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Environmental Impact Sukuk: A Proposal for Environmental Sustainability

Çevresel Etkili Sukûk: Çevresel Sürdürülebilirlik İçin Bir Öneri

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Environmental Impact Sukuk: A Proposal for Environmental Sustainability

Abstract

The effects of climate change have been increasing rapidly in recent years and attracting attention in the context of a global problem. Climate change is leading to an increase in extreme weather events, including both excessive rainfall and droughts. These events lead to problems with serious consequences, such as flooding, combined sewer overflows and wildfires. Recently, the need to take measures against the negative impacts of events such as floods and wildfires on public health and the economy has been at the forefront of the agenda. However, governments attempting to take measures against floods, wildfires, and combined sewer overflows are often hindered by budget constraints. As a matter of fact, adaptation and mitigation measures against climate-related events such as floods and fires are quite costly and require substantial financing. Although traditional finance provides funding for such events, it is emphasized that the funding provided is insufficient, and innovative financing methods are required. In this study, we aim to propose for the first time environmental impact sukuk and a novel model of this sukuk structure in the context of innovative finance using a descriptive and explanatory method. In this model, similar to environmental impact bonds, environmental impact sukuk includes a "payment-for-success" mechanism. In this mechanism, before issuance of environmental impact sukuk, the project's environmental goals (threshold values) are determined, and investors receive payments based on the performance of the project. Accordingly, if the project reaches the specified threshold values, investors receive higher payments; otherwise, they receive lower payments. Unlike previous "impact sukuk" structures, the proposed model in this study includes the local government as a beneficiary and allows beneficiaries to pay the project implementer (entrepreneur) based on project performance. Given the urgent need to address current environmental challenges, the implementation of environmental impact sukuk is crucial and holds significant potential, especially in the context of the growing sukuk and impact investing markets. However, challenges such as the complex structure and costly issuance process may hinder the launch of environmental impact sukuk in the future. According to the result of the study, for environmental impact sukuk to be launched more widely in the future, the problems encountered in the first stage must be resolved.

Keywords: Islamic Finance, Sukuk, Environmental Impact Sukuk, Impact Bonds, Climate Change.

Çevresel Etkili Sukûk: Çevresel Sürdürülebilirlik İçin Bir Öneri

Öz

İklim değişikliklerinin etkileri son yıllarda hızla artmakta, küresel bir sorun bağlamında dikkatleri üzerine çekmektedir. İklim değişiminden dolayı aşırı yağmur, kuraklık gibi hava olayları meydana gelmektedir. Bu olaylar sel, birleşik kanalizasyon taşması ve orman yangınları gibi ciddi sonuçları olan sorunlara yol açmaktadır. Sel ve orman yangını gibi olayların toplum sağlığı ve ekonomi üzerindeki olumsuz etkilerine karşı önlem alma gereği son zamanlarda gündemin ön sıralarında yer almaktadır. Ancak sel, yangın ve birleşik kanalizasyon taşması gibi olaylara karşı mücadeleye çalışan hükümetler bütçe kısıtı ile karşı karşıya kalmaktadırlar. Nitekim sel ve yangın gibi iklim olaylarına karşı uyum ve azaltım önlemleri oldukça maliyetli olup yüksek düzeyde finansman gerektirmektedir. Her ne kadar söz konusu olaylara karşı geleneksel finans kullanılmakta ise de sağlanan finansmanın yetersiz kaldığı ve inovatif finansman yöntemlerine ihtiyaç duyulduğuna vurgu yapılmaktadır. Bu çalışmada betimsel ve açıklayıcı bir yöntem kullanılarak, inovatif finans bağlamında ilk defa çevresel etkili sukûk ve bu sukûk yapısına ilişkin bir model önerisi yapmak amaçlanmıştır. Bu modelde çevresel etkili tahvillere benzer şekilde çevresel etkili sukûk, "başarı için ödeme" mekanizmasını içermektedir. Bu mekanizmada, çevresel etkili sukûk ihraç edilmeden önce projenin ulaşması beklenen çevresel hedefler (eşik değerler) belirlenmekte ve yatırımcılar projenin performansına göre ödeme almaktadırlar. Buna göre yatırımcılar, proje belirlenen eşik değere ulaştığında fazla, ulaşamadığında daha az ödeme almaktadırlar.

Bu çalışmada, daha önceki "etki sukûku" yapılarından farklı olarak, yerel hükümet yararlanıcılar arasında sayılmakta ve ayrıca yararlanıcılar projenin performansına göre proje yürütücüsüne (girişimciye) ödeme yapmaktadırlar. Güncel çevresel gelişmelere karşı önlem alma ihtiyacı biliniyorken, çevresel etkili sukûkun uygulanabilmesi oldukça önemli olup, uygulanma potansiyeli gelişen sukûk ve etki yatırımı piyasası göz önüne alındığında oldukça fazladır. Ancak, çevresel etkili sukûkun karmaşıklığı ve maliyetli ihraç süreci gibi problemleri bu sukûk yapısının gelecekte uygulanma potansiyelini azaltmaktadır. Çalışmanın sonucuna göre, çevresel etkili sukûkun gelecekte daha yaygın uygulanabilmesi için ilk aşamada karşımıza çıkan problemlerin giderilmesi gerekmektedir.
Anahtar Kelimeler: İslami Finans, Sukûk, Çevresel Etkili Sukûk, Etki Tahvilleri, İklim Değişimi.

Introduction

The increasing global temperatures in recent years have made climate change one of the most widely discussed topics in the world. As a matter of fact, climate change has many important consequences, including increasing temperatures, storms, droughts (or water scarcity), loss of species, physical and mental health risks, political instability, poverty, and displacement. Wildfires and extreme rainfall events (and floods) can undoubtedly be added to these consequences of climate change. For example, emphasizing effects of the climate change globally, Myhre et al. (2019) show that extreme precipitation (heavy rain and snowfall) events double in frequency for per degree of global warming.[1]

Extreme rainfall and storms, which are the consequences of climate change, pose significant problems for countries with combined sewer systems (CSS). In this regard, CSS are mostly historical and not compatible with today's rain or weather conditions. Because CSSs are designed to carry sanitary sewer and stormwater (extreme water) to centralized wastewater treatment plants (WWTP). And during heavy rain events, excess water exceeds the capacity of CSS. As a result of this, a relief system inserted in CSS discharges excess and untreated water into nearby water bodies to relieve the system. These overflows are called combined sewer overflows (CSOs). CSOs are more likely to occur during times of heavy rainfall and storms, and as previously mentioned, climate change increases extreme rainfall events. CSOs can result in high concentrations of microbial pathogens, solids, debris, and toxic pollutants in nearby water bodies. Microbial pathogens and other pollutants cause public health problems and degradation of water quality (effect on fish population etc.). For example, it can be clearly seen the effects (deaths, injuries etc.) of floods on people. According to Ritchie & Rosado (2022), approximately 30 million people are affected by floods every year between 2001 and 2023.[2] This number of affected people shows the importance of heavy rainfall and storms and need for innovation against heavy rainfall and extreme precipitation events.

Wildfires, another consequence of climate change, have serious negative effects on the ecosystem, environment, people and property. In this regard, wildfires can cause soil erosion and habitat destruction, loss of biodiversity and carbon storage, health problems, and damage to people's properties. In this regard, according to Global Forest Watch (2024), in 2023, fires account for almost 42% of total tree cover loss.[3] This means increasing CO_2 emissions, economic damages, and health impacts, and therefore highlights the urgency of potential measures that can be taken.

Given the urgency of the measures that must be taken against CSOs and wildfires, governments have been struggling with these problems using costly methods. In this regard,

1 Gunnar Myhre et al., "Frequency of Extreme Precipitation Increases Extensively with Event Rareness Under Global Warming," *Scientific Reports* 9/1 (November 5, 2019), 16063.
2 Hannah Ritchie - Pablo Rosado, "Natural Disasters," *Our World in Data*, (2022).
3 Global Forest Watch, "Global Deforestation Rates & Statistics by Country" (2024).

to prevent CSOs, conducted grey infrastructure projects (such as storage facilities and new sewer pipes etc.) are very costly for governments. Similarly, fire suppression costs are very high for all governments facing high fire events and trying to increase the response capacities to combat fires.[4]

Recently, countries have been investing in "*green infrastructure*" as an alternative to grey infrastructure (such as combined sewer systems). Similarly, instead of suppressing wildfires, countries have been conducting forest restoration projects to avoid high fire suppression costs. In other words, governments have been trying to prevent fires through forest restoration works rather than suppressing them at a great expense.

