

## **Green Finance And Green Sukuk As Environmental Responsibility: Current Issues And Future Challenges**

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### **Abstract**

This study attempted to find out the research development in the field of green finance and green sukuk as environmental responsibility, especially in Scopus indexed journal using PoP devices. This research conducted bibliometric methods using VOS viewer. The results indicated that the year of research publication, from 2010 to 2022, shows the growth in the number of research publications. The highest number of articles published in 2020 with total publication of 38 articles. This number is quite higher compared to the previous five years. In early 2010, research on green finance and green sukuk as environmental responsibility was less fascinating for researchers to review since there were only 4 research articles published and indexed by Scopus. Topics that still rarely discussed are related to green finance and green sukuk, such as energy, strategy, carbon emission, role, company, financial performance, country and others. The researchers who contributed the most in the field of green finance and green sukuk namely; Azhgaliyeva D (3 articles), Bergset L, Morea D, Naeem Ma, Su Y, Taghizadeh-Hesary F, Yin W, Yuan H, Zhang D, Agyabeng-Mensah Y and Zhang Y. Each of the researcher contributed 2 research articles respectively. Future research should explore the impact of government policies, the role of technology, and the integration of ESG factors in green finance and sukuk.

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## **Introduction**

Within a decade, the concept of green finance has become a very important financial concept in a country. In general, the concept of green finance is one of the financial instruments that is focused on financing the projects related to environment, sustainable development and green economy transformation which are aimed to maintain climate change and lower carbon. Green bond has become a globally trending instrument to finance green infrastructure such as low-carbon transportation, renewable energy and green

buildings. This is what developing countries do to promote green bonds as a green financial instrument (Liu and Lai 2021).

Geographical conditions is one of the foundations of green finance mechanisms to be able to solve environmental and climate problems (Bracking 2015). However, there has been criticism regarding green financial instruments, because they are considered to mimicked other financial instruments and do not contribute to environmental benefits (Bracking 2019). Countries with a majority Muslim population are also developing sukuk into green financial instruments, currently known as green sukuk. This Islamic green financial instrument is similar to green bonds but the mechanism is in accordance with Islamic law and regulations (Latif et al. 2021).

Several countries that have developed green sukuk into green financial instruments such as Indonesia, Bahrain, Malaysia, United Arab Emirates, Brunei Darussalam, Qatar, State of Saxony Anhalt-Germany and Pakistan. This program is in line with the program to reduce carbon emission and its practice is also focused on infrastructure that supports the environment, such as potential projects used as underlying assets should meet the green infrastructure criteria (Nugroho, 2022).

Infrastructure from the agricultural sector such as the construction of reservoirs, irrigation, and hydropower plants has the potential to be categorized as green infrastructure because it supports the sustainable water management, reduces the use of groundwater for agriculture, and increases the use of non-fossil renewable energy (Hariyanto 2017).

Because it is considered very important, research on green finance and green sukuk has been carried out by many researchers both in Indonesia and abroad. Thus, in this article, researchers will explore how the development of research on the field of green finance and green sukuk as current environmental responsibility and the direction of future research with bibliometric analysis using the VOSviewer tool. This research will describe the research map on green finance and green sukuk. So that it helps further researchers to determine topics of discussion that are rarely or less explored by previous researchers regarding green finance and green sukuk.

## **Research Methods**

This study conducted quantitative research methods and descriptive research approaches of the bibliometric analysis by outlining the results of the research related to the research topics have been written by researchers, which is associated to the development of green finance and green sukuk as environmental responsibility from 2010 to 2022.

The research subjects are the journals that have been indexed by Scopus and published since 2010 to October 2022. With the topic of the article "green finance," / "green sukuk" / "environmental responsibility".

The research data was obtained through the default bibliometric application, namely Publish or Perish (PoP) and VOSviewer. In the process of data analysis, each step has a result and a systematic map is the final result of the mapping process. The table below will illustrate the process of mapping and searching for data online on the Publish or Perish electronic database (Rahman et al. 2020) (Rusydia, Sanrego, and Rahayu 2021).

