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Green Innovation in Young Entrepreneurship: A Global Bibliometric Study

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ABSTRACT

This study presents a global bibliometric analysis of "Green Innovation in Young Entrepreneurship" to explore the intersection of sustainability, entrepreneurship, and youth education. Through keyword co-occurrence, co-authorship, and citation network analyses, the study highlights the increasing academic focus on the role of young entrepreneurs in driving sustainable innovation. The research identifies key themes such as "green entrepreneurship," "sustainable development," and "entrepreneurship education," revealing a growing body of literature that emphasizes the importance of educating young entrepreneurs to address global environmental challenges. Despite significant progress in this research domain, challenges remain, particularly in integrating training and e-learning systems into the entrepreneurial ecosystem. The study underscores the need for a more inclusive and diverse approach to support young entrepreneurs, especially in emerging economies, as they contribute to building a sustainable future.

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1. INTRODUCTION

In recent decades, the global economy has faced increasing pressure to balance economic growth with environmental sustainability [1]. Climate change, resource depletion, and environmental degradation have intensified the need for innovative solutions that promote sustainable development. Within this context, green innovation has emerged as a critical mechanism for addressing environmental challenges while maintaining economic competitiveness [2], [3]. Green innovation refers to the development of new or improved products, processes, and business models that reduce environmental impacts, enhance resource efficiency, and contribute to long-term ecological balance [4]. As sustainability becomes a strategic priority worldwide, green innovation is no longer confined to large corporations but increasingly driven by entrepreneurial activities [5].

Entrepreneurship plays a pivotal role in fostering innovation and economic

transformation. Young entrepreneurs, in particular, have gained attention for their capacity to introduce novel ideas, adopt emerging technologies, and respond rapidly to market and societal changes [6]. Compared to established firms, young entrepreneurial ventures are often more flexible, risk-tolerant, and open to experimentation, making them well-positioned to implement environmentally friendly innovations [7], [8]. Furthermore, younger generations tend to exhibit stronger environmental awareness and sustainability-oriented values, which influence their entrepreneurial motivations and strategic decisions. As a result, young entrepreneurship has become an important driver of green innovation across various industries and regions [9].

The globalization of markets and knowledge has further amplified the significance of green innovation in young entrepreneurship [10]. Advances in digital technologies, international collaboration, and open innovation platforms have enabled young entrepreneurs to access global networks, share knowledge, and scale sustainable solutions beyond local contexts [11]. At the same time, international policy frameworks such as the Sustainable Development Goals (SDGs) have encouraged governments, academic institutions, and funding agencies to support green entrepreneurial initiatives [12], [13]. These global dynamics have led to a growing body of scholarly research examining the intersection of green innovation, entrepreneurship, and sustainability from diverse disciplinary perspectives, including economics, management, environmental studies, and innovation policy [14].

Despite the expanding literature, research on green innovation in young entrepreneurship remains fragmented. Studies vary widely in terms of theoretical foundations, methodological approaches, geographic focus, and key themes. Some scholars emphasize technological innovation and eco-efficiency, while others focus on social entrepreneurship, institutional factors, or policy interventions. Additionally, empirical evidence is dispersed across journals and regions, making it difficult to identify dominant research trends, influential authors, collaborative networks, and emerging topics. This fragmentation limits the ability of researchers and policymakers to develop a comprehensive understanding of how green innovation evolves within young entrepreneurial ecosystems on a global scale.

Bibliometric analysis offers a systematic and objective approach to mapping and evaluating the intellectual structure of a research field. By analyzing publication patterns, citation networks, keywords, and authorship collaborations, bibliometric methods enable researchers to identify knowledge clusters, research frontiers, and temporal trends [15]. In recent years, bibliometric studies have been widely applied to sustainability-related topics, including green technology, circular economy, and sustainable entrepreneurship. However, a focused global bibliometric investigation that specifically examines green innovation in young entrepreneurship is still limited. Such an analysis is essential to synthesize existing knowledge, highlight research gaps, and guide future scholarly inquiry.

Although green innovation and young entrepreneurship are increasingly recognized as crucial contributors to sustainable development, the existing literature lacks a comprehensive and integrated overview of this research domain at the global level. Prior studies tend to address green innovation or entrepreneurship separately, or they focus on specific countries, industries, or case studies. Consequently, there is insufficient understanding of the overall evolution, thematic structure, and intellectual foundations of green innovation research within the context of young entrepreneurship. The absence of a systematic bibliometric assessment makes it challenging to identify influential contributions, collaboration patterns, and emerging research directions, thereby limiting the strategic development of theory, practice, and policy in this field. The objective of this study is to conduct a global bibliometric analysis of

research on green innovation in young entrepreneurship.

