






“Development and evaluation of Islamic green financing: A systematic review of green sukuk”

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DEVELOPMENT AND EVALUATION OF ISLAMIC GREEN FINANCING: A SYSTEMATIC REVIEW OF GREEN SUKUK

Abstract

The threat of the global climate crisis demands improvement and adjustment from various sides, including the financial sector. Islamic finance responds to environmental responsibility by presenting environmentally friendly financing products in green sukuk. This study aims to show the development trend of the number of publications in green sukuk and systematize the results of studies that explain the development and evaluation of the emergence of green sukuk investments. This study analyzed 15 publications on green sukuk during the 2016-2022 years indexed by the Scopus database. As for methodology, the descriptive analysis was used to explain the green sukuk data quantitatively; the synthesis analysis was used to describe data based on four directions (the development of models (10 sources), opportunities (12 sources), challenges (12 sources), and evaluations of green sukuk (10 sources). Preferred Reporting Items for Systematic Review and Meta-Analyses standard were used to choose samples for this investigation. The green sukuk challenge is dealing with the sukuk market after the pandemic. Several evaluation findings regarding managing commitment from the government and investors for the renewable energy sector and efforts to provide low-cost sukuk financing and risk minimization are found. Green sukuk demands efficient management to be more viable, competitive, and attractive to investors if the operational area supports it. Green sukuk projects face expanding green funding, global climate financing, managing renewable energy, and validating greenhouse gas emissions. The green stock market reaction requires coordination amongst economic subsectors.

Keywords

Islamic finance, Islamic bond, sukuk, descriptive
analysis, synthesis analysis environmental finance,
Scopus database

JEL Classification

G19, Q56, R11

INTRODUCTION

Climate change has a negative impact on development and is increasing global inequality. All developed and emerging emitters must reduce their emissions and prepare for the implications of climate change (Suroso et al., 2022). With declining environmental quality, rising social disparity, and climate change, international events focused on environmental viability and health (Arsandrie & Widayanti, 2018; Karina, 2019). Climate change complicates everything. Long-term climate change will stress and test development because it consumes resources from people, firms, and governments that should have been used for development (Suherman et al., 2019). In financing climate change issues, a country needs to prepare many varied financing sources, both domestic and foreign (Muchtart et al., 2012). Environmental preservation has penetrated economic fields such as green marketing and environmentally friendly consumption behavior (Fatchurrohman, 2006; Wiyadi, 2015).

The basic purpose of the Islamic financial sector is to accomplish long-term benefits and always be within activities that benefit the people (Karina, 2019). Due to environmental contamination and damage, the Islamic finance industry based on the environment and sustainable development is anticipated to be one of the societal solutions (Purnamawati, 2013). The Islamic bond, often known as a sukuk, is one of the most recently developed financial instruments (Fadzlurrahman & Abubakar, 2019; Sial et al., 2022). Sukuk has become a crucial tool for raising funding in global financial markets via Sharia-compliant arrangements (Rani et al., 2022).

With increasing global action on climate change, green finance, such as green sukuk, is receiving significant attention in the recent literature (Zhang et al., 2019). Green sukuk investment products still have many development limitations and need evaluation to see the improvement gaps. Given the importance and great potential for green sukuk, this study answers how much can be known about green sukuk in terms of development trends in the number of publications, opportunities for development, and evaluation.

1. LITERATURE REVIEW

Green finance advocates integrating environmentally responsible company practices and financial decision-making (Hoshen et al., 2017). Green bonds are a type of fixed-income security that can be taxed or exempt from taxation depending on whether the funds raised are used for environmentally friendly or sustainable projects (Ehlers & Packer, 2017). Green bonds work the same way as conventional bonds in pricing, rating, processing, and execution (Abakah et al., 2023; Dervi, 2021). Following the Paris Agreement on Climate Change terms from 2015, the green bond market is anticipated to emerge soon. Green bonds are among the most commonly used sustainable investment tools (Cortellini & Panetta, 2021). The difference is that conventional bonds aim to obtain loans as additional capital followed by interest or returns for the investor within a predetermined period. In contrast, green bonds focus more on raising investment funds for environmentally friendly projects.

On the other hand, green sukuk is an innovation from the sukuk itself. It uses Sharia principles; funds from investors or companies are allocated to develop halal and environmentally friendly products (Rohman, 2017). Several sustainable and environmentally friendly development could be projects such as biogas generators, wind farms, solar energy, inland/marine waste management, ecosystem or natural resource management efficiency agriculture, construction of energy-efficient buildings, and other similar businesses that

benefit the natural environment or reduce the risk of change climate problems such as global warming (Dervi, 2021; Karina, 2019).

Since 2016, the Indonesian Ministry of Finance has begun budget execution for initiatives to mitigate the effects of climate change and adapt to them through green sukuk funds (Ministry of Finance of the Republic of Indonesia, 2019). In addition, the government of Indonesia has also issued green sukuk, which have received a medium green rating from the Center for International Climate and Environmental Research (CICERO) (Ministry of Finance of the Republic of Indonesia, 2019).

Molina-Azorín et al. (2009) conducted a literature study on the positive influence of green management on financial performance. Malhotra and Thakur (2020) and Zhang et al. (2019) also carried out bibliometric studies, showing the development of green finance studies. Whereas Cheong and Choi (2020) surveyed the latest literature on green bonds, and Verma and Agarwal (2020) discussed the prospects of these bonds in India.

Through a literature review, Rapi et al. (2021) and Saleem and Khan (2021) identified and investigated the background and issues relevant to the opportunities for developing green finance in the future. Similarly, Cortellini and Panetta (2021) conducted an in-depth analysis of the published research on the green bond market and the role that environmentally responsible investing plays in reconfiguring financial markets and maintaining economic viability.

Khamis and Nobanee (2021) and Ozili (2022) considered that green finance is exposed to many difficulties, roadblocks, and limitations involved in implementing green finance among various parties. It is aligned with Gilchrist et al. (2021), who analyzed a comprehensive literature review on corporate, shareholder, and stakeholder engagement concerning green bonds and loans. The constraints of emerging green finance were discussed, and new strategies for environmentally responsible investing were suggested.

