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Mapping Researches of Green Sukuk: A Bibliometric Approach

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Abstrak,

Studi ini menyoroti keadaan penelitian sukuk hijau saat ini, yang dilakukan melalui jurnal yang diisi dengan deskripsi objek digital. Analisis ini berfokus pada karakter dan gaya menulis kata kunci, penulis, dan jurnal. Data yang dianalisis berjumlah 123 penelitian yang diterbitkan di Dimensions (https://dimension.ai). Metode statistik deskriptif digunakan, dan analisis bibliometrik dilakukan menggunakan R Biblioshiny untuk menentukan peta bibliometrik. Jumlah artikel yang membahas tema green sukuk cukup banyak dalam beberapa tahun terakhir. Banyak jurnal telah menerbitkan artikel tentang green sukuk, sebagian besar adalah Journal of Islamic Accounting and Business Research yang berisi beberapa penulis yang menyelidiki topik dengan berbagai kata kunci, penulis yang paling produktif adalah Musari K., dan kata kunci yang paling banyak digunakan adalah "green, sukuk dan Islam". Studi ini memberikan gambaran tentang tren dalam topik, kata kunci, jurnal, dan penulis dalam artikel populer tentang green sukuk. Ini memberikan informasi bagi para peneliti yang berfokus pada bidang ini. Secara keseluruhan, sukuk hijau mempunyai potensi besar untuk menjadi instrumen utama dalam membiayai proyekproyek berkelanjutan di masa depan. Dengan dukungan terpadu dari seluruh pemangku kepentingan, sukuk hijau dapat berfungsi sebagai katalis untuk mencapai pembangunan berkelanjutan yang inklusif dan bertanggung jawab terhadap lingkungan dalam skala global. Tema ini dapat diperluas untuk masa depan.

Kata Kunci: Sukuk Hijau, Deskriptif, Bibliometrika, R Biblioshiny

$oldsymbol{Abstract.}$

This study highlights the current state of green sukuk research, conducted through journals filled with descriptions of digital objects. This analysis focuses on the character and writing style of keywords, authors, and journals. The data analyzed amounted to 123 studies published in Dimensions (https://dimension.ai). Descriptive statistical methods were used, and bibliometric analysis was performed using R Biblioshiny to determine bibliometric maps. The number of articles discussing the green sukuk theme has been quite large in recent years. Many journals have published articles on green sukuk, most of which is the Journal of Islamic Accounting and Business Research which contains several authors who investigate the topic with various keywords, the most prolific author is Musari K., and the most widely used keyword is "green, sukuk and Islam". This study provides an overview of trends in topics, keywords, journals, and authors in popular articles about green sukuk. It provides information for researchers focused on this area. Overall, green sukuk holds immense potential to emerge as a key instrument in financing sustainable projects in the future. With concerted support from all stakeholders, green sukuk can serve as a catalyst for achieving inclusive and environmentally responsible sustainable development on a global scale. This theme can be expanded for the future.

Keywords: Green sukuk, Descriptive, Bibliometric, R Biblioshiny

INTRODUCTION

Al Imam Yusuf Qardhawi, a prominent Islamic scientist, has stressed the importance of environmental conservation (Suryomurti et al., 2022). He stated that disasters that threaten human life can be caused by the neglect of the environment. Therefore, the prohibition of natural destruction on land and at sea is of the utmost importance. The idea of "sustainable reservoirs" and "environmentally friendly reservoirs" has gained greater attention over the past ten years in routine discussions on finance in inter- national international forums (Fahamsyah et al., 2023). Therefore, organizations that prioritize environmental principles in their operations are considered very important, even essential. Greening projects emerged in response to the global call to achieve environmentally sustainable development.

Green sukuk is a tool for financing climate change that is getting a lot of attention (Keshminder et al., 2022). In 2008, the World Bank also introduced the idea of green sukuk as an integral part of its "Strategic Framework for Development and Climate Change." The concept provides an innovative solution for investors to support renewable energy projects, mass transportation, and other low-carbon initiatives (Karina, 2019). Green sukuk reflects an asset category that sits at the intersection of three main investment streams: Islamic mutual funds, socially responsible investments, and sukuk financial instruments. The development of green sukuk aims to address Shariah's concerns in protecting the environment (Alam, 2016). Green Sukuk, characterized by its unique structural characteristics as well as its philosophical foundations that describe economic, environmental, and Islamic values simultaneously, has the capacity to overcome a number of barriers that exist in the sustainable financial sphere (Yu et al., 2021).