**Table 1.** Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Type	Indexed in journal/conference	Not indexed in journal/conference
Language	English	Other than English
Period	2010 to 2022	Other than 2010 to 2022
Country	All Countries	Other than country
Topic	Green finance, green sukuk, environmental responsibility	Other topics

## Review of Related Literature

### Green Sukuk

In recent years, green sukuk, as a financing product has been published with a reconsideration of the subsidy system and a financing tool that expands the examination of various existing social and financial models from the side of the Islamic economy. Green Sukuk is a breakthrough financial instrument proposed in accordance with Islamic law as a response to the increasingly uncertain development of a green economy (Morea and Poggi 2017).

### Green Finance

Green finance refers to financial investments that flow into sustainable development projects and initiatives, environmental products and policies that promote more sustainable development of the economy. Green finance includes climate-related financing. Besides, it also refers to a wider range of other environmental objectives such as industrial pollution control, water sanitation, or biodiversity protection. (Rusydziana et al. 2021) Mitigation and adaptation financing is specifically related to climate change-related activities: mitigation finance flows refer to investments in projects and programs that contribute to reducing or avoid greenhouse gas (GHG) emissions while adaptation finance flows refer to investments that contribute to reducing the vulnerability of goods and services. people to the impacts of climate change (Höhne et al. 2012).

### Bibliometric and VOSviewer

Bibliometrics was introduced by Pritchard, Nalimov and Mulchencko around 1969 Bibliometrics is a study of science that existed since the 1980s and included in the field of Library Science, but over time this science can be applied and studied in all fields (Rohanda and Winoto 2019).

Bibliometrics is a mathematical method or method that functions and is used to identify academic publications related to citations and scientific matters and intended for use in libraries or other fields (Daulay 2018) (Gaviria-Marin, Merigo, and Popa 2018). Meanwhile, according to Pattah, bibliometrics belongs to a descriptive study method and is seen from the authorship pattern used to determine the gender of the author, type of work, level of collaboration, productivity of the institution where he works, and as the subject of the article (Husaebah 2013) (Fellnhofer 2019).

VOSviewer is a software to build and visualize bibliometric networks such as journals, titles, authors, authors, publications, etc. In addition, VOS viewer is also capable of mapping various types of bibliometric analysis, generating the main bibliographic database, advanced visualization with visual labeling (Eck and Ludo Waltman 2010).

### Result and Discussion

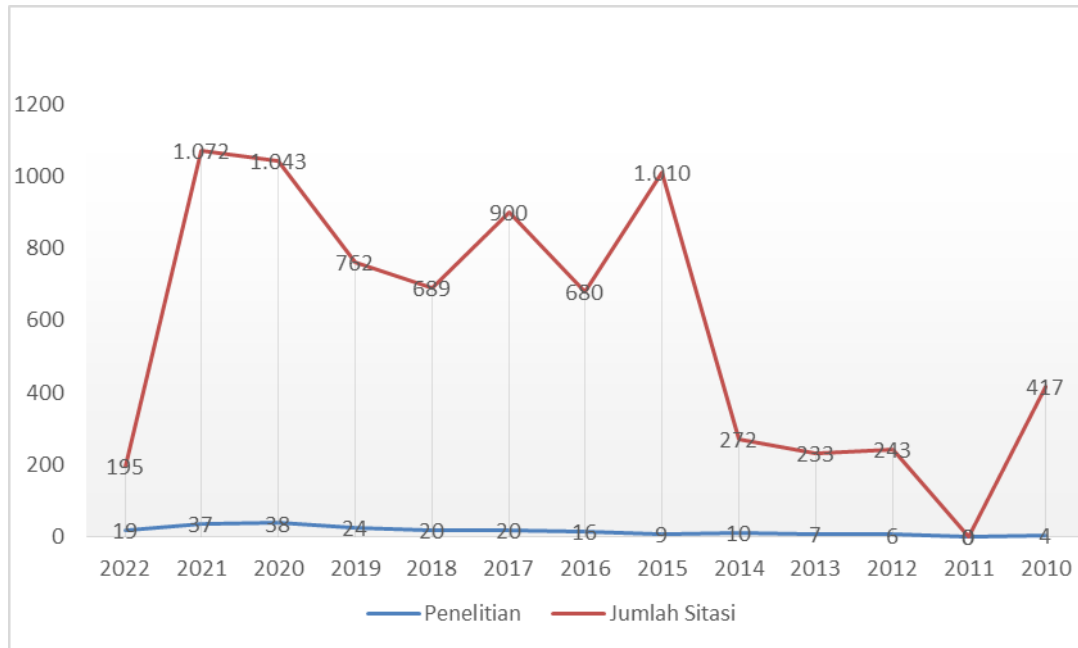
From the data obtained through the Publish or Perish search, it identified that over the last thirteen years from 2010 to 2022, the number of publications and citations increased gradually. The total number of research articles related to green finance and green sukuk indexed by Scopus is 210 research articles. Meanwhile, the number of citations is not very stable or fluctuates from year to year with a total of 7,516 citations.