In order to finance innovative green infrastructure and forest restoration projects at low costs, governments have been exploring innovative financing tools. One of these innovative financing tools is environmental impact bonds (EIBs). In EIBs structure, a measurable environmental goal (KPIs) is determined for a project. And if the output of the project achieves or exceeds the determined goal, the public entity (issuer) pays an additional payout to the investors. his mechanism is referred to as the "*pay-for-success"* model. Although EIBs have been used primarily in the United States, projects financed by these bonds have shown high success rates. Given the growing market for sukuk and the increasing impact investor bases, a model for environmental impact sukuk (EIS) is proposed in this study. Based on the literature proposing models for sukuk structures[5], this study employs a descriptive and explanatory method to propose a model for environmental impact sukuk. In the proposed EIS model, similar to EIBs, a measurable goal is determined for the project, which is funded by EIS. If the project achieves or exceeds the goal, the public entity pays an additional payout to the investors. And if the project underperforms and cannot achieve the goal, the public entity pays less to the investors. To the best of our knowledge, this is the first study to propose environmental impact sukuk and a model for such sukuk worldwide.

In this study, the relationship between environmental sustainability and Islam, the relationship between environment and Islamic finance, environmental impact bonds (EIBs), proposal for environmental impact sukuk (EIS) and the opportunities and challenges for this proposed sukuk structure are examined. Accordingly, this study is structured into five comprehensive sections. The first section encompasses the relationship between environmental sustainability and Islamic principles. The second section highlights the Islamic finance and sukuk mechanisms used in environmental financing. In the third section, EIBs are introduced and discussed. In the fourth section, environmental impact sukuk is proposed and in the fifth and last section, the opportunities and challenges for the proposed sukuk model are examined.

1. Islamic Principles and Environmental Sustainability

The Holy Qur'an and the sayings and deeds (*hadiths*) of the Prophet Muhammad (peace be upon him) convey ecological messages to all humanity, emphasizing the great importance of environmental issues and human responsibility towards the environment.

There are over 200 verses in the Holy Qur'an that specifically address environmental issues.[6] These numerous verses on environmental issues in the Holy Qur'an are the indication of significance Islam places on preserving the nature. In this regard, in addition to planetary

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4 Stavros Kalogiannidis et al., "Socio-Psychological, Economic and Environmental Effects of Forest Fires," *Fire* 6/7 (2023); OECD, *Taming Wildfires in the Context of Climate Change Policy Highlights* (2023), 8.

5 Abdul Rafay et al., "Uniform Framework for Sukuk Al-Ijarah – A Proposed Model for All Madhahib," *Journal of Islamic Accounting and Business Research* 8/4 (2017), 420–454; Hafssa Yerrou - Bezoi Oumaima, "Sukuk and Waqf: Proposal of Structures During the Crisis Linked to Covid-19 Pandemic – Case of Morocco," *2023*, (no date); Asep Maulana et al., "Blue Sukuk as a Solution to Indonesia Maritime Economic Crisis Due to the Global Covid Pandemic," *Journal of Islamic Finance* 10/1 (2021), 36–45.

6 Shabeena Akhter et al., "Climate Change and Islam: A Global Perspective," *IJFANS International Journal of Food and Nutritional Sciences* 11/1 (2022), 1002.

systems, the world's ecosystems operate within their own boundaries and similarly, Islamic teachings impose limits on human behavior.[7] Specifically, Islamic teachings aim to prevent excessive resource use and consider environmental implications when utilizing natural resources.[8] It is possible to explain the limits that Islam sets on human behavior regarding the environment by referencing four key guiding principles: unity (*tawhid*), creation (*fitra*), responsibility (*khalifa*), and balance (*mizan*).[9] Following these principles can lead to environmental sustainability:

The unity *(tawhid*) principle defines the oneness of the Allah (the Almighty Allah) and the unity of all creation.[10] This principle affirms that human beings and nature are created from the same source and with a specific purpose.[11] About the unity of all creation, the Holy Qur'an states:

"*Allah is the Creator of all things; He has charge of everything.*"[12]

"*Everything in the heavens and the earth belongs to Allah. We have commanded those who were given the Scripture before you, and We command you, to be mindful of Allah. Even if you do ignore Him, everything in the heavens and the earth belongs to Him, and He is self-sufficient, worthy of all praise*."[13]

The principle of unity (*tawhid*) emphasizes that each component in the universe has a unique and interconnected role. Since all creations are interconnected and interdependent, Islam stresses the importance of protecting and respecting nature as a whole. Islamic teachings show that the universe and the world are a manifestation of Allah's divine will. As part of creation, human beings have a responsibility to protect the world, which is regarded as Allah's most precious creation.[14]

The creation (*fitra*) principle refers to the natural state of goodness and purity that all humans are born into. According to this principle, all creators have an intrinsic attitude towards goodness.[15] As a result, fitra encompasses an altruistic spirit, thoughtfulness in action, and a conservationist bias.[16] Therefore, fitra emphasizes living in harmony with nature and the environment, not to overexploit them.[17] According to Islamic teaching, environmental problems are a consequence of deviation from fitra (*fasad*).

Responsibility (*khalifa*) principle establishes the strong relationship between the Almighty Allah and human beings.[18] The word "*khalifa*" often translated as vicegerent,

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7 Fazlun Khalid, "Islam and the Environment – Ethics and Practice an Assessment," *Religion Compass* 4/11 (2010), 710; Akhter et al., "Climate Change and Islam: A Global Perspective," 996.

8 Akhter et al., "Climate Change and Islam: A Global Perspective," 1000.

9 Odeh Al-Jayyousi et al., "A Critical Discourse Analysis on Climate Change in a Globalized World: The Nexus of Islam and Sustainable Development," *Sustainability (Switzerland)* 15/19 (October 1, 2023); Khalid, "Islam and the Environment – Ethics and Practice an Assessment," 710; Akhter et al., "Climate Change and Islam: A Global Perspective," 996.

10 Islamic Relief, *Climate Change Policy* (Islamic Relief, 2018), 20.

11 Al-Jayyousi et al., "A Critical Discourse Analysis on Climate Change in a Globalized World: The Nexus of Islam and Sustainable Development."

12 *The Qur'an / A New Translation*, trans. M. A. S. Abdel Haleem (New York: Oxford University Press, 2005), al-Zumar 39/62.

13 al-Nisa 4/131.

14 Imran Hayat et al., "The Role of Islamic Environmental Ethics in The Alleviation of Climate Challenges and The Preservation of Ecosystem," *Russian Law Journal* 11/11 (2023), 397–398; Akhter et al., "Climate Change and Islam: A Global Perspective," 1001–1002.

15 Hayat et al., "The Role of Islamic Environmental Ethics in The Alleviation of Climate Challenges and The Preservation of Ecosystem," 397–400.

16 Saadia Khawar Khan Chishti, "Fitra: An Islamic Model for Humans and The Environment," *Islam and Ecology A Bestowed Trust*, ed. Richard C. Foltz et al. (United States of America: Harvard University Press, 2003), 78.

17 Odeh Rashed Al-Jayyousi, *Islam and Sustainable Development: New Worldviews* (England: Gower Publishing Limited, 2012), 51.