Today, green sukuk has surpassed its initial stage and attracted greater attention, creating room for intense debate and greater scrutiny. This has led researchers to conduct studies related to green sukuk, such as its potential, the challenges it faces, and its implementation as a financing instrument that focuses on environmental sustainability. Emissions of bonds and environmentally friendly loans reached \$257.7 billion in 2019, up 51% from 2018. This figure has increased exponentially over the ten years since it was introduced. The European market, which covers almost half of global emissions, plays a key role in driving the volume of the environmentally friendly bond market. The second position is in the Asia-Pacific market, followed by the North American market (Cheong & Choi, 2020).

Although previous research has unveiled various aspects of green finance as elucidated by Zhang et al. (2019) and Cheong & Choi (2020), their focus tends to lean towards green bonds in general. However, the existence of green sukuk as a unique financial instrument has not been fully explored in the literature. Studies such as those conducted by Karina (2019) and

Prahaji & Arundina (2022) provide insights into green sukuk, yet the lack of bibliometric analysis results in a limited understanding of the literature's contributions to the development of green sukuk. Therefore, there is a clear need for a more comprehensive analysis of green sukuk literature to identify trends, researcher collaborations, and research gaps that still need to be explored in this domain. Thus, this research aims to fill this research gap by providing a deeper understanding of the literature's contributions to the development of green sukuk and guiding future research directions in the realm of sustainable finance by bibliometric approach.

The bibliometric approach plays a significant role in revealing emerging research patterns from various sources such as scholarly articles, journals, conferences, and other references. By applying this method, the authors aim to identify influential works, collaboration networks between researchers, highlight key concepts that have been explored, and observe trends in keyword changes over time. Therefore, this research is the first initiative to explore the theme. It is hoped that the results of this study can provide new insights for future research directions. The main objective of this research is to make a valuable contribution to the development of the green sukuk industry by identifying potential improvements, areas of research that remain unexplored, and providing useful guidance for policy makers and practitioners to take more appropriate and effective steps. In addition, it is expected that this research will also provide valuable input to the advancement of science by exposing research trends regarding green sukuk.

LITERATURE REVIEW

One of the instruments of the Islamic debt market is Sharia bonds, internationally commonly called sukuk (Afandi & Latif, 2023). However, some perceive it as a hybrid form of security, which has similar features of bonds and stocks (Zolfaghari, 2017). This view arises because, unlike conventional bonds, the sukuk uses Islamic commercial contracts such as sales, rentals, services or partnerships that create a relationship between the sukuk issuer and the sukuk holders (Sa'ad et al., 2022). According to Faisal et al. (2023), green sukuk is a way to raise funds for environmental projects from the Islamic capital market by combining the concepts of environmental responsibility and Islamic finance. The Sukuk market has become one of the most sustainable funding channels in many economies today, with many companies and government agencies around the world turning to sukuk issuance to fulfill their funding needs. In a country where the majority of the population is Muslim, Sukuk plays an important role in meeting demand for Sharia-based investment and financing instruments (Rachmaini et al., 2022). According to Ulfah et al. (2023), green sukuk also known as Islamic bonds, is a

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type of Islamic financial instrument used as an alternative source of financing for green financing projects in many industries, such as renewable energy or climate change issues.nnnn The most well-known definition used to define sukuk is the definition of sukuk by AAOFI in their Shariah Standard on investment sukuk, where it is defined as "an equal value certificate representing an integral share in the ownership of material assets, benefits and services or on its ownership of specific project assets or specialized investment activities." (AAOFI Standard No. 17, 2017).

Green sukuk is a special instrument because it must be environmentally friendly and meet the requirements of Shariah (Prahaji & Arundina, 2022). By using these green bonds, the published sukuk shows their commitment to the environment through their projects, assets, and business actions. Impact reports after published and independent review or green certification should be included in the sukuk (Mardi et al., 2022). As we are on the threshold of a new era in Islamic finance driven by a global appetite for SRI investment backed by the Principles of Responsible Investment and backed up by the United Nations, green sukuk is the best way to bridge the gap between Islamic and conventional finance (Tabassum et al., 2019). The concept of green sukuk originated in Muslim countries, where people are already highly aware of future developments (Fahamsyah et al., 2023). The term green sukuk refers to a green bond instrument first introduced by the World Bank in 2008. The green sukuk is an evolution of the sukuk itself. With funds given by investors or companies, it aims to develop halal and environmentally friendly products (Rohman, 2017).

