GREEN JOBS BIBLIOMETRIC ANALYSIS FROM JANUARY 2008 TO FEBRUARY 2025

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ABSTRACT

This study analyses the global research trends on green jobs from 2008 to 2025. There are 164 scientific articles about green jobs studied in this study. Scientific articles are sourced from the Scopus database with open and closed access publication categories. VOSViewer was used to analyses research findings using a bibliometric methodology. The results show a downward trend of publications in the green jobs research area starting from the early period where the concept of green jobs began to be popular among researchers and practitioners. The most significant and most frequently used keywords in research related to green jobs are green economy. This research implies the importance of optimizing publications related to green jobs, especially related to job creation that can build ecological and economic resilience in the era of sustainability.

Keywords*: global research trends, green jobs, vosviewer, ecological and economic resilience.*

INTRODUCTION

In the midst of these challenges in the 21st century, climate change and the destruction of nature have become serious and dangerous for the quality of life now and in the future. Adaptation to climate change and efforts to reduce emissions and shift to production and consumption patterns have implications for economic and social development as well as for companies and jobs. As an effort to transform a more sustainable approach in especially in fostering the development of green economy, in June 2007, the ILO Director-General launched the "Green Jobs Initiatives" in its report entitled *Decent work for sustainable development*. The idea of Green Jobs summarizes the transformation of the economy, enterprises, workplaces and labour market towards a sustainable economy that provides decent work for all (van der Ree, 2019).

The definition of green jobs was initially defined in the report entitled *Green Jobs: Towards Decent Work in a Sustainable World and Low Carbon*. The report was funded by UNEP and as part of the Joint UNEP, ILO, IOE, ITUC Green Job Initiative. It was defined as jobs in the agriculture, manufacturing, research and development (R&D), administrative, and service sectors that contribute to the

maintenance or improvement of environmental quality. In particular, it includes work that can help protect ecosystems and biodiversity, reduce energy, materials, and water consumption through high-efficiency strategies, decarbonize the economy, and minimize or prevent the generation of all forms of waste and pollution (Bracarense & Costa, 2022).

In the above report, it is mentioned that green jobs must be decent work, for example good jobs (offering sufficient wages, safe working conditions, job safety, good career prospects, and workers' rights. Jobs that are dangerous, exploitative, fail to pay high wages and make workers live in poverty cannot be said to be green jobs. There are millions of jobs in sectors that nominally support environmental goals, such as the electronic recycling industry in Asia or biofuel feedstock plantations in Latin America, where daily life is portrayed by poor work practices, exposing workers to harmful substances or not prioritizing freedom of association (Vaquero et al., 2021).

This paper is meant to address the limited research on green jobs especially employing bibliometric analysis. The purpose of bibliometric analysis is to summarize a large amount of bibliometric data to present the state of the intellectual structure and current trends of a research topic or field of science. In this study, science mapping was chosen as the main technique of bibliometric analysis where there are elements of citation analysis, bibliographic coupling (Donthu et al., 2021). This bibliometric analysis aims to enrich literature on green jobs especially from the global perspectives by investigating its academic evolution, global research trends and future research directions. Henceforth, this study intents to evaluate the following questions:

1. What is the growth rate of publication in the field of green jobs?
2. What are the most used keywords in the field of green jobs?
3. Which articles are the most cited?
4. Which journals, institutes, and countries have the largest amount of publication and citation in the field of green jobs?
5. What are the future research directions in the field of green jobs?

THEORETICAL REVIEW

Green Jobs Definitions

Green jobs situate jobs in a broader socio-economic transformation driven by the twin-digital-green transition that involves digitalization, decarbonization, and increased skills requirements. Green jobs not only serve to minimize the negative impact of industry on the environment but are also part of a systemic restructuring that reshapes

skills, competencies, and access to jobs (Bianchi et al., 2024).

Vega et al. (2024) defined green jobs as jobs that are shaped by objectives oriented towards the environment and green technology. Green jobs must also meet the elements of decent work determined by the ILO, which emphasizes the risk that green potential alone does not guarantee job quality, especially in the context of high informality.