Fathihani et al. (2021) demonstrated that the government is essential in providing green finance in all business sectors, including industrial and non-industrial, by setting economic conditions conducive to the goal. Oktasari et al. (2021) also discussed the role and government policies related to green finance in realizing green transformation in company performance. Behind the studies that focus on government and sustainable investment, Ntsama et al. (2021) addressed the social and economic advantages of a green economy for low and middle-income countries, which are countries with financial markets that cannot be compared to those of affluent ones.

Using two methods, Dervi (2021) analyzed sustainable business models and social and environmental projects. This is the first to use quantitative statistical methods and conduct a bibliometric evaluation of the literature, covering a period of 1981–2019 and including the 130 most recent publications from 2020 to 2021. Second, it provides sharia-compliant ethical solutions by employing the Islamic finance model, specifically the Musyarakah and Ijarah financing model, for waste management in impoverished nations like Pakistan. Using this template, regulators might consider providing investors with workable options that comply with Sharia law.

Lanzara (2021) studied bibliometrics from 21 years of topical literature to assess SDGs' impact on Islamic finance discussions. This study maps all relevant studies and evaluates how a study on Islamic finance and social development goals was undertaken, demonstrating the relationship between Islamic money and social effect with a qualitative method.

Paltrinieri et al. (2023) employed the HistCite and VOSviewer tools for bibliometric citation and

content analysis and looked at 80 sukuk studies published between 1950 and 2018. They featured a network of co-authorships and highlighted three distinct areas of research: an introduction to and growth of sukuk; the theory of sukuk and finance; and the behavior of stock markets. Rahman et al. (2020) explored and classified the SRI sukuk literature in a systematic way to offer a comprehensive guide. Similar to previous studies, this study used bibliometric analysis of the period 1970–May 2019. The analysis showed the literature on SRI sukuk with three groups:

- 1) SRI sukuk characteristics;
- 2) SRI sukuk competitiveness; and
- 3) SRI sukuk determinants.

The study revealed that the study on SRI Sukuk greatly collaborates between Malaysia, Australia, and the United States, but the numbers are small.

Uluyol (2021) considered five different parts of Sukuk. It is possible to gain a comprehensive understanding of sukuk by focusing on the following five primary areas:

- 1) the structural and fundamental differences between conventional bonds and Islamic bonds;
- 2) empirical research on sukuk;
- 3) the choice between issuing conventional bonds or sukuk;
- 4) Sharia and sukuk legal issues; and
- 5) the pricing of sukuk (Uluyol, 2021).

Based on the literature survey, most of the research on sukuk has been done through empirical studies, while basic research on sukuk has been mostly ignored. Green sukuk is one of the newest innovative products in the Islamic finance sector (Abdullah & Keshminder, 2022; Alam et al., 2016; Alsmadi & Alzoubi, 2022). Abubakar and Handayani (2020) applied normative legal analysis to green sukuk as alternative project finance for Indonesian green infrastructure devel-

opment. They found that Indonesia used green sukuk to fund green infrastructure development and recommended a legal framework for green sukuk. From prior investigations, Mujizat (2021) identified that green bonds and green sukuk financial flow hurdled to renewable energy power projects. The report also identifies two primary barriers: ministry cooperation and local government capacity.

Fitrah and Soemitra (2022) showed that the green sector financed by sovereign green sukuk funds follows maqashid sharia within five aspects: protecting religion, soul, mind, offspring, and property. They also noted that investors, such as the government and the UN, are becoming more environmentally conscious, which could lead to green sukuk issuance.

In contrast to previous studies that used literature analysis, Alsmadi and Alzoubi (2022), Yu et al. (2021), Zhang et al. (2022), and Ziabina and Pimonenko (2020) used a bibliometric analysis that discusses green finance but has not explicitly discussed green sukuk. Many researchers have also studied sukuk literature in the form of bibliometrics and demonstrated the potential for green sukuk (Paltrinieri et al., 2023; Rahman et al., 2020). There have been several studies conducted on green sukuk. However, they were still focused on initially conceptualizing this new type of Sharia-based financing (Abubakar & Handayani, 2020; Dervi, 2021; Mujizat, 2021; Rohman, 2017; Uluoyol, 2021). Given the potential suitability of green sukuk with Islamic principles (Fitrah & Soemitra, 2022) and a bright future for green bonds (Cortellini & Panetta, 2021), this study addresses a void in the existing literature by providing a comprehensive analysis of previous articles regarding green sukuk in terms of its model development, opportunities, challenges, and evaluation.

Unlike Keshminder et al. (2022), who used the green taxonomy method in projecting the system classification consisting of a list of environmentally friendly economic activities, the analysis still needs more interest. The green sukuk market needs help finding green assets from projects like transportation, farmland, and preventing disasters that can be used to back green sukuk. There are some limitations to transparency in Indonesia's fi-

nancial and greenhouse gas (GHG) accounting systems regarding climate change tackling and green sukuk accountability requirements. Raeni et al. (2022) reported that before the issuing of green sukuk, the Indonesian government employed "climate tagging" in their budgeting and planning to keep track of actions that helped mitigate the consequences of climate change and helped people adjust to them. This was done prior to the issuance of green sukuk. Some researchers use climate tagging to generate climate accounting items, making climate obligations more manageable in terms of budget and planning accounts (Raeni et al., 2022).

Creating green bonds has shown to be a successful vehicle for developing green finance, and their popularity has been growing. Liu and Lai (2021) disclosed that the growth of green sukuk has also helped to promote the domestic Islamic financial sector, one of which is in Malaysia, and has boosted Kuala Lumpur's position as an innovative hub for Islamic banking and finance. Abdullah and Keshminder (2022) demonstrated that factors such as legitimacy, competitiveness, and environmental responsibility play a significant role in the issuance of green sukuk in Malaysia. These findings are consistent with those obtained from the CER model and those gained from earlier investigations on green bonds. It was also found that legitimacy and competition play a big role in issuing green sukuk, whereas ecological responsibility will develop after the process.