**Table 2.** Total of Articles and Citation

Year	Research	Total of Citation
2022	19	195
2021	37	1.072
2020	38	1.043
2019	24	762
2018	20	689
2017	20	900
2016	16	680
2015	9	1.010
2014	10	272
2013	7	233
2012	6	243
2011	0	0
2010	4	417
<b>Total</b>	<b>210</b>	<b>7.516</b>

**Source:** Publish orPerish (processed)

The highest number of articles published in 2020 with a total of 38 publications, this number is quite large compared to the previous five years. In early 2010, research on green finance and green sukuk as environmental responsibility was less interesting for researchers to review, because there were only 4 research articles published and indexed by Scopus. In 2011 there was not even any research on green finance and green sukuk published in Scopus indexed journals. Until 2012, it increased to 6 studies and continued to increase significantly until 2021. Table 2. Also explains that in 2021 research on this topic will experience a slight downward trend, although it is not significant with only one article less.

**Graph 1. Total of Publication and Citation**

**Source:** Publish or Perish (processed)

Meanwhile, the number of citations to research articles on the topic of green finance and green sukuk is fluctuated. The number of citations with the largest number is in 2021 reach the citation number of 1,072. This number is the highest for thirteen years. Then the second highest number in 2020 with a total of 1,043 citations. The lowest number of citations was in 2013 and 2012, only 233 and 243 published documents, respectively. In graph 1, the lowest citation is also followed by a low number of publications.

The following table shows the number of research articles with the highest number of citations on the topic of green finance and green sukuk throughout 2010 to 2022:

**Table 3. The Most Cited Research in Green Finance and Green Sukuk**

No	Title	Author	Year	Citation	Citation Per year
1.	Green R&D for eco-innovation and its impact on carbon emissions and firm performance	Lee Ki Hoon, Min Byung	2015	363	51,86
2.	False discoveries in mutual fund performance: Measuring luck in estimated alphas	Barras L, Scaillet O, Wermers R	2010	341	28,42
3.	Strategies on implementation of waste-to-energy (WTE) supply chain for circular economy system: a review	Pan, Shu Y Du, M A Huang, I. Te	2015	334	47,71
4.	Corporate social responsibility governance, outcomes, and financial performance	Wang, Zhi Sarkis, Joseph	2017	202	40,40
5.	Green practices and financial performance: A global outlook	Miroshnychenko, Barontini, R Testa, F	2017	161	32,20
6.	Green entrepreneurial orientation for enhancing firm performance:	Jiang, Wenbo Chai, Huaqi	2018	142	35,50

