifting patterns of keywords over time point towards policy-driven and interdisciplinary research, mapping a way for environmental health programs to be coupled with the unfolding global agendas such as the Sustainable Development Goals (SDGs).

Theoretical Contribution

Theoretically, the research makes a contribution to environmental health economics by charting its intellectual landscape using bibliometric approaches. It extends the literature by globally indicating over-bearing paradigms, such as cost-benefit analysis, and by highlighting how environmental exposure, health risks, and economic policy meet in academic discourses. The findings highlight the significance of environmental health as an overarching concept that brings various subdisciplines like epidemiology, environmental management, and health economics into juxtaposition. The study also introduces a space-time dimension into theory construction within the discipline, illustrating how various places contribute to knowledge development and how issues mature over time. They provide a solid foundation for the conceptual models of the future that will attempt to merge economic rationality with public health objectives within environmental contexts.

Limitation

While for its general scope, the present study also has several limitations. First, it relies on Scopus database data alone, which, though extensive, might not be exhaustive of all relevant literature—especially gray literature or locally published policy documents in local journals. Second, bibliometric analysis regards quantifiable patterns such as citations and co-occurrence frequency, which may not accurately represent the quality or intensity of each contribution. Third, the interpretation of visual clusters and keyword correlations may be influenced by choices of thresholds and algorithms used by VOSviewer, which can have a potential side effect of leaving out low-frequency but increasing topics. Lastly, while the research charts existing knowledge, it doesn't itself evaluate the practical efficacy of environmental health policies, and empirical verification is reserved for future research.

4. CONCLUSION

This study offers a comprehensive bibliometric overview of the emergent discipline of environmental health economics, with particular focus on cost-benefit approaches and public policy issues. By mapping intellectual structure, thematic clusters, and global research collaborations, the study determines how environmental health has become an integral interdiscipline uniting economic appraisal, epidemiological evidence, and sustainability discourse. The ubiquity of topic areas such as air pollution, health care policy, and sustainable development bears witness to growing economic analysis applicability for influencing environmental decision-making. At the same time, the emergence of newer subjects and global partnerships indicates an active and expanding research frontier. In total, the research not only reviews the current state of knowledge but also provides a strategic handbook for researchers, policymakers, and institutions attempting to address the multifaceted problems at the nexus of environment, health, and economy.

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