Besides that, Keshminder et al. (2019) explained that the interest rate charged by banks for issuing sukuk is much lower than that of conventional loans. Sukuk is also not exposed to fluctuations in interest rates. They offer guaranteed certainty in the long term because their profit levels do not follow changes in interest rates. Therefore, green sukuk is considered a better choice compared to conventional loans.

Alam et al. (2016) demonstrated that the fast-growing global sukuk market might fund green energy and environmentally benign initiatives in developed Islamic countries. Between late 2007 and early 2009, the sukuk market faltered due to the Shariah compliance debate and the current crisis of the world's economies, raising borrowing costs and eroding investor confidence.

Siswantoro (2018) revealed that the value of Indonesian green sukuk declined until November 2018. Early in February 2019, they initiated an above-average price hike. The Indonesian government issued a second bond in 2019, and due to the anticipation of many investors, the second sale was also successful. The initial issuance of green sukuk was successful; therefore, the government decided to issue a second bond.

Besides that, Güçlü (2019) explained that several countries with the highest number of green bonds in 2018, including the United States, China, and France, were at the top, contributing 47% of global green bond issuance. In 2018, US green bond issuance amounted to USD 34.1 billion, China USD 30.9 billion, and France USD 14.2 billion. Islamic finance lags behind its conventional counterparts in green investing, but its development in recent years has been promising. The most unstable market comprises Islamic stocks, conventional stocks, bonds, and green sukuk (Narayan et al., 2022). Islamic stocks are included in the conventional stock market, which is also the most volatile (Narayan et al., 2022). During the quality war, investors moved their money away from riskier assets (such as conventional and Islamic shares) and toward assets with lower levels of risk (such as sukuk and green sukuk) (Narayan et al., 2022). During the COVID-19 pandemic, there is substantial evidence that the volatility increased over time and was higher than usual (Narayan et al., 2022). Oktaviani et al. (2018) mentioned that green sukuk would most likely be successfully implemented in Indonesia.

Instruments, techniques, tactics, and procedures for producing money, minimizing future expenses, offering greater conservation, and aligning spending to be more efficient could be included in financial solutions for preserving biodiversity (Oktaviani et al., 2018). Whereas Santoso (2020) revealed that to support the climate change program, green sukuk issued are prioritized to finance government projects that directly or indirectly contribute to achieving the SDGs agenda. There are several challenges faced by green sukuk, which have high development potential. Keshminder et al. (2019) claimed that the green sukuk market was plagued by a weak green taxonomy, difficulty in identifying green assets, time-consuming and

expensive procedures, a lack of attractive incentives, and an increased risk profile. Green sukuk concerns can help renewable energy sector, such as energy efficiency, decreased risk of natural disasters, sustainable transportation, waste management of natural resources, environmentally responsible tourism and construction, and sustainable agriculture (Santoso, 2020). Another challenge of green sukuk is disclosed by Raeni et al. (2022) with gas emissions validation procedure that supports climate tagging in financial accounting systems. Even if it does not match green sukuk's accountability, climate labeling creates additional climate-related visibility and opportunity (Raeni et al., 2022).

Green sukuk or green bonds that are already running must have several evaluations in their performance; Siswantoro and Surya (2021) demonstrated that the price performance of Indonesian green bonds gradually dropped from the first day of issuance to the 73rd due to the devaluation of US dollar-denominated Rupiah bonds, which were unfavorable. The EUR-USD ratio was added for comparison. Narayan et al. (2022) also observed that green sukuk returns fell sharply during the plague but recovered during the pandemic. Conditional correlations and volatility are varied because asset prices react differently to COVID-19 phases.

According to Güçlü (2019), another critical issue is the lack of consensus on green sukuk standards. Keshminder et al. (2022) stated that the sukuk supply is constrained by green project diversification. Companies must follow the Security Commission framework to get a green-label SRI sukuk for financing. Green and normal sukuk offer similar rates of return due to the premature market, but gaining a green label is tedious, expensive, and has no clear benefits. Liu and Lai (2021) also noted that Green Bond Principles (GBP) requirements are not precise, and best practices like an external review or consistent annual reporting methodology. The alignment of GBP does not guarantee that information will be disclosed in a manner that is accurate, credible, and consistent. External examiners cannot rescind GBP's "green" label if they challenge its green credentials. The issuer employs external reviewers, creating a patronage relationship that may reduce worries about the bond's green credentials.

One evaluation by Güçlü (2019) is that because green sukuk is a new product, there is a significant lack of investor awareness, so this shortage results in low liquidity. Differently, Siswanto (2018) stated that except for Poland, Indonesia's first green sukuk did not outperform other green bonds, including those issued by France, Belgium, and the Netherlands. However, the yield-to-maturity (YTM) performance of the second Indonesian green bond is superior to the first but still inferior to the Belgian green bond (Siswanto, 2018). This finding by Siswanto (2018) shows that the performance of the second Indonesian green sukuk was superior to that of the first.

Keshminder et al. (2019) remarked that Malaysia must establish a resilient green ecosystem where all stakeholders, including the public, understand climate challenges, green initiatives, and their dangers in fighting for green sukuk. Government engagement is needed since green sukuk is new and needs government actions and support (Keshminder et al., 2019). Karim and Naem (2022) revealed that global variables are responsible for determining the links between green, Islamic, and conventional financial markets, with stronger commitment fragmentation depicted by implied volatility in stock prices, energy prices, and gold prices. In contrast, relatively lesser commitment fragments are reported for the currency and bond markets. Indonesian green bonds substantially correlate to EUR/USD, whereas conventional bonds correlate more significantly. The USD green bond may closely track the EUR index against USD. Since investors are profit-driven, climate change may be ignored. Discussing investor green quality issues will be intriguing (Siswanto & Surya, 2021).

This paper aims to study and systematize publications about green sukuk during 2016–2022 to explain the emergence and development of green sukuk investments.