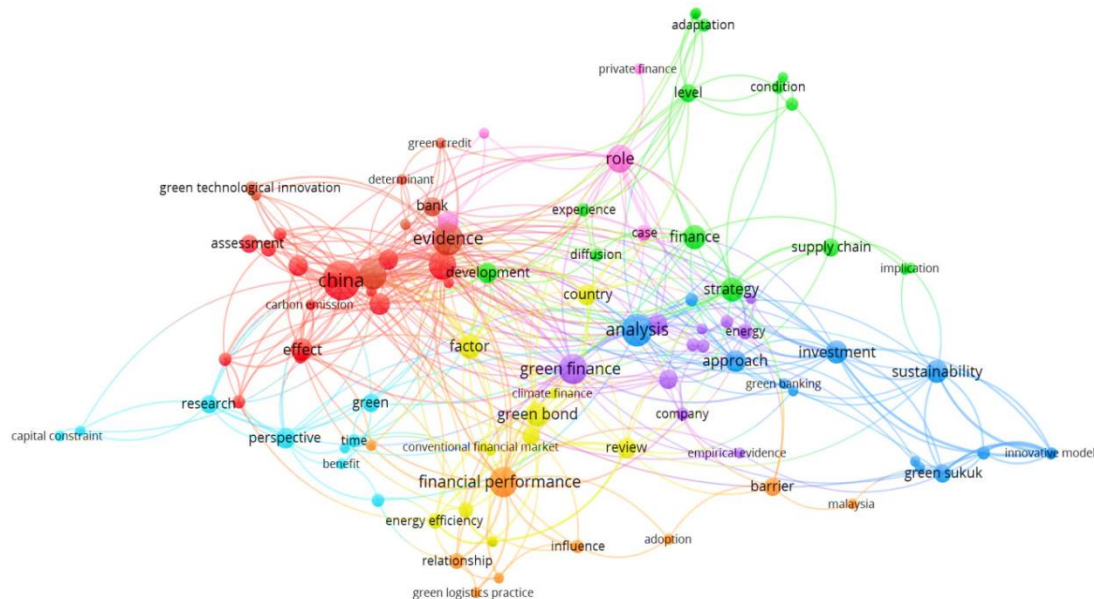
	Adynamic capability perspective.	Shao, Jing				
7.	Effects of corporate environmental responsibility on financial performance: The moderating role of government regulation and organizational slack	Li, Dayuan Cao, Cuicui Zhang, Lu	2017	119	23,30	
8.	Corporate green bonds	Journal of Financial Economics	Flammer, Caroline	2021	118	118,00
9.	The green advantage: Exploring the convenience of issuing green bonds	Gianfrate, Gianfranco Peri, Mattia	2019	112	37,33	
10.	Proactive environmental strategies and performance: Role of green supply chain processes and green product design in the Chinese high-tech industry	Li, Wing Yan Chow, Pui Sze Choi, T	2016	109	18,17	

In general, the number of citations to an article is a bibliometric indicator that shows the quality of the research published (Fellnhöfer 2019). Therefore, this study also collected the number of direct citations related to green finance and green sukuk that are published and indexed by Scopus. There are ten publications with the highest number of citations. The first was Lee Ki Hoon, Min Byung with the title Green R&D for eco-innovation and its impact on carbon emissions and firm performance in 2015 with 363 citations and 51.86 citations per year.

### Visualisation based on Bibliometric Analysis

Analysis using VOS viewer to provide an overview of the bibliometric network from the publication of scientific articles related to green finance and green sukuk. VOS viewer can create maps/links that can summarize or include authors, publication sources, keywords, and more (van Eck and Waltman 2010). The following is the result of the distribution/mapping of bibliographic literature on economic growth and inflation in Indonesia.

**Figure 1.** Outcome of VOS viewer based on co-occurrence of keyword



Source: Vosviwer (processed)

## Co-occurrence of keywords

The function of the review of keywords or co-occurrence of keywords published through journals is to show the frequency of words arranged together in research articles (Gaviria-Marin, Merigo, and Popa 2018). The map of the distribution of keywords in the article on economic growth and inflation in Indonesia is presented in Figure 1. The researcher found the minimum number of occurrences of the keywords used was 2, so that 100 out of 680 keywords appeared according to the provisions or met the criteria. Then from the mapping results, it displays 99 keywords which are classified into nine clusters with different colors.

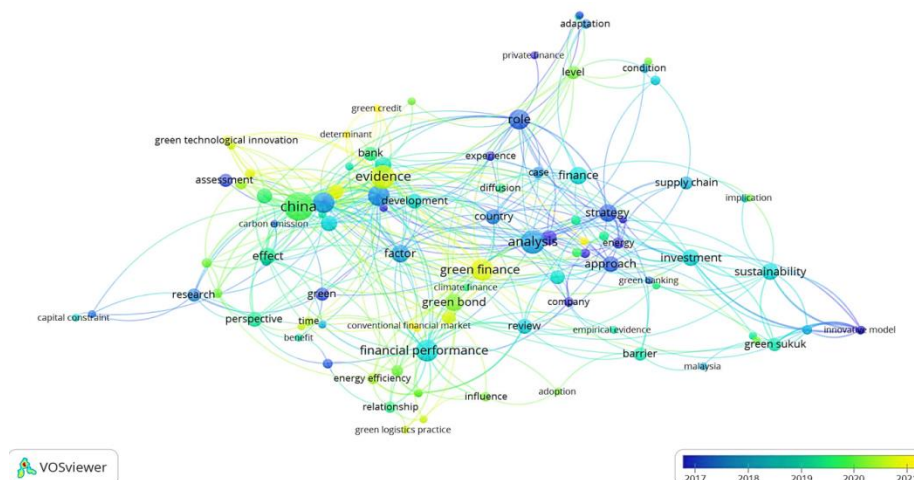
Cluster one contains 16 items, there are: assessment, carbon emission, China, economic growth, effect, empirical study, environmental regulation, financial agglomeration, financial development, firm performance, green credit policy, green development, green transformation, impact, innovation and tourism development.