Green sukuk, an innovative financial instrument that integrates principles of Islamic finance with environmental sustainability, has garnered increasing attention in recent years. Previous research has explored various facets of green sukuk, ranging from its conceptual framework to practical applications and market dynamics. Study of Zhang et al. (2019), conducted a comprehensive bibliometric study on the development of green finance studies, shedding light on the broader landscape of sustainable finance research. While their study provides valuable insights into the evolution of green finance, it does not specifically delve into the unique characteristics and contributions of green sukuk.

On the other hand, Karina (2019), examined the opportunities and challenges of green sukuk development in Indonesia. Her research offered valuable insights into the specific market context of green sukuk in Indonesia, highlighting regulatory frameworks, market potential, and investor sentiments. Similarly, Prahaji & Arundina (2022), investigated green sukuk preferences in environmental projects, revealing significant factors influencing issuers' decisions and proposing simulations to optimize issuance costs.

Than, the study of Cheong & Choi (2020), provided a comprehensive review of papers studying various aspects of green bonds, including market pricing, economic and

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environmental impacts, and legal and institutional issues. While their research contributes to understanding sustainable finance instruments, such as green bonds, the specific characteristics and dynamics of green sukuk remain underexplored. Furthermore, study of Verma & Agarwal (2020), explored bond prospects in India, offering insights into the broader bond market landscape but not specifically focusing on green sukuk.

In addition, Akbar et al. (2024) also conducted research on investment behaviour in Green Sukuk Ritel Indonesia. The results show that determinants of decisions to invest in the retail green sukuk (RGS) are influenced by the intention and perceived behavioural control (PBC). Furthermore, the attitude factors and subjective norms also have a significant impact on the desire to investment in the RGS. It was found that attitudes specifically act as the most dominant predictive variable in determining the investment intention, which in turn is affected by the level of knowledge about RGS, awareness of environmental issues, and the degree of individual religiousity. Based on these findings, it is suggested that the government increase the intensity of campaigns on tribes and related environmental issues. In addition, RGS promotion should focus on individual or community segments with an adequate level of knowledge of the tribe and a high level of awareness of environmental issues.

The literature reviewed emphasizes the increasing prominence of green sukuk as an innovative financial tool that merges principles of Islamic finance with environmental sustainability. While previous research has delved into various dimensions of green sukuk, such as its conceptualization, market dynamics, and preferences of issuers, investors, and regulators, there still exists a gap in the literature regarding a comprehensive understanding of its unique characteristics and contributions to sustainable finance. while existing research offers valuable insights into various aspects of green sukuk, further comprehensive studies are needed to fully comprehend its unique characteristics, market dynamics, and contributions to sustainable finance. Future research endeavors should aim to bridge these gaps and provide a more nuanced understanding of green sukuk's role in promoting environmental sustainability within the Islamic finance framework.

METHODS

Bibliometric analysis is very helpful in studying, collecting, managing, and explaining large amounts of data, especially after the development of various software packages, tools, and tests intended to analyse bibliometric data, such as bibliographic collaboration, cocitations, author influences, word clouds, trend topics, network co-occurrence, thematic evolution, etc (Alshater et al., 2023). The bibliometric approach plays a significant role in revealing emerging research patterns from various sources such as scholarly articles, journals,

conferences, and other references. By applying this method, the authors aim to identify influential works, collaboration networks between researchers, highlight key concepts that have been explored, and observe trends in keyword changes over time.

This study uses journal publication data sourced from various research journals with the theme of green sukuk. The development trend of green sukuk publications was analyzed using R Biblioshiny. This research method can be described as a descriptive approach based on bibliometric analysis. The data used in this research comes from publications related to green sukuk taken from the Dimensions.ai database (https://Dimensions.ai). In indexing alternatives using dimensions, criteria are applied, namely each article must have a title and abstract.

RESULTS

The study examines the data collection of scientific articles related to the green sukuk from various studies indexed on Dimension.ai. From 2013 to 2023, 123 scientific articles have been published in various national and international journals.