RESEARCH METHOD

Study design

This study uses a bibliometric method that summarizes in depth the phenomenon of the development of green jobs from the beginning of its emergence from 2008 to 2025. To meet the quality standards of this bibliometric procedure, data collection is preceded by an initial search attempt, namely on November 16, 2024 until June 17, 2025 using the Scopus database as the article pool database until the final pool that has been sorted with inclusion and exclusion criteria which results in 164 articles in the discussion.

Search protocol

Reflecting the study by Bansal et al. (2023), search protocol or search strategy in a bibliometric research involving these following set of mechanism: database identification, data sourcing, Boolean logic approach, exclusion and inclusion criteria, data inspection, and statistical analysis.

Database identification

First of all, in choosing data or articles that are in accordance with the research objectives, researchers consider choosing the Scopus database because of its widely known status in the social sciences (Bonang et al., 2024). In addition, other influencing factors are the breadth of the scope of research related to green jobs.

Data sourcing

During the initial review of the existing literature, various terms such as "*green jobs", "environmental jobs", "sustainability jobs", "eco-jobs", "green-collar jobs", "clean energy jobs", "low-carbon jobs"* were used to present research related to green jobs. At the beginning of the article search on the Scopus database, 164 articles were obtained without using filters in the form of special criteria in the article search.

Boolean logic approach

Boolean provides a strategy for researchers to expand the scope of their research by using "OR" or “AND” to limit their research in article search (Gionfriddo et al., 2024) and at the same time limit irrelevant data (Liu et al., 2025). Boolean also serves to help researchers find articles that provide particular terms, such as *"green jobs"*

whether it is in the article title, abstract, or keywords. These criteria ensure that the categorization of the article emphasizes the core problem issues of the research (Bansal et al., 2023).

Exclusion and Inclusion Criteria

This research is screened through titles and abstracts from the Scopus database where the inclusion criteria include:

1. Articles publication
2. Articles that address green jobs
3. Articles written in English
4. Articles that are published in the final stage of publication
5. Articles that can be accessed in full text
6. Articles published between January 1, 2008 and February 20, 2025
7. Subject areas that consist of environmental science, social sciences, energy, economics, engineering, business and management, biochemistry, agricultural and biological sciences, and earth and planetary sciences.

Meanwhile, the exclusion criteria for this study consist of:

1. Non-articles publication
2. Articles that do not focus on the scope of research on green jobs
3. Articles that are not written in English
4. Articles that are published in other than final stage of publication
5. Articles that are not accessible in full text
6. Articles that are not published between January 1, 2008 and February 20, 2025
7. Subject area outside the discipline of social sciences, energy, economics, engineering, business and management, biochemistry, agricultural and biological sciences, and earth and planetary sciences.

Data inspection

Based on a study by Akudugu & Ogwu (2024), after identification of the relevant articles in the Scopus database, screening is necessary to remove duplicates and avoid double counting. After that, a number of articles are screened and selected to be documented and involved for further analysis. After this screening was carried out, 164 articles were obtained that focused on the theme and scope of green jobs research.

Statistical analysis

Researchers used Microsoft Excel and VOSViewer to analyse the dataset of articles when the data was finalized. The use of Microsoft Excel emphasizes data analysis that contains the number of publications of articles related to green jobs, starting from

the beginning of the concept appearing in the world of global research until today.

Then, the use of VOSViewer produces descriptive statistics in research from an analytical perspective into global research trends and special themes related to the development of green jobs using several algorithm clustering techniques such as co-citation analysis and Bibliographic coupling as a primary co-occurrence technique. In occurrence analysis, it displays similarities between documents, research, and themes by utilizing how some of these units co-occur. The assumption is that there is a positive relationship between the citations of these items and similarities in the content of the discussion. Co-citation analysis offers an overview within the scope of past studies, while bibliographic coupling measures the degree of similarity between two items by counting the number of shared references between the two items (Marzi et al., 2024).