2. METHODS

This study adopts a bibliometric research design to systematically analyze the global scholarly literature on green innovation in young entrepreneurship. Bibliometric analysis is a quantitative method that examines patterns in academic publications to evaluate the development, structure, and dynamics of a research field. It enables the identification of influential publications, authors, journals, institutions, and countries, as well as the detection of thematic evolution and intellectual linkages over time. This approach is particularly suitable for synthesizing large volumes of literature in emerging and interdisciplinary domains such as green innovation and entrepreneurship, where research outputs are dispersed across multiple disciplines.

The data for this study were retrieved from Scopus Database. A structured search strategy was employed using a combination of keywords related to green innovation (e.g., "green innovation," "eco-innovation," "environmental innovation") and young entrepreneurship (e.g., "young entrepreneurs," "youth entrepreneurship," "startup," "new ventures"). To ensure the relevance and quality of the dataset, only journal articles published in English were included, while conference papers, book chapters, and non-academic documents were excluded. The search results were further refined through screening of titles, abstracts, and keywords to remove irrelevant records and duplicates.

Data analysis was conducted using VOSviewer that support performance analysis and science mapping techniques. Network analysis methods, including co-authorship, co-citation, and keyword co-occurrence analysis, were applied to visualize collaboration patterns and identify major research themes and knowledge clusters.

3. RESULTS AND DISCUSSION

3.1 Keyword Co-Occurrence Network

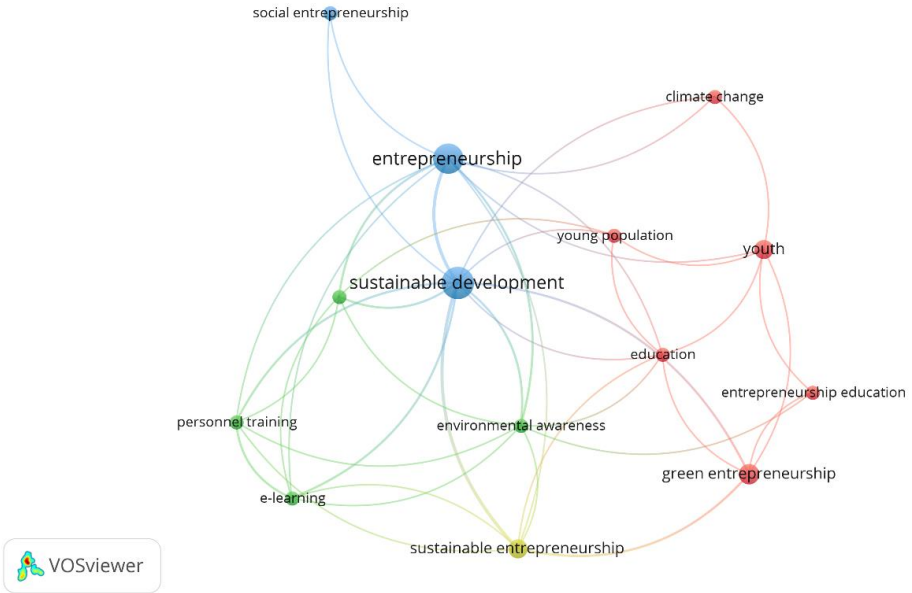

Figure 1. Network Visualization
Source: Data Analysis Result, 2026

Figure 1 represents the bibliometric analysis of keywords related to the field of "Green Innovation in Young Entrepreneurship" with an emphasis on

sustainable development. The visualization reveals how various topics and concepts are interconnected in the global research landscape. The most prominent nodes in the network are labeled "entrepreneurship," "sustainable development," and "youth," which highlight the core themes around which the research on young entrepreneurship and green innovation revolves.

The "entrepreneurship" cluster, represented in blue, shows a strong connection with other topics such as "sustainable development," "social entrepreneurship," and "green entrepreneurship." This indicates that the entrepreneurial activity being studied is closely tied to sustainability and environmental issues. "Green entrepreneurship" specifically appears as a key subset, indicating the focus on environmentally conscious entrepreneurial ventures. Additionally, the connection to "climate change" and "environmental awareness" emphasizes that the research is increasingly addressing the global environmental challenges through entrepreneurial solutions.