2. RESULTS

The descriptive analysis explains the study of green sukuk data quantitatively by year. Figure 1 presents a graph depicting the increase in the number of publications on research about green sukuk over time. Study on green sukuk shows an increase in the number starting in 2018 and 2019, but in 2020 it decreased. In 2021 and 2022, studies on green sukuk increased, and there is a peak number of publications of 5 articles, which is predicted to continue to increase.

The synthesis analysis explains the study of green sukuk data qualitatively based on the development of models, opportunities, challenges, and evaluations of green sukuk. In the developing aspect, the research model conducted by Morea and Poggi (2017) using analytical methods with indicators such as net present value (NPV), internal rate of return (IRR), weighted average cost of capital (WACC), annual debt service cover ratio (ADSCR), and annual loan life cover ratio (ALLCR). Morea and Poggi (2017) show that using Islamic finance leads to better bankability signs, bringing the current situation closer to a state where a project can be profitable.

A thorough analysis of the prior research pertinent to this subject was carried out as part of this study. This method can, in addition to contribut-

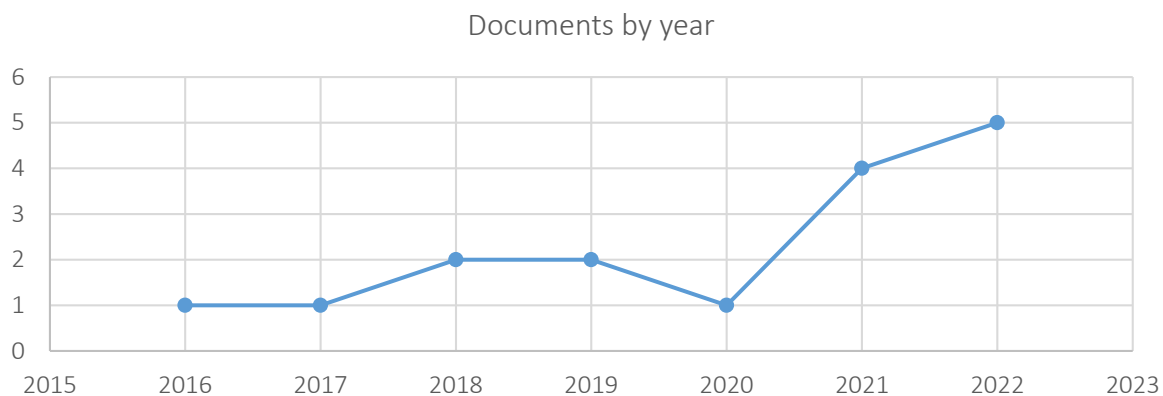


Figure 1. Publication trends about green sukuk by year

ing to the achievement of the goal of this study, demonstrate the extent to which the research has been conducted and give an overview of the areas in which the research differs from previous efforts and calls for a greater level of discipline. In addition, this inquiry was outfitted with the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) standard, which was used to choose samples for this investigation.

The literature on green sukuk can be divided into four main themes: development models, opportunities, challenges, and evaluation of existing products from green sukuk, as illustrated in Tables 1 and 2. Various researchers developed various approaches to making product models from green sukuk. For example, Morea and Poggi (2017) developed a net present value analysis to decide whether a green sukuk project is accepted. Meanwhile, the multivariate regression model on green sukuk was developed by Narayan et al. (2022) and Karim and Naeem (2022). The emergence of green sukuk, which is still relatively new, motivated Keshminder et al. (2022) to conduct studies based on expert opinions that encourage the strengthening of green taxonomy in green sukuk products.

On the theme of opportunities and development of green sukuk, several green sukuk studies focus on environmentally friendly and sustainable programs (Abdullah & Keshminder, 2022; Morea & Poggi, 2017; Santoso, 2020). In addition to environmentally friendly programs, support and innovation from financial institutions and financial markets are also a study of green sukuk (Karim & Naeem, 2022; Raeni et al., 2022). The challenges of green sukuk products have also not escaped the attention of researchers in terms of the response of financial market agents (Morea & Poggi, 2017), competitiveness (Abdullah & Keshminder, 2022), and global demand (Alam et al., 2016).

Considering the last theme in the green sukuk study, the researchers evaluated the journey of green sukuk, including vagueness (Liu & Lai, 2021) and the fragment commitment of green sukuk principles (Karim & Naeem, 2022). Keshminder et al. (2019) showed the sukuk with the need for more involvement from the government, and Keshminder et al. (2022) highlighted the technological risks of green sukuk. Furthermore, there is a need for support in incentives for green sukuk financing projects (Morea & Poggi, 2017) to increase investor awareness (Güçlü, 2019).

Table 1. Green sukuk synthesis in model development and opportunity

Source of literature	Model development	Development and opportunity
Morea and Poggi (2017)	Net present value (NPV) analysis method	Continued investment in the wind energy sector
Keshminder et al. (2022)	Green taxonomy method	–
Raeni et al. (2022)	Desk-based document analysis	<ul style="list-style-type: none"> • An innovative form of green financial instrument • Modification of financial accounting systems through climate tagging
Liu and Lai (2021)	Qualitative and interpretive methodologies	An innovative center for Islamic banking and finance
Abdullah and Keshminder (2022)	Corporate ecological responsibility (CER Model)	Green project financing
Keshminder et al. (2019)	–	Interest rate fluctuations
Alam et al. (2016)	–	Environmentally friendly project
Siswanto and Surya (2021)	Yield-to-maturity (YTM) analysis	The Euro has a high correlation with green sukuk
Güçlü (2019)	–	Issuance of green bonds
Narayan et al. (2022)	Model multivariate generalized autoregressive conditional heteroscedastic dynamic conditional correlation (MGARCH–DCC)	<ul style="list-style-type: none"> • COVID-19 pandemic phase • Risky assets and less risky assets
Oktaviani et al. (2018)	<ul style="list-style-type: none"> • Biodiversity finance initiative • Biodiversity and ecosystem services network 	–
Santoso (2020)	–	Climate change program
Siswanto and Surya (2018)	Index-based comparison analysis	The decline in the price of sukuk
Karim and Naeem (2022)	<ul style="list-style-type: none"> • w • Vector Autoregressive (VAR) 	<ul style="list-style-type: none"> • Improvement of financial market connectivity • Sustainable market potential