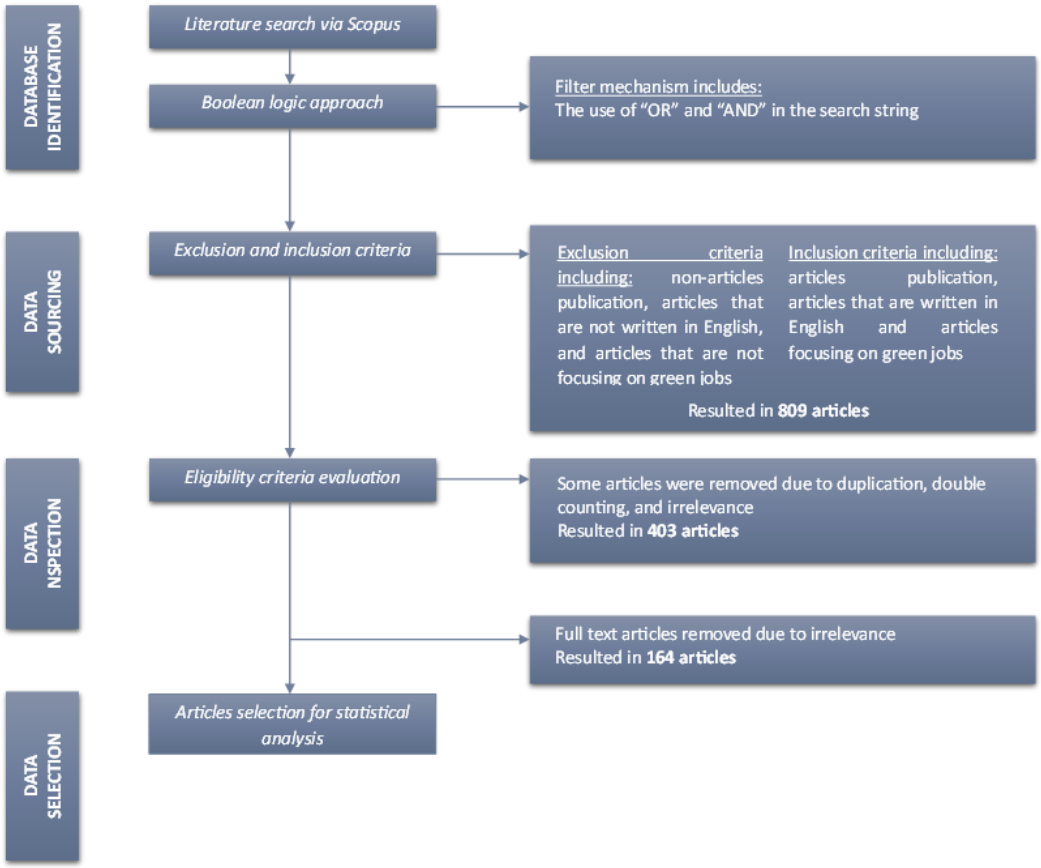

Figure 1: Research flow

Source: Authors' creation (2025)

RESULTS AND DISCUSSION

This study examines the literature on green jobs in recent decades using search strategy dan filter such as Boolean logic, publication year, area of research, type of document, stage of publication, type of source, language used and type of publication access. This study also tries to answer research questions by examining previous studies that help researchers in exploring: 1) the growth rate of publication in the field of green jobs, 2) the most used keywords in the field of green jobs, 3) the articles are the most cited, 4) journals countries and institutes that have the largest amount of publication and citation in the field of green jobs, and 5) the future research directions in the field of green jobs.