Table 1. Document Types

No	Document Types	Number of Articles
1	Article	86
2	Chapter	18
3	Edited Book	2
4	Monograph	4
5	Preprint	7
6	Proceeding	6
	Total	133

Source: R Biblioshiny

The table above shows the number of document collections studied on the theme of the green sukuk, which is a total of 123 data from six different types of documents, with the description as follows: (1) types of journal articles published as many as 82 types, (2) chapter type books as many as 18 documents, (3) types of books edited as many as 2 documents, (4) types of monographs as many as 4 documents, (5) types of preprints as many as 7 documents, and (5) proceedings as many as 6 documents. Based on the table above, it can be concluded that the most documents used as objects of study in research that discuss green sukuk in the first rank are articles published in journals with a percentage of 68.9% or as many as 82 documents. While the least used document is a book edited by 1.6% or 2 documents. The references used are derived from scientific written documents, most of which consist of published documents. The data shows that the references used are quite valid.

Figure 1. Annual Scientific Production

Based on the results of the graphical display above that the author peeled from Dimesions.ai, the number of articles published was 123 articles in 2013-2023. The lowest number of articles published was in 2014 with 0 documents, while the highest number was in 2023 with 41 documents.

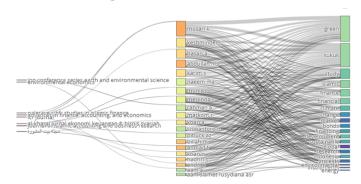


Figure 2. Three Fields Plot

The Three Fields Plot above is an illustration of three elements consisting of the journal name list on the left, the author list in the middle, and the topic list used on the right. The gray plot is used to show how these three elements relate to each other. It starts with the name of the journal and the author's name for each journal, as well as the topics discussed by each author in the green sukuk themed papers. The size of each square in the name list indicates the paper associated with the element.

The first element is a journal. There are 8 journals indexed on the Three Fields Plot that publish articles on the green theme of the tribe, the Journal of Islamic Accounting and Business Research is the most publishing article on the topic, with the largest square length. The second element in the middle is the author's name. Some authors with recognized publication journals will be associated with the previous element, but some authors who are not indexed do not have a relationship with the listed journal. In addition, each author will be linked to a topic with a commonly used keyword on the right. This plot includes the top 20

authors. The large and small square lengths indicate how many articles each author has written. On this plot, Musari K has the largest square length, indicating that he writes most about the green sukuk.

The third focus is the most frequently used keyword topic in the paper that is the subject of research. Each topic has a relationship with the author who uses it a lot. The plot covers 20 top topic keywords, and the green and sukuk keywords are the most frequently appearing, with the square length size dominating. Many of the listed authors seem to use both of these topics as well.

Table 2. Most Relevant Sources

No	Sources	Publications
1	Journal of Islamic Accounting and Business Research	4
2	SSRN Electronic Journal	4
3	مجلة بيت المشورة	4
4	Sustainability	3
5	IOP Conference Series Earth and Environmental Science	3
6	Palgrave CIBFR Studies in Islamic Finance	3
7	Environmental Economics	2
8	ICR Journal	2
9	Advances in Finance, Accounting, and Economics	2
10	Environment and Planning A Economy and Space	1
11	Environmental Science & Policy	1
12	Journal of Cultural Economy	1
13	Environment, Development and Sustainability	1
14	Financial Innovation	1
15	Energy Economics	1

Source: R Biblioshiny

Table 2 shows the number of research articles published by each journal based on their relevance to the theme of the green sukuk. The list of top journals that mostly publish this topic is shown on a blue bar diagram. The darker blue color indicates that the research themes are more relevant and plentiful. The number of articles published by the top 15 journals ranges from 1 to 4 articles.

Of the top 15 journals detected as most relevant to the green sukuk theme, the top journal is Journal of Islamic Accounting and Business Research, SSRN Electronic Journal, and مجلة بيت المشورة which published 4 articles. Followed by Sustainability, IOP Conference Series Earth and Environmental Science, and Palgrave CIBFR Studies in Islamic Finance which published 3 articles. Next Environmental Economics, ICR Journal, and Advances in Finance, Accounting, and Economics published 2 articles. In addition, each of the other journals published an article.