18 Khalid, "Islam and the Environment – Ethics and Practice an Assessment," 711.

successor, trustee, and other terms meaning responsibility.[19] According to this principle, the Almighty Allah created the heavens, the earth and everything between them, and entrusted them to man, and made man his stewardship (*khalifa*) on the earth,[20] as indicated in the following verses:

"*It is He who made you successors on the earth…*"[21]

"*[Prophet], when your Lord told the angels, 'I am putting a successor on earth,' they said, 'How canb You put someone there who will cause damage and bloodshed, when we celebrate Your praise and proclaim Your holiness?' but He said, 'I know things you do not'.*"[22]

In doing so, Creator (the Almighty Allah) gave man authority over everything created for his prosperity and benefit.[23] Additionally, by granting such benefits to humans, the Almighty Allah honored humans above other created beings. Reference is made to these issues in the Holy Qur'an:

"*We established you [people] on the earth and provided you with a means of livelihood there…*"[24]

"*We have honoured the children of Adam and carried them by land and sea; We have provided good sustenance for them and favoured them specially above many of those We have created.*"[25]

The authority given to humans over everything created brings with it a responsibility towards all created. In this sense, people have a responsibility to protect and preserve nature. Human beings should benefit from the Almighty Allah's creations without exaggerating, exploiting or abusing them. Because society and future generations also have a right to benefit from the creatures. Hence, necessary measures must be taken by people to protect and maintain these creatures. [26] According to Islamic belief, those who obey Allah's warnings, on this matter, will be rewarded. Otherwise, Allah often warned people that they would be held accountable and punished for abusing or exaggerating His creations,[27] as indicated in the following verses:

"*Say, '[Allah says], believing servants, be mindful of your Lord! Those who do good in this world will have a good reward– Allah's earth is wide ––and those who persevere patiently will be given a full and unstinting reward'.*"[28]

"*Corruption has flourished on land and sea as a result of people's actions and He will make them taste the consequences of some of their own actions so that they may turn back.*"[29]

Balance (*mizan*) principle illustrates the Almighty Allah's creation of the universe as an orderly system.[30] In this regard, all the creatures have an aim and are in a dynamic balance. The sun, moon, stars and world serve the purpose of creation and created to function as a whole.[31] Reference is made to this issue in the Holy Qur'an:

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19 Islamic Relief, *Climate Change Policy*, 22.
20 Omar A Bakhashab, "Islamic Law and the Environment: Some Basic Principles," *Source: Arab Law Quarterly* 3/3 (1988), 287.
21 al-An'am 6/165.
22 al-Baqara 2/30.
23 Bakhashab, "Islamic Law and the Environment: Some Basic Principles," 287.
24 al-Ar'af 7/10.
25 al-Isra 17/70.
26 Labeeb Bsoul et al., "Islam's Perspective on Environmental Sustainability: A Conceptual Analysis," *Social Sciences* 11/6 (2022); Bakhashab, "Islamic Law and the Environment: Some Basic Principles," 288–299.
27 Bakhashab, "Islamic Law and the Environment: Some Basic Principles," 288–289.
28 al-Zumar 39/10.
29 al-Rum 30/41.
30 Abubakr Ahmed Bagader et al., *Environmental Protection in Islam*, IUCN Environmental Policy Working Paper (Switzerland & Cambridge, UK.: IUCN Commission of Environmental Law, 1994), 1.
31 Khalid, "Islam and the Environment – Ethics and Practice an Assessment," 711.

"*It is the Lord of Mercy who taught the Qur'an. He created man and taught him to communicate. The sun and the moon follow their calculated courses; the plants and the trees submit to His designs; He has raised up the sky. He has set the balance so that you may not exceed in the balance.*"[32]

As a result of this balanced and harmonious coexistence, all beings, including humans, can thrive in a suitable environment and climate. The result of not complying with the balance (*mizan*) principle is the climate change disaster that exists today.[33] In this regard, according to Islamic thought, people should use the resources available in the world as much as they need and have to avoid waste. On the other hand, according to Islamic Relief (2018), many scholars added "*moderation*" principle to the prohibition of waste. About the prohibition of waste and need for the moderation, The Holy Quran says:

"*Children of Adam, dress well whenever you are at worship, and eat and drink [as We have permitted] but do not be extravagant: Allah does not like extravagant people.*"[34]

"*Say, 'People of the Book, do not overstep the bounds of truth in your religion and do not follow the whims of those who went astray before you– they led many others astray and themselves continue to stray from the even path'.*"[35]

According to balance (*mizan*) principle, achieving environmental sustainability requires people to practice moderation, minimizing waste and preserving natural resources to prevent the catastrophic consequences of climate change.[36]

2. Islamic Finance and Environmental Sustainability

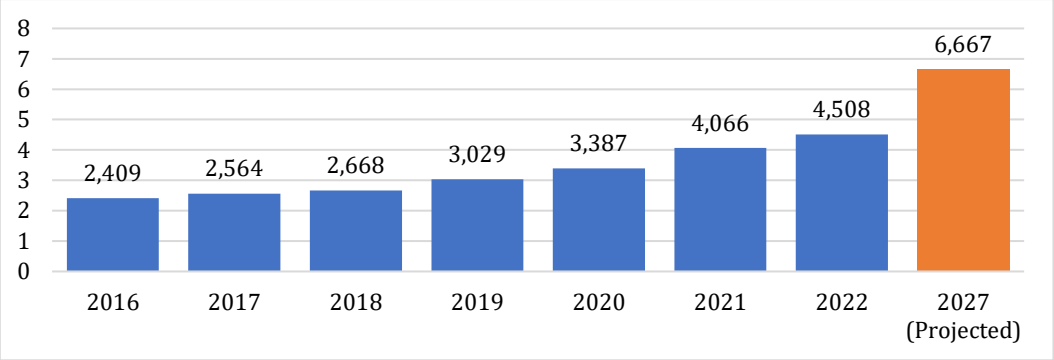
The devastating impacts of climate change, such as floods, droughts, and fires, have been exacerbated in recent years, further highlighting the importance of measures that can be taken in recent years. Indeed, the international community is unlikely to meet the Paris Agreement targets, and it is very likely that the 1.5 °C global warming target will be exceeded within the next 20 years.[37] Hence, achieving the global warming target requires more measures that must be taken and significant enormous financial resources, The United Nations Conference on Trade and Development (UNCTAD) estimates that 5-7 trillion dollars of funding is needed by 2030 to achieve the UN Sustainable Development Goals (SDGs).[38] Therefore, the financial sector has a pivotal role to play in mobilizing these funds. Additionally, developing countries face a financial gap of 2.5 trillion dollars annually in order to achieve SDGs.[39] However, traditional climate finance has been shown to be inadequate in scale and scope to address the full extent of climate change mitigation and adaptation efforts, leaving a significant funding gap. Innovative financing methods, such as green bonds, green sukuk, carbon credits, and impact investing, are widely recommended by many studies[40] as a way to mobilize additional funding for climate action. In this sense, Islamic finance can make a significant

32 al-Rahman 55/1-8.
33 Akhter et al., "Climate Change and Islam: A Global Perspective," 1005.
34 al-Ar'af 7/31.
35 al-Ma'ida 5/77.
36 Islamic Relief, *Climate Change Policy*, 22; Akhter et al., "Climate Change and Islam: A Global Perspective," 1005.
37 Bradley Hiller et al., *Rethinking Development Finance in Response to 21 St-Century Challenges: Islamic Climate Finance and Post-Conflict Recovery*, T20 Policy Briefs (2023), 5.
38 Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects* (Kuala Lumpur: Securities Commission Malaysia, 2019), 12.
39 Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects*, 12.
40 OECD, *How Islamic Finance Contributes to Achieving the Sustainable Development Goals*, OECD Development Co-Operation Policy Papers, No.30 (Paris, 2020); Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects*; Hiller et al., *Rethinking Development Finance in Response to 21 St-Century Challenges: Islamic Climate Finance and Post-Conflict Recovery*.

contribution to climate finance by offering diverse financing options, including green sukuk, sustainability sukuk, and newly developed green and sustainability financing.[41]

It is possible to mention many reasons why Islamic finance can contribute to traditional climate finance. Firstly, given the global value of Islamic finance large enough, it is clear that Islamic finance industry has financial capacity to make a significant contribution to climate finance. In this regard, the global value of Islamic finance has been around 3.5 trillion dollars[42] in 2021. In addition, according to a recent research report, the value of Islamic financial assets is approximately 4 trillion dollars in 2022. The report predicts that the value of Islamic financial assets will continue to increase in the coming years[43] (see Figure 1). The forecast in this report is underpinned by two key factors: the relatively high demographic growth of the Muslim population, which is projected to reach 2.2 billion by 2030, and the strong commitment to ethical values among Muslims. Notably, 76% of Muslims consider religion to be very important, and 66% of Muslim consumers are more likely to purchase products that align with their ethical principles. As a result, it is anticipated that Islamic finance will continue to experience growth.[44]

Figure 1. Islamic Finance Assets (2016-2022, Billion Dollars)



Source: ICD & LSEG (2023).[45]

According to Figure 1, the value of Islamic finance assets has exhibited a steady increase over the period of 2016 - 2022. Projections suggest that by 2027, the value of Islamic financial assets is expected to reach an estimated 6,667 trillion dollars (USD). This remarkable growth trend and the substantial value of Islamic finance assets imply that Islamic finance industry has significant potential to support climate change mitigation and adaptation investments.