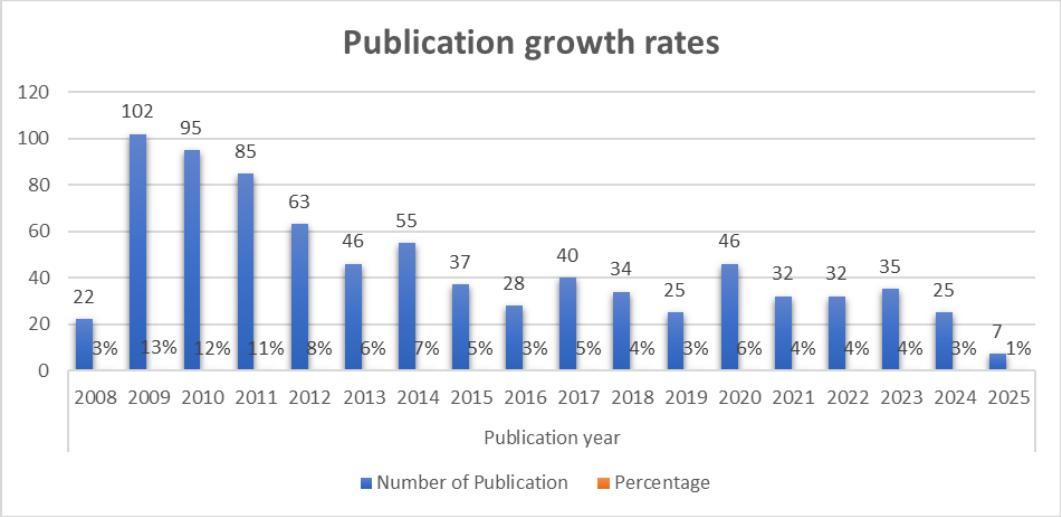

Figure 2: Green jobs theme publication growth rates in 2008-2025

Source: Authors' creation (2025)

Research output by year

The researcher reviewed the development of research with the theme of green jobs from 2008 to 2024. The figure below illustrates a total of 809 article publications produced from 2008 to 2025. In recent decades, a high number of article publications were generated in 2009 which is 102 articles (13%). However, in the previous few years, the number of publications related to green jobs in the all-access category (both close access and open access) experienced an up-and-down process.

The sharp rise in publications occurred from 2008 to 2011, corresponding to the global policy momentum born out of the 2008 financial crisis, when many countries adopted green recovery packages that linked labour markets to low-carbon growth. Initial foundational research, particularly conducted by Bowen and Kuralbayeva (2015) framing green jobs as a labour market response to climate policy, stimulated

substantial academic interest. It reflects efforts to conceptualize green employment, evaluate the potential for employment growth from renewable energy sectors, and determine how environmentally-related regulations affect labour demand. This theme dominated the literature in the early 2010s and is in line with the high volume of publications featured in the figure.

The gradual decline and stabilization of publication activity after 2012 reflects the transition from broad conceptual discussions to more specific exploration of empirical research. During this period, the literature expanded into green skills (Consoli et al., 2016), occupational (Vona et al., 2018), and sector-specific labour impacts (Dechezleprêtre & Sato, 2017). As this research became more interdisciplinary, penetrating from labour economics, energy studies, regional development, and environmental policy, terminology became more diverse, and publications became distributed across disciplines such as clean energy employment, green human capital, and sustainable labour markets. Research conducted by Perruchas et al. (2020) noted that defining inconsistencies and fragmented conceptual frameworks make this field of science more diffuse, which plausibly contributes to the stabilised mid-2010 output reflected in the chart.

The increase in publication volume is in line with the global shift towards net-zero commitments and the surge of green recovery initiatives during the COVID-19 pandemic. Countries increasingly emphasized labour-market transition policies, just transition frameworks, and the creation of resilient low-carbon workforces. The momentum of this policy is reflected in contemporary academic work examining transition risks for workers (Briggs et al., 2022), workforce shortages in renewable sectors (Pearse & Bryant, 2021), and regional labour market vulnerabilities related to decarbonization (Garvey et al., 2022), Up-to-date bibliometrics and systematic reviews (Apostel & Barslund, 2024; Mathieu, 2024) also underlined a sharp increase in studies related to green-skill shortages, policy implementation gaps, and heterogenous national transition pathways, issues related to the second rise in publication intensity in the figure.

Most impactful keywords

The researchers analysed the Scopus database using keywords namely *"green jobs"*, "*environmental jobs"*, *"sustainability jobs"*, *"eco-jobs"*, *"green-collar jobs"*, *"clean energy jobs"*, and *"low-carbon jobs"* to produce a bibliometric study. From a total of 61 keywords generated from the co-occurrence analysis, the 20 most impactful keywords with occurrences and the highest total link strength in the scientific concept of green jobs were obtained. Keyword analysis

was carried out to help understand the dynamics of literature in bibliometric research related to green jobs where VOSViewer identified 20 keywords that are linked to each other which presented in total link strength (see Table 1) and formed a cluster that showed the same colour which indicates a strong relationship between keywords (see figure 2).