Table 2. Green sukuk synthesis in challenge and evaluation

Source of literature	Challenge	Evaluation
Morea and Poggi (2017)	<ul style="list-style-type: none"> • Effective interaction of economic agents • Professional 	Incentives to achieve network parity
Keshminder et al. (2022)	–	Green project technology risk
Raeni et al. (2022)	<ul style="list-style-type: none"> • Conservatory gas accounting system • Space gas emission validation 	–
Liu and Lai (2021)	–	Green bond principles (GBP) terms are unclear
Abdullah and Keshminder (2022)	Competitiveness and legitimacy	Cost financing low
Keshminder et al. (2019)	Bad green taxonomy	Government involvement in the green sukuk project
Alam et al. (2016)	Developing global demand	–
Siswanto and Surya (2021)	Sustainable development (SDGs)	<ul style="list-style-type: none"> • Depreciation of currency • Issues of climate change
Güçlü (2019)	Consensus on green sukuk standards	<ul style="list-style-type: none"> • Low liquidity • Investor awareness
Narayan et al. (2022)	Global crisis and pandemic	Price reduction phase COVID-19
Oktaviani et al. (2018)	Biodiversity funding	–
Santoso (2020)	Achievement of the SDGs agenda, sector contribution	–
Siswanto and Surya (2018)	–	Green sukuk performance
Karim and Naeem (2022)	<ul style="list-style-type: none"> • Trading volumes • Global financial uncertainty in the cryptocurrency market. 	<ul style="list-style-type: none"> • Green sukuk commitment fragment • Global factors

3. DISCUSSION

Research and measurement models for greenness (environmental friendliness) on financing are still being discussed and developed. Further study on the development side of the model is not only in green taxonomy or climate tagging. After COVID-19, it is necessary to develop and enlarge the sample and determine if the results remain the same and if green sukuk continues to increase in terms of being environmentally benign and sustainable in terms of development. Robust estimation techniques such as Markov switching dependency models, time-frequency models, and dynamic connectedness approaches are recommended (Abakah et al., 2023).

A study on the development and opportunities of green sukuk has more influence on green finance and domestic and global Islamic financial markets. Green sukuk has limitations in the financial accounting system and GHG (greenhouse gases) valuation. This deficiency in its management necessitates the establishment of a new accounting object that provides a granular link between financial data and GHG accounting. The current accounting system is reused by developing a green sukuk accounting object, which tries to link the equal dispersal of money with social and environmental advantages, most prominently represented by emission reductions in greenhouse gases (Raeni et al., 2022).

Opportunities from green sukuk are more dominated by biodiversity and climate change and involve government projects to achieve the SDGs agenda. A green sukuk study would be more fascinating if it included sukuk issuers and sukuk experts from other green sukuk-dominant nations to quantify the hurdles and comprehend the government's activities to assure resilience growth in the sukuk market. Future studies are anticipated to generate findings that can be used to create a comprehensive growth framework for green sukuk that can be adopted internationally to stimulate more green funding to address environmental challenges (Narayan et al., 2022).

A study on research facing issues and assessments in the green sukuk market is focused on finding solutions to difficulties in identifying green assets, managing the renewable energy sector, and the GHG energy validation procedure. The green stock market reaction further requires cooperation between different sectors of the economy. Investors and businesses are responsible for promoting sustainable development and the use of renewable energy, as well as enhancing the quality of existing green assets for the benefit of current and future generations. This condition can be accomplished by issuing green bonds with strong brand values tied to eco-friendly projects (Verma & Bansal, 2023).

CONCLUSION

This study aims to show the development trend of the number of publications in green sukuk and systematize the results of studies that explain the development and evaluation of the emergence of green sukuk investments. This study obtained documents regarding green sukuk from 2016 to 2022. Downloads were carried out by taking the abstracts of each article. 15 publications were final numbers to be analyzed. Green sukuk studies are improving in the number of articles from year to year, and it peaked at five articles in 2021 and 2022.

Green sukuk literature covers development methods, opportunities, obstacles, and product evaluation. Researchers created green sukuk product models in various ways, including net present value analysis and multivariate regression model for green sukuk. Green sukuk research on possibilities and development emphasizes ecologically friendly and sustainable initiatives. These studies also examined the response of financial market agents, competitiveness, and worldwide demand for green sukuk products. Evaluation of green sukuk can be pointed at the vagueness and fragment commitment to green sukuk principles. A green sukuk study would be more interesting if it included issuers and experts from other green sukuk-dominant nations to quantify the challenges and understand the government's actions to ensure resilience growth in the market: green sukuk issuers and specialists.

Future studies should produce a comprehensive growth strategy for green sukuk that may be implemented internationally to increase green funding to address environmental issues. Research must address concerns in identifying green assets, managing the renewable energy sector, and validating GHG energy. The green stock market reaction necessitates more economic collaboration than what has existed.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Abakah, E. J. A., Tiwari, A. K., Adekoya, O. B., & Oteng-Abayie, E. F. (2023). An analysis of the time-varying causality and dynamic correlation between green bonds and US gas prices. *Technological Forecasting and Social Change*, 186(A), 122134. <https://doi.org/10.1016/j.techfore.2022.122134>
2. Abdullah, M. S., & Keshminder, J. S. (2022). What drives green sukuk? A leader's perspective. *Journal of Sustainable Finance and Investment*, 12(3), 985-1005. <https://doi.org/10.1080/20430795.2020.1821339>
3. Abubakar, L., & Handayani, T. (2020). Green sukuk: Sustainable financing instruments for infrastructure development in Indonesia. *Proceedings of the 1st Borobudur International Symposium on Humanities, Economics and Social Sciences (BIS-HESS 2019)* (pp. 983-987). <https://doi.org/10.2991/assehr.k.200529.206>
4. Alam, N., Duygun, M., & Ariss, R. T. (2016). Green sukuk: An