The "youth" cluster, located in the upper-right section and depicted in red, illustrates a focus on young people, their education, and their involvement in entrepreneurial endeavors. Terms like "young population," "youth," "entrepreneurship education," and "education" are all linked in this area, demonstrating that the intersection of youth and entrepreneurship education is a key topic in the research. This connection reflects a growing interest in nurturing the next generation of entrepreneurs with an understanding of sustainability and social responsibility, and equipping them with the necessary skills to address the challenges of climate change.

The "sustainable development" cluster, situated centrally in the network, is linked to various dimensions such as "personnel training," "e-learning," and "sustainable entrepreneurship." This highlights the broader concept of sustainable development that encompasses not just entrepreneurship but also the systems, education, and capacity-building needed to foster sustainable practices. It suggests a growing body of research aimed at exploring how training and education can empower entrepreneurs to pursue innovative solutions that contribute to long-term societal and environmental benefits.

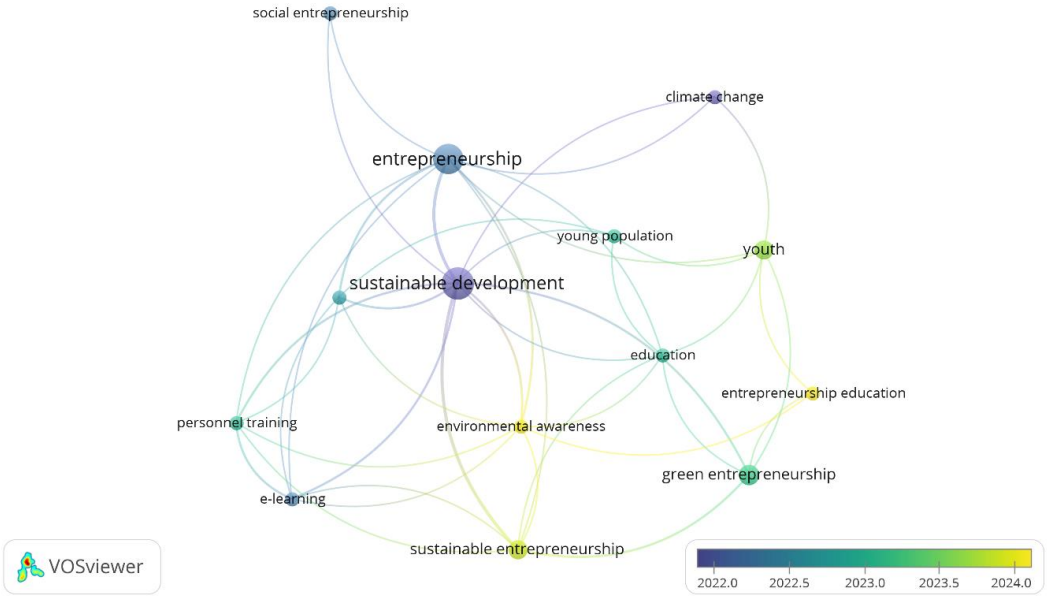

Figure 2. Overlay Visualization

Source: Data Analysis Result, 2026

Figure 2 offers insights into the temporal trends in research related to "Green Innovation in Young Entrepreneurship." The color gradient, ranging from blue (2022) to yellow (2024), reveals how certain topics have evolved over time. It is evident that research in the areas of "entrepreneurship," "sustainable development," and "green entrepreneurship" is growing, as indicated by the warmer colors associated with these keywords. This suggests that there has been an increasing focus on green and sustainable entrepreneurship, with research expanding in the last couple of years.

The keywords "education," "youth," and "entrepreneurship education" show a noticeable concentration of more recent studies, represented by yellow and light green shades. This points to a surge in interest around equipping young entrepreneurs with the tools and knowledge to engage in sustainable practices. The strong connection between "youth" and "education" further highlights the growing emphasis on fostering entrepreneurial skills in younger populations, particularly those who will be tasked with addressing future global challenges, such as climate change.

On the other hand, topics like "personnel training," "e-learning," and "environmental awareness" still appear in the early phases of the timeline (2022–2023), suggesting that these areas are gradually gaining attention but have not yet reached the same level of research intensity as the central themes. These findings underscore the importance of building a comprehensive educational ecosystem for young entrepreneurs, blending traditional and innovative learning approaches with a clear focus on sustainability and environmental impact.

