

Mapping Innovation: A Scientometric Review of Global Hydrogen Energy Research

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This study will use scientometric analysis method to comprehensively and systematically review the research in the field of hydrogen related research publications. Specific analysis methods such as text mining, word frequency analysis, co-word analysis, cluster analysis, co-citation analysis, and network analysis will be adopted in this research to answer the following questions: (1) What are the changes in international experts' and scholars' attention to hydrogen related research? (2) Which scholars, research institutions, countries, or regions have outstanding influence and contribution to the development of hydrogen-based research? (3) Which journals have a high impact in the area of hydrogen research? (4) What is the status of scientific research cooperation across global, multi-institution, and authors in hydrogen research? (5) What is the evolutionary context, research frontiers, hot topics, and future trends in global hydrogen research? Methodologically answer to the research question, the formulated search query used to retrieved literature data on hydrogen energy global publications from scopus for last five years (2020-2024). Bibliometrix (version 1.7), and R-Tool of R-Studio (Version 3.6.1) used for comprehensive science mapping analysis. According to the formulated search string, 57,788 original research articles (81.23%), review articles (9.48%), conference papers (7.74%) and book chapters (2.65%) are published globally on hydrogen energy. Global research trend shows 19.57% of annual growth rate and 18.67% of average citation per document. Around 26% of the publications have international co-authorship and 2.65% of the publications are single authored. Most productive authors were tabulated according to the number of publication; among them Dincer I (131) attached to the Clean Energy Research Laboratory (CERL), Faculty of Engineering and Applied Science, Ontario Tech. University, followed by Domen, K, (111), and Wang, L (90). Globally there are number of organizations involved in hydrogen research, Ministry of Education of the People's Republic of China (3878), Chinese Academy of Sciences (2686), and University of Chinese Academy of Sciences (952). High number of publications were funded by National Natural Science Foundation of China (18497), followed by, Ministry of Science and Technology of the People's Republic of China (6691) and National Key Research and Development Program of China (3604). China (30,004) identified as most productive country on hydrogen related research because of strong government policies and funding specially the Chinese government has prioritized hydrogen energy in its national energy strategy, including the 14th Five-Year Plan (2021–2025), high research output and investment and leading in hydrogen patents and publications. International journal of hydrogen energy is leading journal published 5991 articles and received 107680 citations received and 101 as h-index for those publications. Country collaboration shows that, high number of publications were done the collaboration between China and USA, followed by China and Australia and China and Canada. Thematic map is used to answer the last research question. Hydrogen production, hydrogen generation and water electrolysis were identified as the motor theme, which are well developed and highly relevant to the research field. Fuel cell, exchange membrane and carbon dioxide are niche themes which are specialized and advanced but not widely connected to the main research field also remain in specialized domains unless their broader relevance increases. Basic themes are foundation and widely integrated but underdeveloped in terms of detailed exploration. Energy storage and hydrogen energy and renewable energy are basic themes and these topics are crucial to the field and provide a base for further research. Green hydrogen is identified as emerging or decline theme, these themes are either emerging area or once losing relevance.

Keywords: Hydrogen Energy, Scientometric Analysis, Global Research Trends, Sustainable Energy