Cluster two contains 15 items, namely: adaptation, climate change, condition, development, diffusion, experience, finance, Ghana, green economy, green growth, implication, level, Paris agreement, strategy and supply chain. Cluster three contains 14 items: analysis, approach, green banking, green sukuk, Indonesia, innovative model, investment, Italian case study, literature, mitigating climate change, sustainability, sustainable finance, use and wind energy sector.

Cluster four comprehends 12 items: climate finance, conventional financial market, country, covid, energy efficiency, factor, financing renewable energy, green bond, market, policy, review and south east Asia. Cluster five consisted of 11 items: application, challenge, company, empirical evidence, energy, green finance, implementation, opportunity, post covid, water dan world. Cluster six are 9 items: benefit, capital constraint, Europe, green, green innovation, green supply chain management, perspective, research and time

Cluster seven consisted of 9 items: adoption, barrier, financial performance, green logistics practice, influence, Malaysia, moderating role, relationship and social performance. Cluster eight are 8 items: bank, determinant, digital finance, evidence, green credit, green technological innovation, moderating effect and performance. Cluster nine or the last, consisted of 5 items: case, enterprise, private finance, role dan sustainability performance

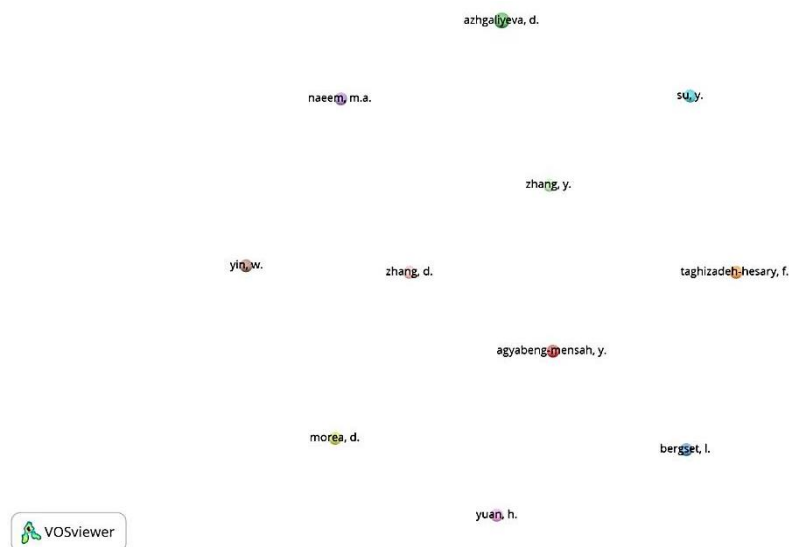
**Figure 2.** Overlay Visualization VOS viewer based on Co-occurrence of keyword



Source: Vosviewer(processed)

In the Figure 2 displayed above, keywords that often appear can be represented with the size of the circle, or the darker blue color indicating that the research has often been conducted, such as energy, strategy, carbon emission, role, climate finance, company, financial performance, countries and others. Meanwhile, for keywords that appear the least or with a yellow color pattern is rarely conducted; green technological innovation, green credit, evidence, convertible finance market, green logistics practice and others. This indicates that when using these keywords, researchers are still rarely or less discussed. Therefore, keywords can be studied or discussed in future research.