- innovation in Islamic capital markets. In A. Dorsman, Ö. Arslan-Ayaydin, & M. Karan (Eds.), *Energy and Finance: Sustainability in the Energy Industry* (pp. 167-185). Springer International Publishing. https://doi.org/10.1007/978-3-319-32268-1_10
5. Alsmadi, A. A., & Alzoubi, M. (2022). Green economy: Bibliometric analysis approach. *International Journal of Energy Economics and Policy*, 12(2), 282-289. <https://doi.org/10.32479/ijeep.12758>
 6. Arsandrie, Y., & Widayanti, E. (2018). Perhitungan ruang terbuka hijau di kecamatan Kartasura Sukoharjo berdasarkan luas wilayah, jumlah penduduk, dan kebutuhan O2 [Calculation of green open space in Kartasura Sukoharjo district based on area, total population, and O2 needs]. *Jurnal Arsitektur*, 15(2), 93-98. (In Indonesian). <https://doi.org/10.23917/sinekтика.v15i2.9867>
 7. Atkinson, L. Z., & Cipriani, A. (2018). How to carry out a literature search for a systematic review: A practical guide. *BJPsych Advances*, 24(2), 74-82. <https://doi.org/10.1192/bja.2017.3>
 8. Barricelli, B. R., Cassano, F., Fogli, D., & Piccinno, A. (2019). End-user development, end-user programming and end-user software engineering: A systematic mapping study. *Journal of Systems and Software*, 149, 101-137. <https://doi.org/10.1016/j.jss.2018.11.041>
 9. Cheong, C., & Choi, J. (2020). Green bonds: A survey. *Journal of Derivatives and Quantitative Studies*, 28(4), 175-189. <https://doi.org/10.1108/jdqqs-09-2020-0024>
 10. Cortellini, G., & Panetta, I. C. (2021). Green bond: A systematic literature review for future research agendas. *Journal of Risk and Financial Management*, 14(12), 589. <https://doi.org/10.3390/jrfm14120589>
 11. Dervi, U. D. (2021). *A bibliometric review of green financing, implication for Islamic Finance* (Unpublished Master's Thesis). Institute of Business Administration Karachi. Retrieved from <https://ir.iba.edu.pk/etd/87/>
 12. Ehlers, T., & Packer, F. (2017). Green bond finance and certification. *BIS Quarterly Review*, 89-104. Retrieved from https://www.bis.org/publ/qtrpdf/r_qt1709h.pdf
 13. Fadzlurrahman, F., & Abubakar, L. (2019). Pengalokasian risiko dalam pembiayaan proyek berbasis sukuk guna mewujudkan kemudahan berusaha [Allocation of risks in sukuk-based project financing to realize ease of doing business]. *Jurnal Jurisprudence*, 9(2), 133-148. (In Indonesian). <https://doi.org/10.23917/jurisprudence.v9i2.8073>
 14. Fatchurrohman, F. (2006). Consumerism dan perlindungan konsumen [Consumerism and consumer protection]. *Jurnal Benefit*, 10(2), 155-163. (In Indonesian). Retrieved from <https://journals.ums.ac.id/index.php/benefit/article/view/1237>
 15. Fathihani, J. S., Haat, M. H. C., Yusliza, M. Y., Muhammad, Z., & Bon, A. T. (2021). A review of sustainable green finance literature: Mini-review approach. *Proceedings of the International Conference on Industrial Engineering and Operations Management* (pp. 3194-3207). Singapore. Retrieved from <http://www.ieomsociety.org/singapore2021/papers/573.pdf>
 16. Fitrah, R., & Soemitra, A. (2022). Green sukuk for sustainable development goals in Indonesia: A literature study. *Jurnal Ilmiah Ekonomi Islam*, 8(1), 231-240. <http://dx.doi.org/10.29040/jiei.v8i1.4591>
 17. Gilchrist, D., Yu, J., & Zhong, R. (2021). The limits of green finance: A survey of literature in the context of green bonds and green loans. *Sustainability*, 13(2), 478. <https://doi.org/10.3390/su13020478>
 18. Güçlü, F. (2019). The rise of environmental consciousness in Islamic finance: Green sukuk. In *Handbook of Energy and Environment Policy* (pp. 245-259). Peter Lang AG. Retrieved from https://www.academia.edu/40710517/The_Rise_of_Environmental_Consciousness_in_Islamic_Finance_Green_Sukuk
 19. Hoshen, M. S., Hasan, N., Hossain, S., Abdullah, M., Sabuj Hoshen, M., Hasan, M. N., Al Mamun, A., Mannan, A., & Al Mamun, M. A. (2017). Green financing: An emerging form of sustainable development in Bangladesh. *IOSR Journal of Business and Management (IOSR-JBM)*, 19(12), 24-30. Retrieved from https://www.academia.edu/63333139/Green_Financing_An_Emerging_Form_of_Sustainable_Development_in_Bangladesh
 20. Karim, S., & Naeem, M. A. (2022). Do global factors drive the interconnectedness among green, Islamic and conventional financial markets? *International Journal of Managerial Finance*, 18(4), 639-660. <https://doi.org/10.1108/IJMF-09-2021-0407>
 21. Karina, L. A. (2019). Peluang dan tantangan perkembangan green sukuk di Indonesia [Opportunities and challenges in the development of green sukuk in Indonesia]. *Conference on Islamic Management Accounting and Economics*, 2, 259-265. (In Indonesian). Retrieved from <https://journal.uui.ac.id/CIMAE/article/view/14165/9772>
 22. Keshminder, J. S., Abdullah, M. S., & Mardi, M. (2022). Green sukuk – Malaysia surviving the bumpy road: Performance, challenges and reconciled issuance framework. *Qualitative Research in Financial Markets*, 14(1), 76-94. <https://doi.org/10.1108/QRFM-04-2021-0049>
 23. Keshminder, J. S., Singh, G. K. B., Wahid, Z. A. B., & Abdullah, M. S. (2019). Green sukuk: Malaysia taking the lead. *Malaysian Journal of Consumer and Family Economics*, 22(2), 1-22. Retrieved from <https://www.majcafe.com/green-sukuk-malaysia-taking-the-lead/>
 24. Khamis, M. A., & Nobanee, H. (2021). *Green financing: A literature review*. Abu Dhabi University. Retrieved from <https://>