Secondly, Islamic finance supports environmental protection, in line with the Paris Agreement and SDGs.[46] In this regard, there is a natural harmony between Islamic finance and green finance.[47] Indeed, the principles of Islamic finance, rooted in faith, inherently promote environmental protection, sharing same values as SDGs for the environment.[48] The harmony between Islamic finance and the SDGs can be better understood through the concept of "*maqasid al-Sharia*", which translates to "the objectives of Sharia". This term refers to the

41 See DIFC, *Green and Sustainability Sukuk Update 2023: Financing a Sustainable Future-* (DIFC, UKIFC, Global Ethical Finance Initiative & LSEG, 2023); ICD, LSEG, *Islamic Finance Development Report 2023: Navigating Uncertainty* (ICD & LSEG, 2023).
42 DinarStandard, *State of the Global Islamic Economy Report 2023/24* (2023), 38.
43 ICD, LSEG, *Islamic Finance Development Report 2023: Navigating Uncertainty*, 8.
44 OECD, *How Islamic Finance Contributes to Achieving the Sustainable Development Goals*, 10.
45 ICD, LSEG, *Islamic Finance Development Report 2023: Navigating Uncertainty*, 7.
46 Hiller et al., *Rethinking Development Finance in Response to 21 St-Century Challenges: Islamic Climate Finance and Post-Conflict Recovery*, 6.
47 Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects*, 12.
48 ADB, *Unlocking Islamic Climate Finance* (Manila, Philippines: Asian Development Bank, 2022), ix.

fundamental goals and objectives of Islamic law, which are universal in nature and aimed at promoting the well-being and prosperity of individuals and society by preserving religion, life, lineage, intellect and property/wealth.[49] According to a report by UN, natural disasters such as floods and storms caused by climate change can cause significant financial damage and income loss for individuals. Hence, the objectives of Sharia regarding wealth, life, and property protection align with the SDGs 6, 7, 8, 13, 14, 15.[50] According to a report by Deloitte, SDG 6 (clean water and sanitation) aligns with Sharia's objective of "preserving human life", while SDG 14 (life below water) aligns with Sharia's objective of preserving "religion".[51] On the other hand, The UKIFC's report, which employs content analysis and expert interviews, finds that the SDGs and the objectives of Sharia share similarities in their underlying goals, indicating a lack of substantial differences between the two.[52] These alignments between the SDGs and the objectives of Sharia demonstrate the compatibility between Islamic values and global development objectives.

Thirdly, Islamic finance has introduced several financing mechanisms that cater to green finance needs, including sukuk. To facilitate the diversity and scope of these products, regulations for Islamic green finance have been developed in multiple countries. In this context, in 2019, Malaysia introduced the Sustainable and Responsible Investment Sukuk (SRI Sukuk) Framework and in 2002, the ASEAN Capital Markets Forum introduced a sustainability-linked bond standard that includes sukuk.[53] In 2023 the SCA introduced a regulatory framework governing green and sustainability-linked sukuk.[54] On the other hand, a recent report by ICD and LSEG observed that 42 of the 136 countries in the report have sustainability guidelines.[55] Although these developments demonstrate the growing interest of countries in Islamic green finance, there are some obstacles that hinder Islamic green finance from reaching its full potential. Absence of a common taxonomy, low human resources levels, and a fragmented governance framework can be regarded as some of these obstacles. And one of the obstacles is the fact that Islamic green finance lags behind in terms of innovation.[56] In fact, Islamic green finance accounts for less than 2% of the total Islamic finance industry and innovative solutions are needed to address the obstacles[57] in question. Many studies recommend designing sukuk specifically for climate change and environmental issues[58] and Hiller et al. (2023) recommend countries to initiate environmental impact sukuk. Considering these studies, it can be argued that removing obstacles to Islamic green finance, including innovative financing methods, will support the growth of Islamic green finance in the coming decades.

3. Environmental Impact Bonds

In recent years, impact bonds (IBs) have emerged as new and growing financing instruments that fund projects addressing social, developmental, and environmental challenges. Impact bonds, defined by Wellenstein & Afanasieva (2019) as "Innovative performance-based contracts between an investor, a fund manager or an impact investor, and

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49 UN, *Mobilising Islamic Banking for Climate Action* (Geneva: United Nations Environment Programme Finance Initiative, 2023), 13; Hatim El-Tahir, *Islamic Finance as a Catalyst for Financing the Sustainable Development Goals (SDGs)* (Deloitte, 2023), 2.

50 UN, *Mobilising Islamic Banking for Climate Action*, 15.

51 El-Tahir, *Islamic Finance as a Catalyst for Financing the Sustainable Development Goals (SDGs)*, 3.

52 Fares Djafri - Younes Soualhi, *Islamic Finance: Shariah And the SDGs*, Thought Leadership Series, Part 4 (ISRA & UKIFC, 2021).

53 Mohamed Damak et al., *Islamic Finance's Role In The Climate Transition*, Sustainability Insights (S&P, 2023), 3.

54 DIFC, *Green and Sustainability Sukuk Update 2023: Financing a Sustainable Future-*, 6.

55 ICD, LSEG, *Islamic Finance Development Report 2023: Navigating Uncertainty*, 9.

56 Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects*, 69.

57 For detailed information about obstacles, see ADB, *Unlocking Islamic Climate Finance*; Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects*.

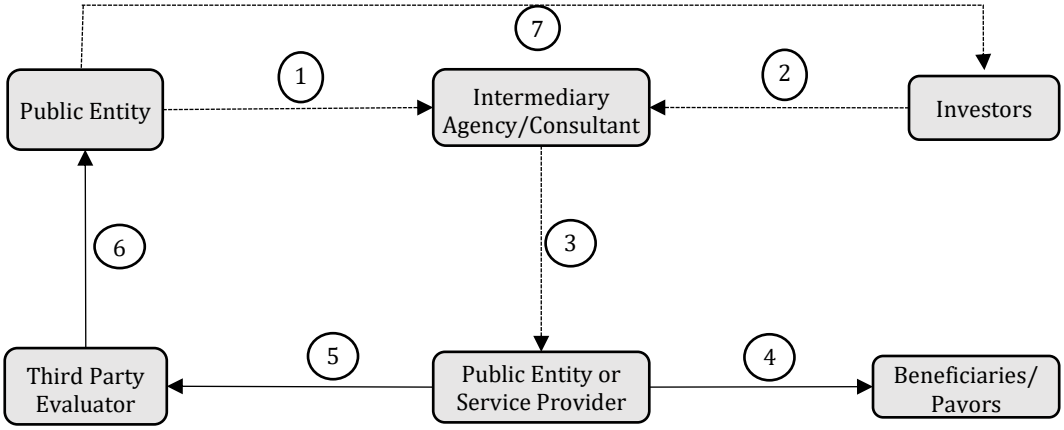
58 DIFC, *Green and Sustainability Sukuk Update 2023: Financing a Sustainable Future-*, 9; Securities Commission Malaysia, World Bank, *Islamic Green Finance Development, Ecosystem and Prospects*, 69.

a service provider that tackle a social or environmental challenge".[59] According to this definition, IBs are financial instruments that aim to address complex social or environmental issues. In contrast, Government Outcomes Lab provides a more concise definition of impact bonds as "outcomes-based contracts".[60] Types of impact bonds can be further categorized into social impact bonds, development impact bonds, and environmental impact bonds, each addressing specific social or environmental challenges. As of June 2024, Government Outcomes Lab's Impact Bond Dataset reports that a total of 296 impact bonds globally have been issued, mobilizing 736 billion dollars (USD) in capital.[61]

EIBs have emerged more recently than other types of impact bonds. As a result, there are a few environmental impact bonds that have been primarily issued in the USA and UK.[62] According to Trotta (2024), "Environmental impact bonds (EIBs) are innovative financial models included in the toolbox of impact investing that focus on environmental challenges".[63] On the other hand, Quantified Ventures defines environmental impact bond as "an innovative financing tool that uses a Pay for Success approach to provide up-front capital from private investors for environmental projects".[64] These two definitions illustrate the distinct features of EIBs, showcasing their versatility. They exemplify the innovative structure of EIBs, which are designed to address environmental challenges in a unique way.