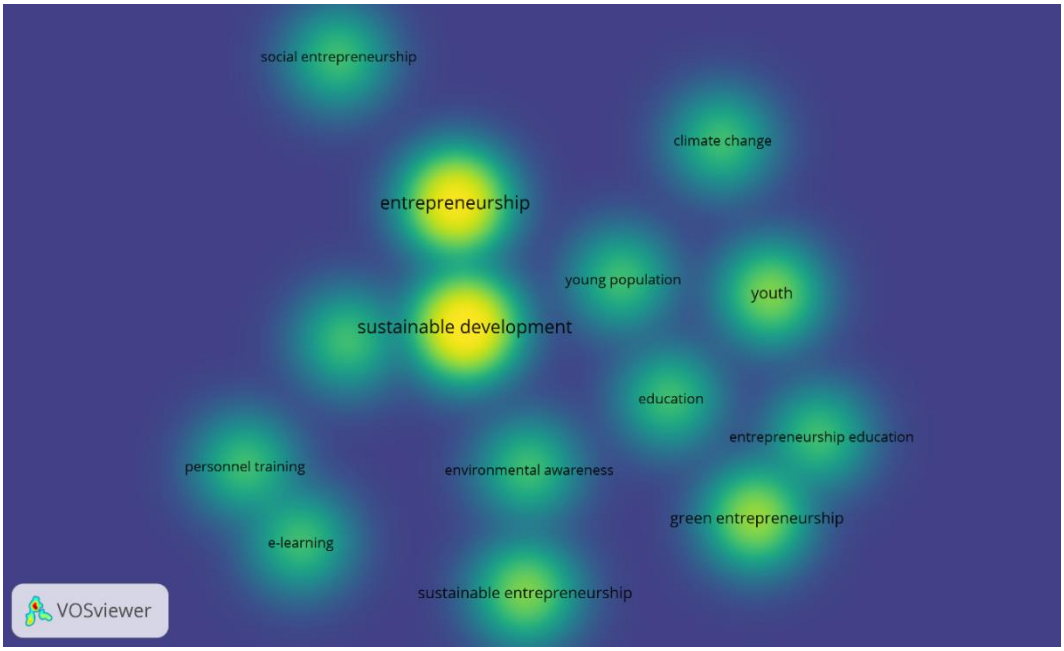

Figure 3. Density Visualization
Source: Data Analysis Result, 2026

Figure 3 highlights the intensity of research focus across various keywords related to "Green Innovation in Young Entrepreneurship." The central nodes, "entrepreneurship" and "sustainable development," are the most concentrated areas, showing their dominant role in current research. These areas are surrounded by highly connected terms such as "green entrepreneurship," "youth," and "education," indicating that these concepts are closely intertwined. The vibrant yellow and green clusters around these keywords emphasize their strong research presence, particularly in the intersection of entrepreneurship with sustainability and youth engagement.

Meanwhile, terms like "personnel training," "e-learning," and "environmental awareness" appear in more peripheral regions, with lower heat intensity. These keywords suggest growing interest but not yet at the same scale as the core themes. The visualization reflects the increasing importance of integrating sustainability into entrepreneurship education and the growing role of youth in addressing global environmental challenges through entrepreneurial efforts. The research focus continues to shift toward nurturing the next generation of green entrepreneurs through education, training, and awareness initiatives.