- www.researchgate.net/publication/355195674
25. Lanzara, F. (2021). Islamic finance and sustainable development goals. A bibliometric analysis from 2000 to 2021. *European Journal of Islamic Finance*, 18, 1-19. <https://doi.org/10.13135/2421-2172/5765>
 26. Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Journal of Clinical Epidemiology*, 62(10), E1-E34. <https://doi.org/10.1016/j.jclinepi.2009.06.006>
 27. Liu, F. H. M., & Lai, K. P. Y. (2021). Ecologies of green finance: Green sukuk and development of green Islamic finance in Malaysia. *Environment and Planning A: Economy and Space*, 53(8), 1896-1914. <https://doi.org/10.1177/0308518X211038349>
 28. Malhotra, G., & Thakur, K. (2020). Evolution of green finance: A bibliometric approach. *Gedrag & Organisatie Review*, 33(2), 583-594. Retrieved from <https://lemma-tijdschriften.com/gallery/goj-1577.pdf>
 29. Ministry of Finance of the Republic of Indonesia. (2019). *Public finance for climate change in Indonesia 2016–2018*. Fiscal Policy Agency, Ministry of Finance. Retrieved from https://www.undp.org/sites/g/files/zskgke326/files/migration/id/INS-ENGLISH-Full-Report-Public-Finance-for-Climate-Change-in-Indonesia-2016-2018_compressed.pdf
 30. Molina-Azorín, J. F., Claver-Cortés, E., López-Gamero, M. D., & Tarí, J. J. (2009). Green management and financial performance: A literature review. *Management Decision*, 47(7), 1080-1100. <https://doi.org/10.1108/00251740910978313>
 31. Morea, D., & Poggi, L. A. (2017). An innovative model for the sustainability of investments in the wind energy sector: The use of green sukuk in an Italian case study. *International Journal of Energy Economics and Policy*, 7(2), 53-60. Retrieved from <https://www.econjournals.com/index.php/ijeeep/article/view/4073>
 32. Muchtar, A. T., Amelia, L., Dachlan, A. N., Nur, A. I., & Bastari, G. R. (2012). *Literature study on climate change financing in Indonesia: Mapping sources, distribution mechanisms, and beneficiaries of climate change-related funds*. The Indonesian Institute Center for Public Policy Research. Retrieved from <https://media.neliti.com/media/publications/45138-ID-studi-literatur-pembiayaan-perubahan-iklim-di-indonesia-pemetaan-sumber-mekanism.pdf>
 33. Mujizat, D. A. (2021). *The sovereign green sukuk: An analysis of its process and barriers to funding renewable energy projects in Indonesia* (Master's Thesis). Uppsala University. Retrieved from <https://www.diva-portal.org/smash/get/diva2:1565307/FULLTEXT01.pdf>
 34. Narayan, P. K., Rizvi, S. A. R., & Sakti, A. (2022). Did green debt instruments aid diversification during the COVID-19 pandemic? *Financial Innovation*, 8(1), 21. <https://doi.org/10.1186/s40854-021-00331-4>
 35. Ntsama, U. Y. O., Yan, C., Nasiri, A., & Mboungam, A. H. M. (2021). Green bonds issuance: Insights in low- and middle-income countries. *International Journal of Corporate Social Responsibility*, 6(1), 2. <https://doi.org/10.1186/s40991-020-00056-0>
 36. Oktasari, D. P., Jamaludin, N., Saputra, J., Yusliza, M. Y., Muhammad, Z., & Bon, A. T. (2021). Green transformation and finance literature: A mini-review approach. In *Proceedings of the International Conference on Industrial Engineering and Operations Management* (pp. 3302-3315). Singapore. Retrieved from <http://www.ieomsociety.org/singapore2021/papers/597.pdf>
 37. Oktaviani, Y., Rangkuti, K., Pyan Putro Surya, A. M., & Puspita, A. (2018). Financial solutions for biodiversity in contributing to the economic development in Indonesia. *E3S Web of Conferences*, 74. <https://doi.org/10.1051/e3s-conf/20187401007>
 38. Ozili, P. K. (2022). Green finance research around the world: A review of literature. *International Journal of Green Economics*, 16(1). <https://doi.org/10.1504/ijge.2022.10048432>
 39. Page, M. J., McKenzie, J. E., Bossuyt, P., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The prisma 2020 statement: An updated guideline for reporting systematic reviews. *Medicina Fluminensis*, 57(4), 444-465. https://doi.org/10.21860/med-flum2021_264903
 40. Paltrinieri, A., Hassan, M. K., Bahoo, S., & Khan, A. (2023). A bibliometric review of sukuk literature. *International Review of Economics and Finance*, 86, 897-918. <https://doi.org/10.1016/j.iref.2019.04.004>
 41. Purnamawati, I. (2013). Perbandingan sukuk dan obligasi (Telaah dari perspektif keuangan dan akuntansi) [Comparison of sukuk and bonds (A review from a financial and accounting perspective)]. *Jurnal Akuntansi Universitas Jember*, 11(1), 62-71. (In Indonesian). <https://doi.org/10.19184/jauj.v11i1.1261>
 42. Raeni, R., Thomson, I., & Frandsen, A.-C. (2022). Mobilising Islamic funds for climate actions: From transparency to traceability. *Social and Environmental Accountability Journal*, 42(1-2), 38-62. <https://doi.org/10.1080/0969160X.2022.2066553>
 43. Rahman, M., Isa, C. R., Tu, T.-T., Sarker, M., & Masud, M. A. K. (2020). A bibliometric analysis of socially responsible investment sukuk literature. *Asian Journal*