Table 1: Most impactful keywords

Source: Authors creation (2025)

Keywords	***Occurrences***	***Total link strength***
Green jobs	*152*	*195*
Green economy	*53*	*95*
Sustainable development	*44*	*79*
Climate change	*50*	*68*
Renewable energy	*43*	*56*
Employment	*31*	*49*
Sustainability	*40*	*43*
Environment	*17*	*36*
Green skills	*20*	*30*
Just transition	*20*	*27*
Policy	*10*	*25*
Circular economy	*16*	*24*
Decarbonization	*9*	*19*
Green growth	*7*	*18*
Energy	*10*	*17*
Green growth	*7*	*18*
Equity	*9*	*17*
Environmental justice	*9*	*16*
Green transition	*10*	*15*
Energy transition	*14*	*14*
Green new deal	*8*	*14*

Figure 3 below depicts a map with the theme of green jobs. This map includes keyword analysis that describes the network analysis for each research domain. Each circle means how often these keywords appear in article publications. The circles also explain the relationships that occur between keywords. The keywords that are most often used in the green jobs literature can be categorized into seven clusters.

1. **Cluster 1 (red)** illustrates the correlation between *"green jobs"* and

"climate change". Stanef-Puică et al. (2022) suggest that the existence of green jobs can help industries to adopt production and service methods that can minimize global warming and irreversible climate change. In addition, green jobs also play a role in solving problems around waste recycling, noise pollution, and improving the overall global ecosystem. In a study conducted by Bohnenberger (2022) explain how green jobs can help the industry in offering products or services that can meet all the needs of the community and still be able to minimize negative impacts on the environment, especially minimizing and improving the impact of climate change. This concept is an output approach of green jobs which is a taxonomy of sustainable employment.

2. **Cluster 2 (green)** illustrates the correlation between *"green jobs"* and *"circular economy"*. The research by Moreno-Mondéjar et al. (2021) supports the findings of the cluster where it is stated that green jobs can grow significantly along with the development of the circular economy due to the existence of business processes, both in terms of products and services that require new knowledge and technological processes and the opening of jobs in accordance with the green sector can encourage the use of green jobs that can be in accordance with the principles of the circular economy. Sulich & Sołoducho-Pelc (2022) support these findings where it is explained that circular economy play an important role in the creation of green jobs especially in ensuring decent work for each individual which is part of the Sustainable Development Goals.

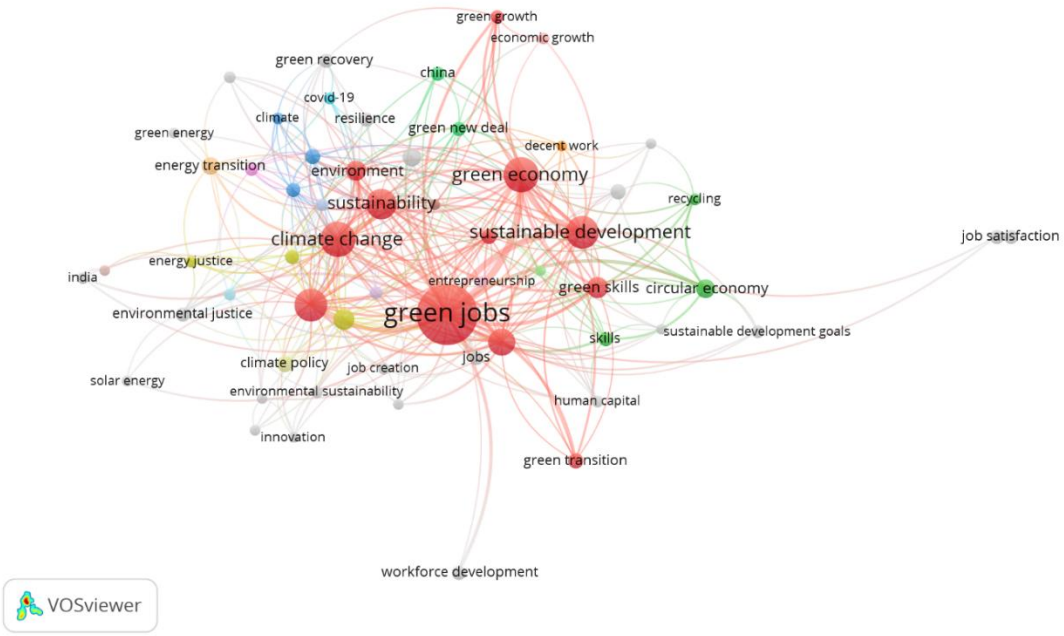

Figure 3: Visualization of author keywords utilizing VOSViewer

Source: Authors' creation (2025)