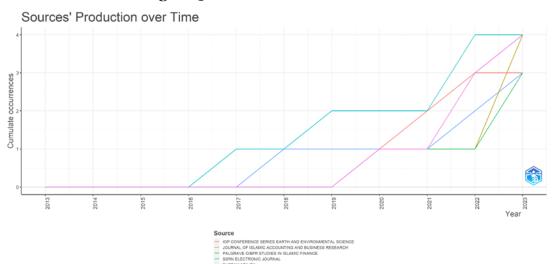


Figure 3. Sources Production over Time

The research also found developments in journals that were the source of research on the theme of the green triangle. The figure above shows the development of the cumulative events of each journal from 2013 to 2023. From the curve, it can be seen that the research on the theme of green dialect published tends to increase. By 2022, there is a significant increase especially in the Journal of Islamic Accounting and Business Research, SSRN Electronic Journal, and مجلة بيت المشورة. Palgrave CIBFR Studies in Islamic Finance and SSRN Electronic Journal have begun to develop in 2017.

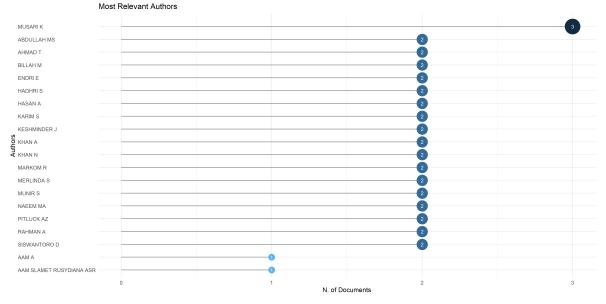


Figure 4. Most Relevant Authors

The authors can also be ranked according to the number of articles they publish and their relevance to the green sukuk. Of the 20 most productive authors, the numbers of articles each author ranges from 1 to 3. Figure 5 shows that the longer the diagram with the old blue

circle, the more relevant the author is. The results show that the author with the most articles is Musari K who has 3 articles. The other 17 authors each have 2 articles. While Aam A and Aam Slamet Rusydiana Asr have 1 article.

Authors' Production over Time

MUSARI K - ABDULLAH MB - AHMAD T - BILLAH MB - BIONE E - HADAPIRI B - HADAPIRI

Figure 5. Authors' Production over Time

In addition, annual publications show how productive the writer is. The figure above shows the productivity of the author based on the spread of publications from year to year. Production is shown with a red line from the first year the author published the publication to the last year the writer was recorded. The number of articles published by year is shown in circles within the red lines.

It was recorded that Musari K wrote 3 articles spread in 2021 as many as 1 article, in 2022 as many as 1 article, and in 2023 as many as 1 article. The longest detected authors researching green sukuk are Hasan A and Siswantoro D, which have appeared since 2018. However, their productivity is less consistent. It was recorded that they wrote again in 2021, but in 2022 and 2023 they did not write again.

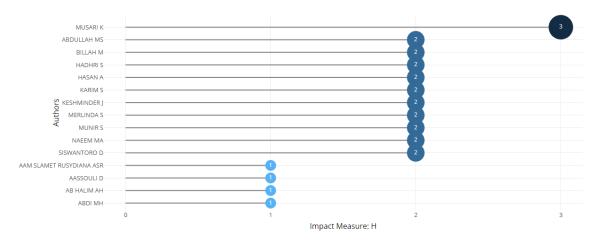


Figure 6. Authors' Local Impact by H index

In addition, the authors of published articles can be ranked according to their influence by h-index rating. The h-index of this study range from o to 3, the circle at the end of the diagram has a blue color indicating the level of impact, and a darker blue color suggests that the impact is greater. In the figure above, Musari K. is the author who has the greatest impact with h-index 3, the other 10 writers have h-index 2, and the others have the h-index value of a lower value, which is 1.

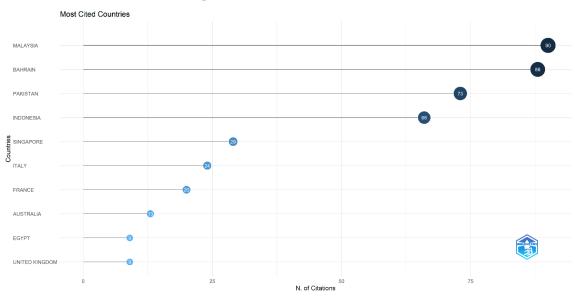


Figure 7. Most Cited Countries

The figure above describes a country-based citation of an article with a green sukuk. The biggest citation is shown in blue on the circle at the end of the diagram, where the darker the color indicates the greater the impact. The figure above shows that the country with the highest number of citations is Malaysia with 90 citations. Followed by the states of Bahrain, Pakistan, and Indonesia with more than 50 citations.