- of Sustainability and Social Responsibility*, 5(1), 7. <https://doi.org/10.1186/s41180-020-00035-2>
44. Rani, L. N., Laila, N., Filianti, D., & Ramadani, D. W. (2022). Analysis of sukuk research in Indonesia bibliometric approach. *Al-Muzara'ah*, 2022(Special Issue), 43-56. <https://doi.org/10.29244/jam.specialissue2022.43-56>
 45. Rapi, K., Maisarah, S., Rambe, S. A. F., Chandra, W., & Rahmana, A. (2021). Green Finance for the era of post COVID-19: A systematic literature. *Advances in Economics, Business and Management Research*, 198, 190-195. Retrieved from <https://www.atlantis-press.com/article/125965523.pdf>
 46. Rohman, R. S. (2017). *The prospect implementation of green bond toward green sukuk in Indonesia*. Universitas Islam Indonesia. Retrieved from <https://dspace.uui.ac.id/bitstream/handle/123456789/33136/13423138> Rizaldi Saeful Rohman.pdf
 47. Saleem, M., & Khan, M. U. (2021). Green finance for sustainable development: A bibliometric review of current status, development and prospects. *International Journal of Advanced Research in Commerce, Management & Social Science (IJARCMSS)*, 4(4), 1-9. Retrieved from <https://www.inspirajournals.com/uploads/Issues/632981321.pdf>
 48. Santoso, I. R. (2020). Green sukuk and sustainable economic development goals: Mitigating climate change in Indonesia. *Global Journal Al-Thaqafah*, 10(1), 18-26. Retrieved from <http://www.gjat.my/gjat2020vol10/3.pdf>
 49. Sial, M. S., Cherian, J., Meero, A., Salman, A., Rahman, A. A., Samad, S., & Negrut, C. V. (2022). Determining financial uncertainty through the dynamics of sukuk bonds and prices in emerging market indices. *Risks*, 10(3), 61. <https://doi.org/10.3390/risks10030061>
 50. Siswanto, D. (2018). Performance of Indonesian green sukuk (Islamic bond): A sovereign bond comparison analysis, climate change concerns? *IOP Conference Series: Earth and Environmental Science*, 200(1), 012056. <https://doi.org/10.1088/1755-1315/200/1/012056>
 51. Siswanto, D., & Surya, H. V. (2021). Indonesian Green Sukuk (Islamic Bond) of climate change: A revisited analysis. *IOP Conference Series: Earth and Environmental Science*, 716(1), 012044. <https://doi.org/10.1088/1755-1315/716/1/012044>
 52. Suherman, Noor, I., & Manzilati, A. (2019). Identifikasi potensi pasar green sukuk Republik Indonesia [Identification of Republic of Indonesia's green sukuk market potential]. *Human Falah: Jurnal Ekonomi Dan Bisnis Islam*, 6(1), 37-53. (In Indonesian). Retrieved from <http://jurnal.uinsu.ac.id/index.php/humanfalah/article/view/4177>
 53. Suroso, D. S. A., Setiawan, B., Pradono, P., Iskandar, Z. S., & Hastari, M. A. (2022). Revisiting the role of international climate finance (ICF) towards achieving the nationally determined contribution (NDC) target: A case study of the Indonesian energy sector. *Environmental Science and Policy*, 131, 188-195. <https://doi.org/10.1016/j.envsci.2022.01.022>
 54. Triandini, E., Jayanatha, S., Indrawan, A., Werla Putra, G., & Iswara, B. (2019). Metode systematic literature review untuk identifikasi platform dan metode pengembangan sistem informasi di Indonesia. *Indonesian Journal of Information Systems*, 1(2), 63-77. (In Indonesian). <https://doi.org/10.24002/ijis.v1i2.1916>
 55. Uलयol, B. (2021). A comprehensive empirical and theoretical literature survey of Islamic bonds (sukuk). *Journal of Sustainable Finance and Investment*. <https://doi.org/10.1080/20430795.2021.1917224>
 56. Vale, J., Amaral, J., Abrantes, L., Leal, C., & Silva, R. (2022). Management accounting and control in higher education institutions: A systematic literature review. *Administrative Sciences*, 12(1), 14. <https://doi.org/10.3390/admsci12010014>
 57. Verma, A., & Agarwal, R. (2020). A study of green bond market in India: A critical review. *IOP Conference Series: Materials Science and Engineering*, 804(1), 012052. <https://doi.org/10.1088/1757-899X/804/1/012052>
 58. Verma, R. K., & Bansal, R. (2023). Stock market reaction on green-bond issue: Evidence from Indian green-bond issuers. *Vision*, 27(2), 264-272. <https://doi.org/10.1177/09722629211022523>
 59. Wiyadi, W. (2015). Pengaruh implementasi strategi pemasaran hijau dan karakteristik konsumen terhadap pilihan produk (Studi empiris pada konsumen AMDK di Surakarta) [The influence of implementation of green marketing strategy and consumers on product choice (Empirical study on AMDK consumers in Surakarta)]. *BENEFIT: Jurnal Manajemen Dan Bisnis*, 19(2), 168-180. (In Indonesian). Retrieved from <http://journals.ums.ac.id/index.php/benefit/article/view/2316>
 60. Yu, X., Mao, Y., Huang, D., Sun, Z., & Li, T. (2021). Mapping global research on green finance from 1989 to 2020: A bibliometric study. *Advances in Civil Engineering*, 2021, 9934004. <https://doi.org/10.1155/2021/9934004>
 61. Zhang, D., Zhang, Z., & Managi, S. (2019). A bibliometric analysis on green finance: Current status, development, and future directions. *Finance Research Letters*, 29, 425-430. <https://doi.org/10.1016/j.frl.2019.02.003>
 62. Zhang, Z., Liu, Y., Han, Z., & Liao, X. (2022). Green finance and carbon emission reduction: A bibliometric analysis and systematic review. *Frontiers in Environmental Sciences*, 10, 1-17. <https://doi.org/10.3389/fenvs.2022.929250>
 63. Ziabina, Y., & Pimonenko, T. (2020). The green deal policy for renewable energy: A bibliometric analysis. *Virtual Economics*, 3(4), 147-168. [https://doi.org/10.34021/ve.2020.03.04\(8\)](https://doi.org/10.34021/ve.2020.03.04(8))