3. **Cluster 3 (blue)** emphasizing the correlation between *"green jobs"* and "*decarbonization"*. The study conducted by Esteves et al. (2024) explain how decarbonization leads to the creation of job creation, especially green jobs that can help the transition to a net-zero economy. The study also explains how Latin American and Caribbean (LAC) focuses on investing in transformation policies connected to energy production and energy building that have very promising potential value. In addition, the study also explains the labour implications of increased spending on decarbonization initiatives, especially in the American and the Caribbean. Meanwhile, the research conducted by Junod et al. (2024) supports how local decarbonization planning can support the creation of green jobs that can offer local job training for underrepresented communities in the industries, strengthen the prospects of household level economy and achieve decarbonization goals.
4. **Cluster 4 (yellow)** focuses on the correlation between *"green jobs"* and *"energy justice"*. In the study by Healy & Barry (2017), it is mentioned that energy justice is an important part of the political economy of socio-technical energy transitions which will later be related

to the focus of the economic recovery agenda in creating green jobs, especially in the green sector. In addition, a study by Elmallah et al. (2022) also explained that the political economy approach is expected to compensate for the negative social externalities of carbon capitalism (through higher tax payments for fossil-fuel-based sectors) so as to provide a welfare safety net and appropriate compensation for affected people and communities. In the study, it is clearly described how policies related to green jobs must be able to facilitate economic opportunities for each prospective workforce, for example by creating local jobs through the use of workforce development programs, local hiring plans, community benefits and labour agreements. The research also prioritizes the adoption of a rights-based approach that can be a guide for progress not only for the growth of green jobs and the improvement of energy justice but also for the overall green economy.

5. **Cluster 5 (purple)** connects *"green jobs"* with *"China"*. Chen & Bian (2023) pinpoint that China's green economy will create nearly 9 million new jobs by 2030, including green jobs. The plan will be accompanied by the use of renewable resources to strengthen sustainable development in China. Whereas, a study by Ding & Liu (2023) highlight how the creation of green jobs in China are seen as spillover effects and competition affects which can affect the decrease in the amount of pollution and improve the condition of the planet we live on.
6. **Cluster 6 (cyan)** reflects an association between *"green jobs"* and *"COVID-19"*. Lahcen et al. (2020) explained in their study that the workforce greening aspect is one of the economic recovery plans after the emergence of the COVID-19 pandemic where the first step is to open investment opportunities in the construction sector that can increase economic recovery in Belgium. It is also supported by research from van de Ven et al. (2022), where it was concluded that green growth is a post-pandemic agenda in European Union and China whose success is determined by several strategic factors such as strategic management in the investment portfolio which focuses on solar photovoltaics investment.
7. **Cluster 7 (orange)** underlines the relationship between *"green jobs"*

and *"decent work"*. A study by Yakymchuck & Rataj (2024) explains the concept of correlation between these two terminologies, where it is stated that the growth of green jobs supports economic growth and helps the industry develop employment opportunities for individuals to promote the Sustainable Development goals, especially in the realm of social protection and social dialogue in the informal economy sector. Apart from that, a study by Van der Ree (2024) Justifying the above findings where it is explained that Greener Future requires labour policy that supports decent work creation, both in developing, emerging, and advanced economies. The study also uses the definition of green jobs as decent jobs that contribute to the maintenance or improvement of the environment, whether in traditional sectors such as manufacturing and construction or in new sectors such as green sectors (e.g. renewable energy and energy efficiency).

Articles with the highest number of citations

The table below shows a summary of the articles that have the highest number of citations in the green jobs theme from 2008 to 2025. An article written by Yi in 2013 with the theme "Clean Energy Policies and Green Jobs: An Evaluation of Green Jobs in US Metropolitan Areas" took first place with 208 citations. Meanwhile, the article entitled "Varieties of Green Capitalism: Economy and Environment in The Wake of The Global Financial Crisis" written by Tienhaara in 2014 ranked second in the category of articles with the highest citations, namely 201 citations.