EIBs are similar to the conventional bonds, with two main differences. Firstly, EIBs' proceeds must be used to fund a project that has a measurable environmental impact. Secondly, at the initial stage of the EIBs issuance, a measurable environmental goal (KPIs) is determined. If the project achieves or exceeds the determined goal, the public entity pays an additional payout to the investors, in addition to the principal and coupon payments. If the project performs on par, then the public entity pays only the market rate (coupon and principal). However, if the project cannot achieve the environmental goal, the public entity may pay a lower amount than the principal and coupon or nothing at all to the investors.[65]

Figure 2. Environmental Impact Bonds Structure



[59] Anna Wellenstein - Inga Afanasieva, "Have You Heard of Impact Bonds?," *World Bank Blogs* (Accessed July 1, 2024).

[60] Government Outcomes Lab, "Impact Bonds," *The Government Outcomes Lab* (2024).

[61] Government Outcomes Lab, "Impact Bond Dataset," *The Government Outcomes Lab* (2024).

[62] Katharina Lütkehermöller, *The Little Book of City Climate Finance* (NewClimate Institute, 2023), 27.

[63] Annarita Trotta, "Environmental Impact Bonds: Review, Challenges, and Perspectives," *Current Opinion in Environmental Sustainability* 66 (February 1, 2024), 101396.

[64] Quantified Ventures, "Sharing Risk, Rewarding Outcomes: The Environmental Impact Bond," *Quantified Ventures* (October 31, 2018).

[65] American Flood Coalition, "Innovative Financing: Environmental Impact Bonds" (2019); Liz Harvell et al., *Identifying Water Infrastructure Funding and Financing Options to Assure Safe, Clean, Affordable Water for All Michigan Citizens and Communities* (Environmental Finance Center at The University of North Carolina, 2020), 22.

Source: Harvell et al. (2020:22); American Flood Coalition (2019); Quantified Ventures (2018).[66]

The process of EIBs typically involves five key participants: a public entity, investors, a project developer (consultant), beneficiaries (payors), and service providers. As depicted in Figure 2, the process can be summarized as follows: The process starts with a public entity identifying a pressing environmental issue, such as flood, CSOs, or wildfires and selecting a solution approach, like green infrastructure. Secondly, a consultant (intermediary agency) develops a comprehensive project evaluation framework, specifying key performance indicators (such as reducing CSO volume by 0.5 million gallons). This enables the attraction of private investors, who subsequently provide financial resources to service providers for project implementation. Private investors then provide capital to the service provider. Thirdly, the service provider implements the project using the up-front capital provided. Fourthly, beneficiaries (such as land users) pay for the improvement in their lands through the project. Fifthly, a third-party evaluator assesses the project's performance after completion, determining if it has achieved its intended environmental outcomes, such as reducing combined sewer overflow (CSO) volume by 0.5 million gallons or less. If the project exceeds its targets (i.e., reducing CSO volume by 0.6 million gallons), it is deemed a success, and investors receive a performance payment (additional payout) in addition to principal and coupon payments. If the project performs on par, then the public entity pays only the market rate (coupon and principal). However, if the project exhibits under-performance (for example, reducing CSO volume by 0.4 million gallons), then the public entity may pay less than the principal and coupon payment, or potentially nothing at all to the investors.[67]

While EIBs provide some benefits to their parties, these niche instruments also have some disadvantages. EIBs offer multiple benefits, including cost savings, competitive returns, environmental satisfaction, upfront capital, and accelerated benefits. By EIBs, public institutions can reduce their environmental investment costs, investors can earn a competitive return while supporting green (environmental) projects, implementers can access up-front capital, and beneficiaries can receive benefits earlier than under traditional projects (such as grey projects). Additionally, by EIBs, public entity can transfer the project implementation risk to the private investors.[68]

EIBs have some disadvantages such as complex bond structure, high transaction costs, and difficulty in determining the right outcome metrics. In this regard, EIBs have quite a few participants and hence, it is very difficult to coordinate the parties. Additionally, making legal, fiscal, and technical analysis about EIBS, determining the right outcome metrics, and monitoring and evaluating the performance metrics makes transaction costs of EIBs very high and the structure and process of these bonds very complex.[69]

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66 Harvell et al., *Identifying Water Infrastructure Funding and Financing Options to Assure Safe, Clean, Affordable Water for All Michigan Citizens and Communities*, 22; American Flood Coalition, "Innovative Financing: Environmental Impact Bonds" (2019); Quantified Ventures, "What Is an Environmental Impact Bond?" (October 31, 2018).

67 Cristina M. Balboa, "Accountability of Environmental Impact Bonds: The Future of Global Environmental Governance?," *Global Environmental Politics* 16/2 (May 1, 2016), 34–35; Harvell et al., *Identifying Water Infrastructure Funding and Financing Options to Assure Safe, Clean, Affordable Water for All Michigan Citizens and Communities*, 22.

68 Environmental Defense Fund, Qualified Ventures, *Financing Resilient Communities and Coastlines. How Environmental Impact Bonds Can Accelerate Wetland Restoration in Louisiana and Beyond* (2018), 14–18; Harvell et al., *Identifying Water Infrastructure Funding and Financing Options to Assure Safe, Clean, Affordable Water for All Michigan Citizens and Communities*, 23; Satyajit Bose et al., "The Role of Finance in Achieving Sustainability," *The Financial Ecosystem: The Role of Finance in Achieving Sustainability*, ed. Satyajit Bose et al. (Cham: Springer International Publishing, 2019), 332; Michael Curley, *The Price of Climate Change: Sustainable Financial Mechanisms* (Florida: CRC Press, 2022), 108–109.

69 David Hall, "Greening the Future: A Case for Environmental Impact Bonds," *Policy Quarterly* 13/2 (May 1, 2017), 46; Angela Wong, *Strategies to Advance Investments in Coastal Resilience Solutions in Boston* (Massachusetts Institute of Technology. Department of Urban Studies and Planning, Master's Thesis, 2019), 40.

4. Environmental Impact Sukuk

Following the development of impact bonds in traditional markets, significant advancements have been made in impact sukuk structures in the sukuk market. To date, only social impact sukuk have been issued or various proposals for social impact sukuk models have been presented in the literature. In this regard, *wakala bi al-istithmar* based SRI (Sustainable and Responsible Investment) Sukuk has been issued by Ihsan Sukuk Bhd in Malaysia.[70] However, unlike social impact bonds and social impact sukuk structures suggested in the literature, which typically pay more (performance payment) to investors when KPIs are met, Ihsan SRI Sukuk uses a step-down approach, paying less to investors when the determined KPIs are reached.[71] Additionally, there are social impact sukuk proposals based on *mudarabah*[72] and *musharakah*[73] in the literature.

Regarding innovative sukuk models, Islamic finance literature emphasizes the compliance of these proposed models with objectives of Sharia (*maqasid al-Sharia*) and public utility (*maslaha*). Several studies[74] focus on the emergence of innovative sukuk and bond types related to sustainable development—such as Socially Responsible Investing (SRI), social impact sukuk, social impact bonds, and blue sukuk—are compatible with *maqasid al-Sharia* and *maslaha*. In this context, the model proposed in this study is considered compliant with Sharia due to its adherence to the mudarabah structure and its impact-oriented framework.

In this study, as a novel approach, we propose an environmental impact sukuk (EIS) based on the *mudarabah* structure, which is a pioneering effort in the development of environmental impact sukuk. There are some basic reasons why we choose "*mudarabah structure*" for the proposed environmental impact sukuk. These reasons are as follows:

Firstly, the purpose of EIS is to attract investors and channel their capital towards the project. Similar to EIBs, in EIS, the local government or public entity uses the capital raised through sukuk to fund a specific project. As a result, a public-private partnership is formed, as in EIBs.[75] There are many types of sukuk based on sale, lease and partnership in practice, and *musharakah* and *mudarabah* sukuk are known as partnership-based sukuk.[76] In this regard, the fact that both the environmental impact structure (i.e. impact bonds) and the *mudarabah* sukuk structure are based on partnership has led us to the use of *mudarabah* for environmental impact sukuk model.