3.2 Co-Authorship Network

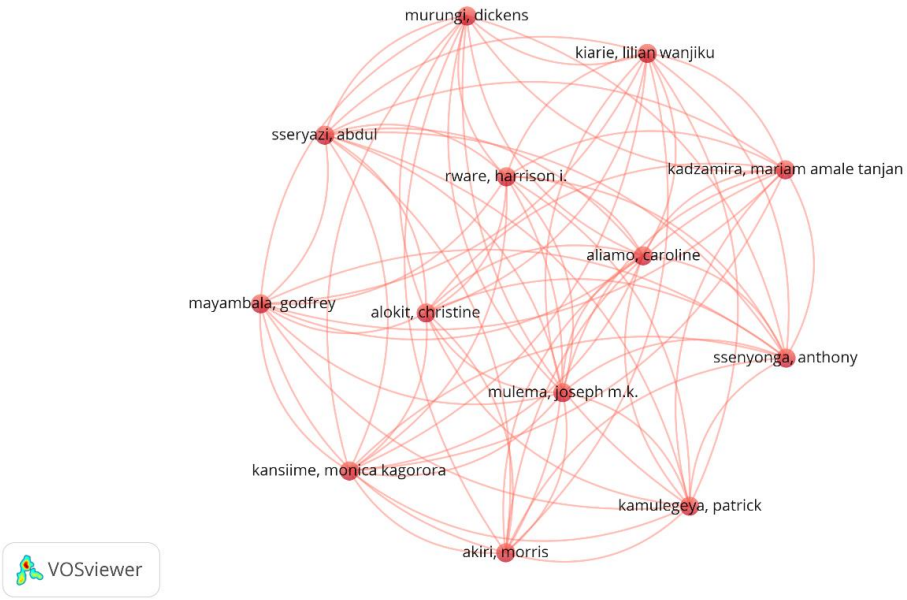

Figure 4. Author Collaboration Visualization
Source: Data Analysis Result, 2026

Figure 4 shows the co-authorship relationships between various researchers, as indicated by the connected lines between their names. The dense cluster in the center, which includes researchers like "Murungi, Dickens," "Kiari, Lilian Wanjiku," and "Rwache, Harrison I.," suggests that these individuals have frequently collaborated with others in the network. The overall structure indicates a highly collaborative research community, with many authors working together on shared projects or topics. The interconnectedness of the authors may reflect a tight-knit research group or a common area of study, highlighting how collaboration spreads across the network. The nodes are linked in a web of interrelationships, which underscores the collaborative nature of their academic work.

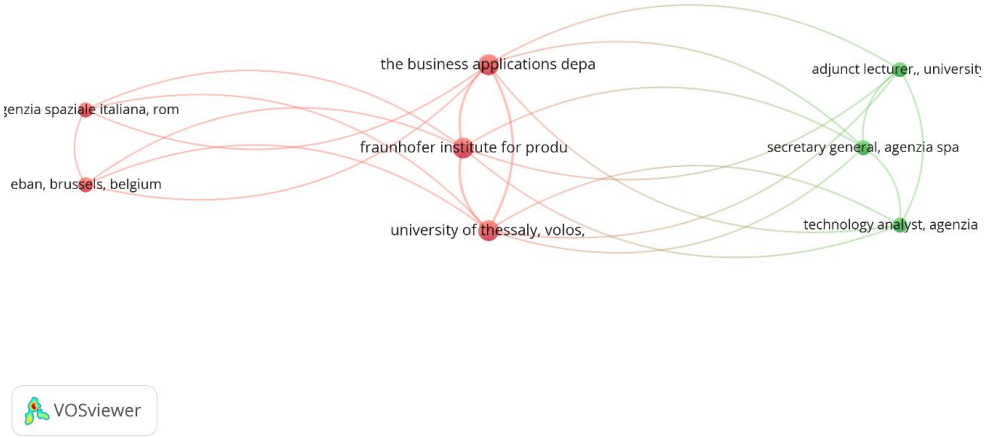

Figure 5. Affiliation Collaboration Visualization
Source: Data Analysis Result, 2026

Figure 5 illustrates the professional relationships among various institutions and individuals, focusing on their connections through research or collaborations. The nodes on the left, such as "Agenzia Spaziale Italiana" and "EBAN, Brussels, Belgium," are linked with others like the "Fraunhofer Institute for Production" and the "University of Thessaly, Volos," which shows collaborations between these institutions. The green nodes on the right, such as "Adjunct Lecturer, University" and "Technology Analyst, Agenzia SPA," signify individuals or positions connected with more specialized roles in technology and academia. The red connections indicate the strength of co-authorship or collaborative ties, and the green connections highlight roles or positions that engage with these institutions in different contexts, such as through academic or technological analysis. This visualization shows a diverse network of academic and professional collaborations spanning different sectors, including space research, technology, and higher education.

Figure 6. Country Collaboration Visualization
Source: Data Analysis Result, 2026

Figure 6 illustrates the connections between countries based on a bibliometric or collaborative research network. The nodes represent different countries, with Saudi Arabia, Pakistan, China, and the United Kingdom forming the key nodes in the network. The varying colors, ranging from red for Saudi Arabia, blue for Pakistan, yellow for China, to green for the United Kingdom, likely indicate the time periods or intensity of research activity linked to each country. The connections between these countries suggest some level of collaborative work or shared focus in research. Notably, China appears as a central node connecting with several other countries, which may reflect its significant role in global research collaborations, while Saudi Arabia and Pakistan are more closely clustered. This visualization highlights the research or collaboration ties between these nations, with a particular emphasis on the role of China in connecting with others.