Table 2: Journals with the greatest number of article documents and citations

Source: Authors creation (2025)

Source	Area of Research	H-index	Ranking by Scimago	Documents	Citations
Energy policy	Energy and environmental science	272	Q1	33	3701
IEEE access	Computer science,	242	Q1	10	327

	engineering, materials science				
Environmental science and pollution research	Environmental science and medicine	179	Q1	8	264
Energy research and social science	Energy and social sciences	113	Q1	8	150
Energies	Energy, engineering, and mathematics	152	Q1	8	127
Applied energy	Energy, engineering, and environmental science	292	Q1	6	307
Ecological economics	Economics, econometrics and finance, environmental science	248	Q1	6	256
Energy	Energy, engineering, environmental science, and mathematics	251	Q1	6	202
Energy economics	Economics, econometrics, and finance, and energy	210	Q1	6	202
Geoforum	Social sciences	141	Q1	6	195
Environment, development and sustainability	Economics, econometrics, and finance, environmental science, and social sciences	82	Q1	5	116
Climate policy	Earth and planetary science,	85	Q1	5	24

	environmental science

World's most acclaimed journals

The table below is a collection of journals that produced the highest number of documents and citations with the theme of green jobs from 2008 to 2025. Energy policy, which is Q1 of a journal that contains articles with the area of energy and environmental science, produced the most article documents, namely 33 documents with a total of 3701 citations. Meanwhile, IEEE access occupies the second position with the number of documents as many as 10 articles and citations as many as 327 citations.

Table 3: World's most notable publication with highest number of citations

Source: Authors' creation (2025)

Author/year	Title	Citations	Findings
Yi (2013)	Clean energy policies and green jobs: An evaluation of green jobs in US metropolitan areas	208	The study finds that state clean energy policies and local climate actions positively impact the creation of green jobs.
Tienhaara (2014)	Varieties of green capitalism: economy and environment in the wake of the global financial crisis	201	Different proposals for green economic initiatives reveal varying approaches to capitalism and government regulation, fostering deeper discussions on sustainable economic solutions in developed countries.
Kozar et al. (2022)	Green jobs in the EU Renewable Energy Sector: Quantile Regression Approach	50	An escalation in research and development within the renewable energy sector positively impacts the creation of green jobs.
Hoque et al. (2019)	Environmental Life Cycle Assessment of Alternative Fuels for Western Australia's Transport Sector	36	Electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs) possess the potential to mitigate greenhouse gas (GHG)

emissions, fossil fuel depletion (FFD), and water consumption (WC) impacts in comparison to gasoline, primarily attributable to reduced tailpipe emissions and the utilization of cleaner electricity sources.

World's most notable institutions

Based on table 4 below, the Department of Advanced Research in Management, Faculty of Business Management, Wroclaw University ranks first in the most research category, namely 4 document articles with 66 citations. Meanwhile, The Centre for Environmental Policy, Imperial College, London ranks last in this category, with 3 document articles and 25 citations.

Table 4. World's Leading Institutions with the highest number of articles publication and citations. Source: Authors' creation (2025)

Organizations	Documents	Citations
Department of advanced research in management, faculty of business management, Wroclaw university of economics and business, Poland	4	66
Schulich school of business, York university, Toronto	4	66
Basque centre for climate change, Leioa, Spain	3	35
Grantham institute for climate change and the environment, imperial college	3	35
Centre for environmental policy, imperial college, London, United Kingdom	3	25

Countries with the number of documents, citations, and research collaboration

Based on the data below, the 10 countries mentioned produced the highest number of research articles, citations, and research collaborations (shown in total link strength) in the green jobs research area. The United States has the highest number of documents, namely 191 documents with 6021 citations and a total link strength of 5901. Meanwhile, Greece is the country with the lowest number of article documentation, citations, and research collaboration, namely 9 articles, 116 citations and a total link strength of 2135.

Table 5: Top 10 countries by publications

Source: Authors' creation (2025)

Country	Documents	Citations	Type of Economy	Total link strength
United Kingdom	74	3362	Developed	6204
United States	191	6021	Developed	5901
Italy	40	1148	Developed	3968
Spain	26	1091	Developed	3116
China	60	1961	Developing	2915
Switzerland	17	381	Developed	2640
France	17	963	Developed	2615
Greece	9	116	Developed	2135
Germany	21	832	Developed	2111
Canada	30	1187	Developed	2052

Research collaboration between countries

In the theme of green jobs (see figure 3 below) contains 6 main clusters where the cluster displays a collection of countries that collaborate in writing scientific articles with the theme of green jobs where the size of each circle in the country reflects the intensity of the number of published articles.