Secondly, due to the prohibition on interest (*riba*) and fixed returns in Islamic teaching, risk-sharing is a fundamental component of Islamic finance. In other words, interest payments and fixed returns are not permissible in Islam; therefore, Islamic teachings encourage risk-

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70 Syed Marwan Mujahid Syed Azman et al., "An Empirical Comparison of Sustainable and Responsible Investment Ṣukūk, Social Impact Bonds and Conventional Bonds," *ISRA International Journal of Islamic Finance* 14/3 (January 1, 2022), 258.

71 Syed Marwan - Mohamed Aslam Haneef, "Does Doing Good Pay Off? Social Impact Bonds and Lessons for Islamic Finance to Serve the Real Economy," *Islamic Economic Studies* 27/1 (January 1, 2019), 31.

72 Abdessamad Raghibi - Lahsen Oubdi, "A Proposed Model for Social Impact Sukuk," *Turkish Journal of Islamic Economics* 8/2 (August 15, 2021), 501–516.

73 Marwan - Haneef, "Does Doing Good Pay Off?"

74 Dina Diana, "Maqashid Sharia Perspective and the Opportunity of Blue Sukuk for Sustainable Development Goals in Indonesia," *Proceedings of Femfest International Conference on Economics, Management, and Business* 2 (2024), 197–208; Syed Marwan, "Social Impact Bonds in Light of Maqasid Al-Shari'ah and Maslahah," *Journal of Islamic Economics, Banking and Finance* 11/4 (2015), 31–40; Syed Marwan et al., "Achieving the Maqasid of Islamic Finance through Social Impact Bonds (SIB) and Sustainable and Responsible Investment (SRI) Sukuk," *Proceedings of the 7th ASEAN Universities International Conference on Islamic Finance 7th AICIF - Volume 1* (7th ASEAN Universities International Conference on Islamic Finance - 7th AICIF, Indonesia: SciTePress, 2019), 152–159.

75 Charis Lypiridis - Michael Kuzio, *Innovative Finance Solutions for Climate-Smart Infrastructure New Perspectives on Results-Based Blended Finance for Cities.* (Washington: International Bank for Reconstruction and Development / The World Bank, 2019), 41.

76 Mohd Azmi Omar et al., *Fundamentals of Islamic Money and Capital Markets* (Singapore: John Wiley & Sons, 2012), 81.

sharing.[77] And similarly, *mudarabah* sukuk is based on the risk-sharing concept.[78] In an environmental bond structure, if a project's results fail to reach the KPIs, investors receive reduced or no returns. [79] Similar to an EIBs structure, in a *mudarabah sukuk* structure, losses are borne solely by the investors.[80] As a result, *mudarabah sukuk* is well-suited to the EIS structure.

Thirdly, EIS structure has the potential to overcome problems in *mudarabah*. According to literature, some studies[81] have expressed concerns about the agency problem in *mudarabah* structure, where the entrepreneur (*mudarib*) has significant control power and full information on the project. This agency problem arises from asymmetric information, which gives rise to two primary issues, namely adverse selection and moral hazard.[82] Indeed, EIB structures, which involve a third-party evaluator to assess project outcomes, incorporate control mechanisms within their design.[83] This control mechanism may have the potential to overcome the agency problem in mudaraba sukuk structures and enable the launch of *mudarabah* based environmental impact sukuk for environmental projects.

In this study, the proposed environmental impact sukuk raises capital for specific projects such as sewerage infrastructure and forest restoration projects. The target metrics (KPIs) are then determined. For instance, a reduction in CSO by 0.5 million gallons per annum is an example of a specific target metric. If the project meets its KPIs, which are the target metrics, investors will receive additional payouts (performance payouts) in addition to principal and periodic payments. Conversely, if the project fails to meet its KPIs, investors will receive lower payouts.

The results (benefits) of the project financed by EIS align with the objectives of Sharia. Accordingly, the benefits gained by the community, such as reduced illness and death rates or improved access to clean water, align with the objectives of Sharia (*maqasid al-Sharia*) which prioritize the well-being and protection of human life and health.

In EIB structure the project can be implemented by beneficiaries, a nonprofit organization or a or local government partner.[84] Hence, in proposed environmental impact sukuk, we identified a public independent entity as entrepreneur (*mudarib*) and the capital providers are the investors. As a trustee on behalf of the investors, special purpose vehicle (SPV) is the *rab-ul-maal.* Like EIBs structure, in EIS, beneficiaries consist of many local parties such as landowners, and power generating units. Since the local government is among the beneficiaries because of the cost savings it has, a public independent entity has been added to the proposed sukuk structure as an issuer.[85] In this regard, a key innovation of our proposed new model is to incorporate the local government as a paying beneficiary.

Considering all these rationales and alignment with Sharia principles presented earlier, we propose an environmental impact sukuk model based on a *mudarabah* structure. The proposed model is depicted in Figure 3.

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77 Ahmet Sekreter, "Sharing of Risks in Islamic Finance," *IBSU Scientific Journal* 5/2 (December 6, 2011), 13–20.

78 Karmila Hanim Kamil et al., "The Subprime Mortgages Crisis and Islamic Securitization," *International Journal of Islamic and Middle Eastern Finance and Management* 3/4 (January 1, 2010), 399.

79 Balboa, "Accountability of Environmental Impact Bonds: The Future of Global Environmental Governance?," 36.

80 Noraina Mazuin Sapuan, *7th International Economics & Business Management Conference (IEBMC 2015)*, "An Evolution of Mudarabah Contract: A Viewpoint from Classical and Contemporary Islamic Scholars," *Procedia Economics and Finance* 35 (January 1, 2016), 350.

81 Noraina Mazuin Sapuan - Roly Mohammad Rahmdzey, "Problem of Agency in Mudarabah Contract," *Global Journal Al-Thaqafah* 9/3 (2019), 57–67; Sapuan, *7th International Economics & Business Management Conference (IEBMC 2015)*.

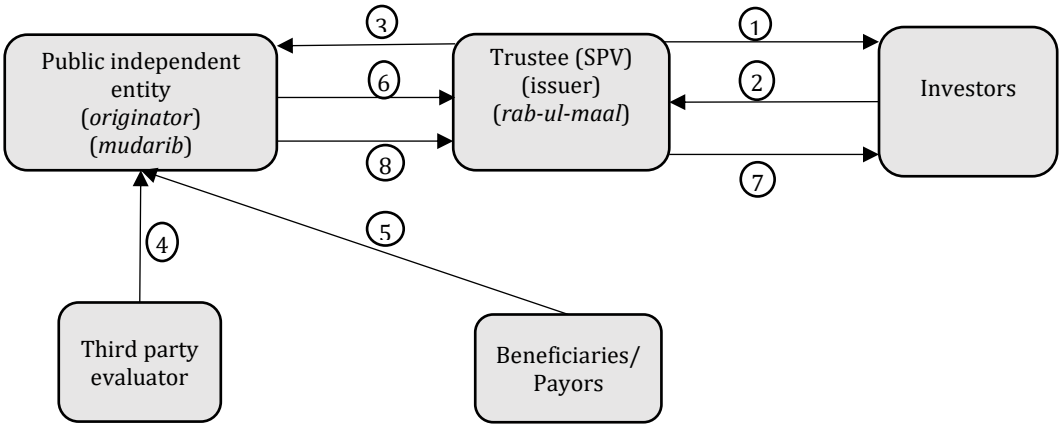
82 Sapuan, *7th International Economics & Business Management Conference (IEBMC 2015)*, 350.

83 Hall, "Greening the Future," 14.

84 M. W. Brand et al., "Environmental Impact Bonds: A Common Framework and Looking Ahead," *Environmental Research: Infrastructure and Sustainability* 1/2 (July 2021), 6.

85 Government (independent) entity is adapted from Raghibi - Oubdi, "A Proposed Model for Social Impact Sukuk," 512–513.

Figure 3. Proposed Structure for Environmental Impact Sukuk



Source: Adapted from DIFC (2009); Raghibi & Oubdi (2021) with the innovations made by the authors.[86]

The process of EIS starts with a public independent entity identifying an environmental issue, such as flood, CSOs, or wildfires and selecting a solution approach, like green infrastructure. Then, consultant (intermediary agency) develops a comprehensive project evaluation framework, specifying KPIs (such as reducing CSO volume by 0.5 million gallons). This enables the attraction of private investors, who subsequently provide financial resources for project implementation.