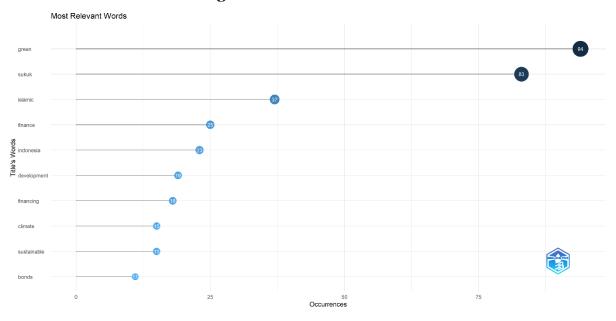


Figure 8. Most Relevant Words

The study counted the relevant words used in the collection of article titles that were the object of the study, some words appeared between o and more than 90 times, and the ten most important words are listed in the figure above. In addition, the blue circle at the end of the diagram shows a comparison of the number of occurrences of each word and its relevance to the theme of the green sukuk.

In this study, the word "green" appears 94 times and is most relevant to the object, as indicated by the dark blue line diagram. Next followed by the words "sukuk" appear 83 times, and the words "Islam, finance, Indonesia" more than 20 times.



Figure 9. Word Cloud

The word cloud above describes the words that most often appear in the data collection of the article that was researched with the theme of the green sukuk. The most frequently appearing words in the first order are green, followed by sukuk, Islam, finance, and financial. According to the number of words that appear, the word cloud displays words in different sizes. Although word clouds tend to be placed randomly, the dominant words are placed in the middle to be clearer.

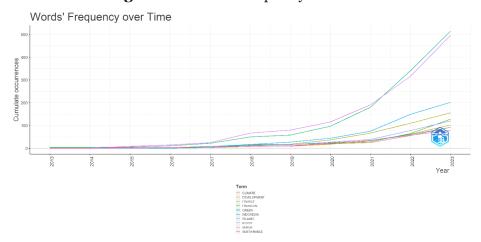


Figure 10. Words' Frequency over Time

The figure above also shows the evolution of words that often appear in articles every year. The following graph shows the cumulative occurrence value. The results show that the

average word that appears in the article about green sukuk increases from year to year. There are the 10 most frequently appearing words from 2013 to 2023 based on the study period, these words are constantly increasing. Since 2013, the word green has been the most frequently appearing, followed by the word sukuk. Other developing words are not very significant. Its recent development has been visible since 2018.

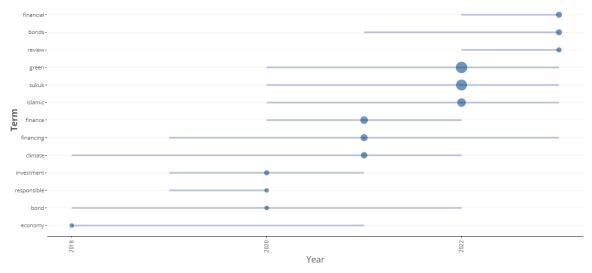
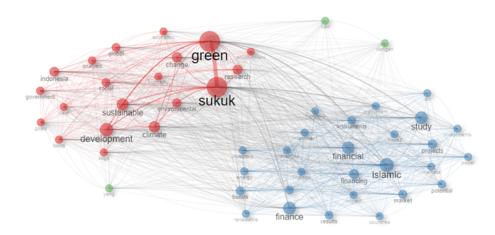


Figure 11. Trend Topics

In addition, the study covers the trend topics, the figure above shows the evolution of the topic from year to year with annual division, so it can be identified as topics that are long and frequently used and topics that are most recently used. The appearance of the topic is adjusted to the frequency of the words that appear in the research on this green sukuk theme. A higher word level indicates that the word is more frequently used, and a lower word level suggests that it is newer. The theme has been growing since 2018.