1. **Cluster 1 (red)** comprises of Australia, China, India, Iran, Ireland, Japan, Malaysia, South Africa, Taiwan, Thailand, Viet Nam.
2. **Cluster 2 (green)** comprises of Brazil, France, Germany, Italy, Netherlands, Norway, Pakistan, Portugal, Spain.
3. **Cluster 3 (blue)** comprises of Belgium, Canada, Finland, Greece, Lithuania, Poland, Turkey, and United Kingdom.
4. **Cluster 4 (yellow)** comprises of Czech Republic, Denmark, Mexico, Romania, Sweden, and Switzerland.
5. **Cluster 5 (purple)** comprises of Austria, Egypt, and Saudi Arabia.
6. **Cluster 6 (cyan)** comprises of South Korea and United States.

CONCLUSION

This study provides new insights into the progress of the global literature on green jobs from 2008 to the present. Bibliometric analysis was used in this study and produced a sample of 164 publication articles in recent decades. In the analysis carried out, it was found that in 2009, articles with the theme of green jobs experienced a significant increase, namely 102 publication articles.

But unfortunately, it has experienced ups and downs in the number of publications until now.

The most significant and most frequently used keywords in research related to green jobs are green economy (Gregson et al., 2016; Montt et al., 2018; O'Gorman, 2014; Tănasie et al., 2022) and sustainable development (Al-Shetwi, 2022; Cruickshank & Fenner, 2007; Filho, 2011; Mensah, 2019; Tosun & Leininger, 2017) with a total occurrence of 97 which means that these two keywords have been mentioned 97 times in various research publications. The article titled *"Clean Energy Policies and Green Jobs: An Evaluation of Green Jobs in US Metropolitan Areas"* published in 2013 received the highest number of citations in the last decade with a total of 208 citations. The energy policy journal, with a specialization in energy and environmental science area research, was ranked first for the journal that published the most articles with the theme of green jobs, namely 33 documents and 3701 citations.

At the institutional level, the Department of advanced research in management, faculty of business management, Wroclaw University of Economics and Business, Poland and Schulich School of Business, York University Toronto have a balanced score by achieving the category of the highest number of articles and citations in the global ranking, namely 4 documents and citations with a total of 66. In addition, the country with the highest number of article documents was obtained by the United Kingdom with a total of 191 documents, citations of 6021. Meanwhile, in terms of total link strength using bibliographic coupling method, United Kingdom ranked first for the country with the highest international research collaboration, with a score of 6204.

This study enriches the current literature and provides guidance for future research. By using bibliometric analysis, it presents science mapping which includes keyword analysis, citation analysis, and bibliographic coupling analysis. However, despite a rich variety of analysis themes presented in the study, the researchers acknowledge several limitations presented in the study, some of which are: 1) single source database, namely by only using the Scopus Database and not using other databases that provide a broader point of view, idea or research, theme, 2) research only uses scientific articles in analysis, does not involve ideas from books and conference proceedings, 3) the use of bibliometric analysis alone without other scientific approaches such as qualitative surveys with experts that can help present more in-depth research data, 4) the use of Boolean logic that may not cover the research theme comprehensively.

Based on the limitations of the research that has been discussed. Proposed future research agendas that can help meet existing research gaps, including:

1. **Combining two or more literature database**

   According to a study by Kumpulainen & Seppänen (2022), a systematic approach to bibliometrics is needed to minimize biased views from researchers when conducting literature reviews. By combining datasets obtained from two or more literature databases (i.e. through the process of converting Scopus citation data into a form that is in accordance with citation data from the Web of Science), helps to achieve a more systematic bibliometric analysis. To achieve this goal, computer-based data processing is needed known as "data wrangling" where the software used is Microsoft Excel and Notepad++.

2. **Using more scientific data to accelerate bibliometric analysis**

   Future researchers can conduct bibliometric analysis using books, book chapters, conference proceedings to present a more comprehensive scientific perspective that can capture the current state at global level (Martins et al., 2024).

3. **Performing bibliometric analysis along with qualitative interviews**

   Qualitative interviews can be conducted to compare the results of bibliometric studies with facts in the field. After the two research approaches were carried out, the researcher was able to crossmap the bibliometric findings with the results of the interview (Saif & Purbasha, 2023).

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