The proposed environmental impact sukuk process is outlined as follows:

1. The issuer SPV issues environmental impact sukuk, which represent an undivided ownership interest in a specific project, such as green infrastructure.

2. Investors invest in the sukuk and pay the required capital (proceeds) to the issuer SPV. The SPV then declares a trust over the proceeds and acts as trustee on behalf of the investors.

3. The issuer SPV (as *rab-al-maal*) and the public independent entity (as *mudarib*) enter into a *mudarabah* agreement. This agreement gives rise to a *mudarabah* enterprise (project), and the issuer SPV disburses the proceeds to the public independent entity.

4.After the project is implemented, a third-party evaluator assesses its results. If the project meets its goals (KPIs), investors receive additional payouts. However, if the project underperforms (e.g., reduces CSO volume by 0.3 million gallons instead of the 0.5 million gallons -the goal-), investors receive lower payouts.

5. After evaluation, beneficiaries pay to the government independent entity according to their benefits from the project. For example, the government may enjoy cost savings due to low project costs, and landowners may benefit from increased property values due to cleaner and greener environments. The amount paid by beneficiaries depends on the project's performance: if it exceeds KPIs, beneficiaries pay more; if it underperforms, they pay less.

6. After payment of profits by beneficiaries, the issuer SPV (as *rab-al-maal*) and public independent entity (as *mudarib*) divide these profits.

7. The SPV then makes periodic disbursements to investors based on profits (and hence on project results).

8. Finally, at maturity, the public independent entity purchases the project's assets, and the SPV pays out the purchasing amount to investors.

[86] Adapted from DIFC, *Dubai International Financial Centre Sukuk Guidebook* (2009); Raghibi - Oubdi, "A Proposed Model for Social Impact Sukuk." with the innovations made by the authors.

Consequently, the government's costs regarding green infrastructure will decrease, investors will receive a higher return on investment and environmental satisfaction, and other beneficiaries will benefit from cost savings and increased property values sooner by the help of EIS.

5. Challenges And Prospects for The Launch of Environmental Impact Sukuk

Sukuk has several advantages, including its potential for innovation and instrument diversification, but it also faces several challenges. In terms of its structure and operation, sukuk has a complex transaction process and requires significant legal documentations, which can lead to additional costs. Furthermore, the lack of standardization in sukuk structures and documentations can require additional efforts in the sukuk market.[87] Given the complexity of sukuk structures and the lack of standardization in sukuk documentation, the proposed environmental impact sukuk may introduce additional complexities in terms of third-party evaluation, KPIs, and project monitoring, which require meticulous and careful assessment and verification. These added complexities may lead to increased costs in the process of sukuk structures.

Secondly, measuring the benefits of the project funded by environmental impact sukuk may be challenging. Because infrastructure projects often have at least some characteristics of public good.[88] This makes it difficult to quantify the benefits of the projects, which can increase the complexity and transaction costs of the environmental impact sukuk. The hardship of measuring the benefits of public infrastructure projects, may deter potential issuers. In addition, however, some EIBs issued in the last decade have demonstrated the measurability of economic benefits of the projects.

Thirdly, there is a lack of standardization in the sukuk market currently.[89] Furthermore, for projects funded by the EIBs, the climate and environmental conditions specific to the regions can change the expected results of the project.[90] Consequently, it is impossible to determine standardized KPIs or results for the environmental projects. Hence, the lack of standardization in the results of the projects may hinder the launch of the proposed EIS.

Despite some obstacles to the launch of environmental impact sukuk, it is possible to say that EIS holds significant potential, thanks to the impact investment market and supportive conditions in the sukuk market. In this regard, the growing sukuk market can support the launch of EIS in the coming years. According to Figure 4, green and sustainability sukuk issuances have been growing every year from 2017 to 2023Q3.

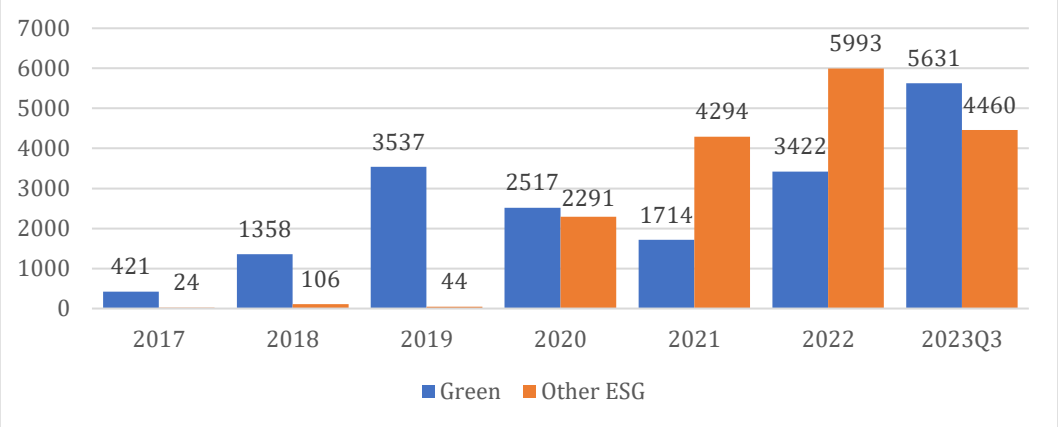
87 COMCEC, *The Role of Sukuk in Islamic Capital Markets* (2018), 12, 22.

88 Chukwuebuka Bernard Azolibe et al., "Government Infrastructure Expenditure and Investment Drive in an Emerging Market Economy: Evidence from Nigeria," *Emerging Economy Studies* 6/1 (May 1, 2020), 63.

89 Jonathan Ercanbrack, "The Standardization of Islamic Financial Law: Lawmaking in Modern Financial Markets," *The American Journal of Comparative Law* 67/4 (December 31, 2019), 859.

90 Hall, "Greening the Future," 46.

Figure 4. Green and Sustainable Sukuk Issuances (Million Dollars) (2017 – 2023Q3)



Source: DIFC (2023:5).[91]

As of 2023Q3, it is estimated that green and other ESG sukuk issuances will reach 10.09 million dollars (USD) and are expected to continue growing in the future. According to DIFC (2023:7), there is a strong investor demand for green and sustainability sukuk in international markets, which has been higher than that for traditional sukuk.[92] IIFM (2023:144) also highlights abundant opportunities for green and ESG[93] sukuk in the future.

Similar to the developments in the sukuk market, the growth in the impact investment sector also presents a significant opportunity for environmental impact sukuk. According to the results of a survey, which had 200 respondents from six Islamic Finance Institutions participate, 48% of the respondents are familiar with impact investing. [94] This suggests a substantial opportunity for environmental impact sukuk in the coming years.

Consequently, there is a big opportunity for environmental impact sukuk in sukuk market and this opportunity will increase as problems are solved.

Conclusion

Global climate change has had a significant impact in recent years, attracting international attention. The primary reasons why global climate change has attracted international attention are its profound negative impacts on the environment and the community. In particular, climate change increases the likelihood of wildfires, extreme rainfalls, and storms. These increased rainfalls and wildfires have a negative impact on the environment as a whole and public health specifically. Governments attempting to mitigate the effects of climate change face significant budget constraints. In fact, addressing the effects of climate change requires substantial financing sources. Traditional financing is insufficient to meet the funding needs, leading to a demand for innovative financial mechanisms. The literature highlights Islamic financial structures as a recommended solution to address the effects of climate change, emphasizing their potential benefits. As an Islamic finance instrument, sukuk can attract private sector funding for the measures against the climate change. Sukuk is an Islamic instrument that aligns with Islamic thought emphasizing environmental protection. In this regard, there are many verses in the Quran regarding the protection of the environment. Additionally, various countries have issued environmental-

91 DIFC, *Green and Sustainability Sukuk Update 2023: Financing a Sustainable Future-*, 5.
92 DIFC, *Green and Sustainability Sukuk Update 2023: Financing a Sustainable Future-*, 7.
93 IIFM, *Sukuk Report. A Comprehensive Study of the Global Sukuk Market 12th Edition* (2023), 144.
94 Sultan Choudhury Obe, *Islamic Finance and the UN SDGs Retail Banking Customer Perspectives Global Survey 2023* (HM Treasury & UKIFC, 2023).

themed sukuk products, including green and sustainability sukuk and this makes sukuk suitable for environmental projects.