3.3 Citation Analysis

Table 1. Top Cited Research

Citations	Authors and year	Title
75	[16]	Entrepreneurs and environmental sustainability in the digital era: Regional and institutional perspectives
52	[17]	Linking green and sustainable entrepreneurial intentions and social networking sites; the mediating role of self-efficacy and risk propensity
34	[18]	Youth Awareness and Attitudes towards a Circular Economy to Achieve the Green Deal Goals
29	[19]	Perceptions of young entrepreneurial aspirants towards sustainable entrepreneurship in Pakistan
27	[20]	Entrepreneurship education and business and science students' green entrepreneurial intentions: The role of green entrepreneurial self-efficacy and environmental awareness
19	[21]	Greening ambitions: exploring factors influencing university students' intentions for sustainable entrepreneurship
19	[3]	The role of green entrepreneurship in understanding indonesia economy development sustainability among young adults
18	[22]	Feeding young people to the social investment machine: The financialisation of public services
18	[23]	Project BBChina: A new master program in three Chinese universities on bio-based circular economy; from fields to bioenergy, biofuel and bioproducts
15	[24]	Academic Entrepreneurial Support, Social Capital, and Green Entrepreneurial Intention: Does Psychological Capital Matter for Young Saudi Graduates?

Source: Scopus, 2026

Discussion

The findings highlights the increasing intersection of youth, sustainability, and entrepreneurship in global research. The visualizations and keyword network analyses reveal a growing academic focus on green entrepreneurship, particularly as it relates to young populations. Central to this research is the role of education in fostering entrepreneurial skills that emphasize sustainability and environmental consciousness. The network connections between terms such as "youth," "education," and "green entrepreneurship" suggest that research is increasingly directed at preparing the next generation of entrepreneurs to address the global environmental challenges, such as climate change. This focus on education and training underlines the importance of equipping young entrepreneurs with the tools necessary to drive green innovation and sustainable business practices.

Further, the connection between "sustainable development" and "entrepreneurship" in the research landscape underscores the recognition of entrepreneurship as a key driver of sustainable solutions. As seen in the bibliometric analysis, the collaborative research across multiple nations, particularly in regions like China, Saudi Arabia, and the United Kingdom, signals a growing global awareness of the need for sustainable entrepreneurial models. Research on "sustainable entrepreneurship" and "green entrepreneurship" has become a prominent area, with a clear emphasis on how entrepreneurship can contribute not only to economic growth but also to environmental stewardship and social responsibility. This suggests that the academic community is increasingly seeing entrepreneurship as a powerful tool to promote both economic and environmental sustainability.

However, while the network analysis points to a clear upward trajectory in research on green innovation and entrepreneurship, some challenges remain. The peripheral positioning of terms like "personnel training" and "e-learning" suggests that while these topics are gaining attention, they are not yet as central to the discourse as other themes. This indicates that there is still a need for further integration of educational frameworks that focus specifically on training young entrepreneurs in sustainable practices. Moreover, the gap in research between developed and developing regions highlights the need for more inclusive and diverse research that incorporates the unique challenges and opportunities faced by entrepreneurs in different global contexts. Moving forward, there is a clear opportunity for researchers to delve deeper into how educational systems and entrepreneurial ecosystems can better support the development of green businesses, particularly in emerging economies.

4. CONCLUSION

This bibliometric study on "Green Innovation in Young Entrepreneurship" reveals a growing academic focus on the intersection of sustainability, entrepreneurship, and youth education. The research highlights the vital role of young entrepreneurs in driving sustainable business practices and the increasing importance of equipping them with the necessary skills through educational frameworks that emphasize green innovation. As the global research landscape expands, key themes such as "green entrepreneurship" and "sustainable development" have gained prominence, signaling a shift towards more environmentally-conscious entrepreneurial models. However, challenges remain, including the need for stronger integration of training and e-learning systems into the entrepreneurial ecosystem, particularly in emerging economies. Overall, this study underscores the importance of fostering a global collaborative approach to support young entrepreneurs in addressing environmental challenges and contributing to a more sustainable future.

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