**Figure 3.** VOS viewer result based on co-authorship analysis of authors



**Source:** Vosviewer(processed)

### Co-authorship analysis of authors

Overlay visualization according to Rusydiana based on co-authors can be used to interpret the authors that directed most of the published research (Rusydiana, Sanrego, and Rahayu 2021). The following visualization / description of the mapping of co-authors or authors, researchers related to research on economic growth and inflation can be seen in Figure 3. The findings show that the authors who wrote the most publications related to green finance and green sukuk were Azhgaliyeva D (3 articles), Bergset L, Morea D, Naeem Ma, Su Y, Taghizadeh-Hesary F, Yin W, Yuan H, Zhang D, Agyabeng-Mensah Y and Zhang Y, published 2 articles each. Besides, each of the mentioned authors published one academic writing on green finance and green sukuk. However, the results of Vos viewer found no relationship between researchers. It means that these researchers did not conduct research collaborations with other researchers included in the data sample of this study. There are eleven clusters that are divided into co-authors, all clusters only have one author.

### Future Research Directions

The analysis using bibliometrics explains how the bibliographic characteristics of an article are related to green finance and green sukuk which include frequently appearing keywords, year of publication, total citations, approach method used, journal sources and authors. Based on the year of research publication, every year since 2010 shows an increase



in the number of research publications and a significant increase occurred in 2020 and 2021. This fact explains that within the years, the research on the topic of green finance and green sukuk is highly discussed. Also many researchers are interested in the topic of green finance and green sukuk, especially in the discussion of their impact on the environment, and more intensive for comparisons between countries. In addition to the growth of publications in each period, the topic of green finance and green sukuk, also the citations that continue to hit the roof. The impact of research can be seen by the number of citations.

Analysis of keywords describe the most and the least frequently used in published research articles indexed by Scopus. It is important for researchers to map out the trend issues from research and explore more topics related to green finance and green sukuk. Topics that are still rarely discussed are related to green finance and green sukuk, such as energy, strategy, carbon emission, role, company, financial performance, country and others. This result indicated that the researcher would find untapped or infrequently elaborated field of when using these keywords. Therefore, the keywords mentioned before could be considered for the future research.

## **Conclusion**

From the discussion above, it can be concluded that the topic of green finance and green sukuk has shown a significant increase in the number of research publications every year since 2010. Notably, a substantial surge in publications occurred in 2020 and 2021, indicating that during these years, research on green finance and green sukuk was highly elaborated. This trend underscores a growing interest among researchers in these topics.

Moreover, several researchers have made notable contributions to the field. Among them, Azhgaliyeva D stands out with three published articles. Other prolific researchers include Bergset L, Morea D, Naeem M.A., Su Y., Taghizadeh-Hesary F., Yin W., Yuan H., Zhang D., Agyabeng-Mensah Y., and Zhang Y., each of whom has published two research articles on green finance and green sukuk. This diversity of researchers and their contributions highlights the broadening interest and recognition of the importance of these topics within the academic community.

In addition to the increase in the number of publications, the growth in research on green finance and green sukuk has also led to a significant rise in citations. This surge in citations reflects the relevance and impact of these studies within the broader research community. The topics explored in these publications are diverse, yet they collectively contribute to a deeper understanding of green finance and green sukuk.

Despite the growing body of research, there are still several subtopics within green finance and green sukuk that remain underexplored. These include areas such as energy, strategy, carbon emissions, corporate roles, financial performance, and country-specific analyses. The limited exploration of these areas presents opportunities for future research to delve deeper into how green finance and green sukuk can be leveraged to address specific challenges related to sustainability and environmental impact.

Furthermore, the increased attention to green finance and green sukuk aligns with global efforts to promote sustainable development and combat climate change. Green finance, including green sukuk, plays a crucial role in mobilizing the necessary capital for green projects, such as renewable energy, energy efficiency, and other environmental initiatives. By channeling investments into these areas, green finance supports the transition towards a more sustainable and low-carbon economy.

The rise in research publications also reflects the evolving policy landscape, as governments and regulatory bodies around the world increasingly recognize the importance

of sustainable finance. Policies and regulations that encourage green finance and green sukuk issuance are likely contributing to the heightened academic interest and research output in these areas.

In conclusion, the upward trend in research publications on green finance and green sukuk since 2010, with a marked increase in 2020 and 2021, demonstrates a growing interest and recognition of the significance of these topics. Key researchers have made substantial contributions, and the rise in citations indicates the relevance of this research. However, there remain areas within green finance and green sukuk that are yet to be fully explored, presenting opportunities for future research to further advance the field and contribute to global sustainability goals.

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