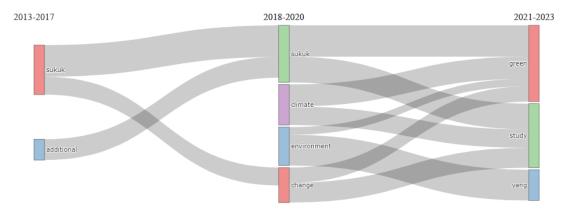
Based on the data above, the topic used since 2018 is "economy". In 2020, the words "responsible, investment, and bond" appeared, in 2021 the words "finance, financing, and climate" appeared, in 2022 the words "green, sukuk, and islamic" appeared, and in 2023 the words "financial, bonds, and review" appeared. Many topics used in 2020 reached its peak with term frequency reaching more than 70, namely green and sukuk.

Figure 12. Co-occurrence Network



Next, the Co-occurrence Network displays words in the form of colored balls based on the relationship between one word and another word. Word clusters of the same color indicate the relationship between words, while the size of the balls indicates how great the relationship is. The picture above shows that the words green and sukuk are most closely related to each other.

Figure 13. Thematic Evolution



The themes used in research papers are constantly changing, especially from the newly published ones to the older ones. The figure above shows the development of the theme. Although the theme of this study is a green sukuk, this data shows some frequently used subthemes. The left part shows some of the most used themes from 2013 to 2017, there are only 2 themes listed which are sukuk and additional. The "sukuk" theme occupies the first position, followed by the "additional" theme.

Some widely used themes from 2018 to 2020 are shown in the middle of the second part. Some of the themes that appear during this period are evolutions of themes previously used and have a connection to their content. For example, the "change" theme appears as an

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evolution from the "sukuk" theme, which suggests that research with the change theme is an extension of research with a shaped theme in previous research. The most widely used themes from 2021 to 2023 are displayed on the right; in this section, "green and study" are the most common themes.

This research has a significant impact on the understanding and development of green sukuk. By using a bibliometric approach, this research provides a more comprehensive understanding of previous research on these sustainable financial instruments, identifies emerging research trends, and provides an overview of the opportunities and problems associated with these sustainable financial instruments. The results of this research include providing guidance for practitioners, academics, and all stakeholders who want to use this sustainable financial instrument. Thus, this research not only has academic value but also has important practical relevance in supporting the growth and implementation of green sukuk in the context of sustainable finance.

DISCUSSION

From the results described above, it can be seen that the Journal of Islamic Accounting and Business Research emerged as an important contributor, showing the highest frequency of publication on the topic. Similarly, the productivity of the writers showed Musari K leading with three articles, while others contributed one to two articles each.

The country-based citation analysis is increasingly enriching this theme, with Malaysia collecting the highest quotation, which shows its scientific impact. Although Malaysia collects the most quotations, the emerging country on the Co-occurrence Network is Indonesia. So the author has hope for the future, there is also research from other countries about this green sukuk, ranging from potential, projects, markets, results, their influence on state finances, and so on, so that every word is closely related.

CONCLUSION

In conclusion, the research findings underscore the significance of green sukuk as an innovative financial instrument that has garnered increasing attention in recent years. Green sukuk not only signifies the convergence of Islamic finance principles and environmental sustainability but also presents an opportunity to broaden funding access for environmentally friendly projects. Through bibliometric analysis, valuable insights into the current landscape of green sukuk research have been obtained, shedding light on key themes, influential authors, and emerging trends. This information can serve as a guide for future research endeavors and foster collaboration among researchers and practitioners in this field.

However, despite the promising prospects of green sukuk, several challenges persist in its development. These challenges include the need to raise awareness and understanding of this instrument, strengthen regulatory frameworks, and expand the investor base. Additionally, it is imperative to ensure that green sukuk delivers tangible environmental benefits while upholding ethical and social justice standards. Therefore, strategic actions are required to address these challenges effectively. This entails bolstering cross-sector collaboration, enhancing the capacity of Islamic financial markets, and improving market infrastructure. Furthermore, further research is essential to deepen our understanding of the characteristics and contributions of green sukuk and to identify future opportunities and challenges.

Overall, green sukuk holds immense potential to emerge as a key instrument in financing sustainable projects in the future. With concerted support from all stakeholders, green sukuk can serve as a catalyst for achieving inclusive and environmentally responsible sustainable development on a global scale.

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