This study proposes a model for environmental impact sukuk based on a *mudarabah* structure. The proposed model differs from existing impact sukuk structures in that it includes the local government as a beneficiary. In addition, the payment adjustments based on project outcomes are a unique feature of this model. In this way, similar to environmental impact bonds, investors receive higher payments if the project performs high and lower payments if the project performs poorly. Performance of project is measured according to key performance indicators determined before the issuance of environmental impact sukuk.

By the help of proposed environmental impact sukuk model, private capital can be raised against the negative consequences of climate change through the innovative green infrastructure and forest restoration projects. As a result of the projects financed by environmental impact sukuk, the local governments will benefit from cost savings and other beneficiaries also will obtain various benefits. In this way, measures against the negative effects of climate change will be less costly and more effective.

This study opens up new avenues for future research. For instance, researchers may investigate alternative financing structures, such as *istisna* and hybrid, for environmental impact sukuk. Moreover, studies can explore potential solutions to overcome the obstacles hindering the launch of environmental impact sukuk.

Etik Beyan/Ethical Statement: Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur / It is declared that scientific and ethical principles have been followed while carying out and writing this study and that all the sources used have been properly cited.
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References

ADB. *Unlocking Islamic Climate Finance*. Manila, Philippines: Asian Development Bank, 2022. https://doi.org/10.22617/TCS220511-2

Akhter, Shabeena et al. "Climate Change and Islam: A Global Perspective." *IJFANS International Journal of Food and Nutritional Sciences* 11/1 (2022), 996–1007.

Al-Jayyousi, Odeh et al. "A Critical Discourse Analysis on Climate Change in a Globalized World: The Nexus of Islam and Sustainable Development." *Sustainability (Switzerland)* 15/19 (October 1, 2023). https://doi.org/10.3390/su151914515

Al-Jayyousi, Odeh Rashed. *Islam and Sustainable Development: New Worldviews*. England: Gower Publishing Limited, 1st Edition., 2012.

American Flood Coalition. "Innovative Financing: Environmental Impact Bonds." 2019. Accessed July 2, 2024. https://floodcoalition.org/2019/11/innovative-financing-environmental-impact-bonds/

Azolibe, Chukwuebuka Bernard et al. "Government Infrastructure Expenditure and Investment Drive in an Emerging Market Economy: Evidence from Nigeria." *Emerging Economy Studies* 6/1 (May 1, 2020), 61–85. https://doi.org/10.1177/2394901520907722

Bagader, Abubakr Ahmed et al. *Environmental Protection in Islam*. IUCN Environmental Policy Working Paper. Switzerland & Cambridge, UK.: IUCN Commission of Environmental Law, 1994.

Bakhashab, Omar A. "Islamic Law and the Environment: Some Basic Principles." *Source: Arab Law Quarterly* 3/3 (1988), 287–298.

Balboa, Cristina M. "Accountability of Environmental Impact Bonds: The Future of Global Environmental Governance?" *Global Environmental Politics* 16/2 (May 1, 2016), 33–41. https://doi.org/10.1162/GLEP_A_00352

Bose, Satyajit et al. "The Role of Finance in Achieving Sustainability." *The Financial Ecosystem: The Role of Finance in Achieving Sustainability*. ed. Satyajit Bose et al. 1–18. Cham: Springer International Publishing, 2019. https://doi.org/10.1007/978-3-030-05624-7_1

Brand, M. W. et al. "Environmental Impact Bonds: A Common Framework and Looking Ahead." *Environmental Research: Infrastructure and Sustainability* 1/2 (July 2021), 023001. https://doi.org/10.1088/2634-4505/ac0b2c

Bsoul, Labeeb et al. "Islam's Perspective on Environmental Sustainability: A Conceptual Analysis." *Social Sciences* 11/6 (2022). https://doi.org/10.3390/socsci11060228

Chishti, Saadia Khawar Khan. "Fitra: An Islamic Model for Humans and The Environment." *Islam and Ecology A Bestowed Trust*. ed. Richard C. Foltz et al. 67–82. United States of America: Harvard University Press, 2003.

COMCEC. *The Role of Sukuk in Islamic Capital Markets* (2018). https://www.sbb.gov.tr/wp-content/uploads/2018/11/The_Role_of_Sukuk_in_Islamic_Capital_Markets.pdf

Curley, Michael. *The Price of Climate Change: Sustainable Financial Mechanisms*. Florida: CRC Press, 1st Edition., 2022. https://www.routledge.com/The-Price-of-Climate-Change-Sustainable-Financial-Mechanisms/Curley/p/book/9781032057910

Damak, Mohamed et al. *Islamic Finance's Role In The Climate Transition*. Sustainability Insights. S&P, 2023. https://www.spglobal.com/ratings/en/research/pdf-articles/231114-sustainability-insights-research-islamic-finance-s-role-in-the-climate-transition-101589265

Diana, Dina. "Maqashid Sharia Perspective and the Opportunity of Blue Sukuk for Sustainable Development Goals in Indonesia." *Proceedings of Femfest International Conference on Economics, Management, and Business* 2 (2024), 197–208.

DIFC. *Dubai International Financial Centre Sukuk Guidebook* (2009). https://www.isfin.net/sites/isfin.com/files/dubai_international_financial_centre_sukuk_guidebook_.pdf

DIFC. *Green and Sustainability Sukuk Update 2023: Financing a Sustainable Future*-. DIFC, UKIFC, Global Ethical Finance Initiative & LSEG, 2023. https://ukifc.com/green-and-sustainability-sukuk-update-2023/

DinarStandard. *State of the Global Islamic Economy Report 2023/24* (2023). https://www.dinarstandard.com/post/state-of-the-global-islamic-economy-report-2023

Djafri, Fares - Soualhi, Younes. *Islamic Finance: Shariah And the SDGs*. Thought Leadership Series, Part 4. ISRA & UKIFC, 2021. https://www.ukifc.com/wp-content/uploads/2021/09/IF-Report-part-4-Oct-2021.pdf

El-Tahir, Hatim. *Islamic Finance as a Catalyst for Financing the Sustainable Development Goals (SDGs)*. Deloitte, 2023. https://www2.deloitte.com/content/dam/Deloitte/xe/Documents/financial-services/Deloitte_Islamic-Finance-as-Catalyst-for-Financing-SDGs_Nov-23.pdf

Environmental Defense Fund, Qualified Ventures. *Financing Resilient Communities and Coastlines. How Environmental Impact Bonds Can Accelerate Wetland Restoration in Louisiana and Beyond* (2018). https://www.edf.org/ecosystems/financing-resilient-communities-and-coastlines

Ercanbrack, Jonathan. "The Standardization of Islamic Financial Law: Lawmaking in Modern Financial Markets." *The American Journal of Comparative Law* 67/4 (December 31, 2019), 825–860. https://doi.org/10.1093/ajcl/avz010

Global Forest Watch. "Global Deforestation Rates & Statistics by Country." 2024. Accessed June 20, 2024. https://www.globalforestwatch.org/dashboards/global?category=undefined

Government Outcomes Lab. "Impact Bond Dataset." *The Government Outcomes Lab*. 2024. Accessed July 1, 2024. https://golab.bsg.ox.ac.uk/knowledge-bank/indigo/impact-bond-dataset-v2/

Government Outcomes Lab. "Impact Bonds." *The Government Outcomes Lab*. 2024. Accessed July 1, 2024. https://golab.bsg.ox.ac.uk/the-basics/social-impact-bonds/

The Qur'an / A New Translation. trans. M. A. S. Abdel Haleem. New York: Oxford University Press, 2005.

Hall, David. "Greening the Future: A Case for Environmental Impact Bonds." *Policy Quarterly* 13/2 (May 1, 2017). https://doi.org/10.26686/pq.v13i2.4662

Hanim Kamil, Karmila et al. "The Subprime Mortgages Crisis and Islamic Securitization." *International Journal of Islamic and Middle Eastern Finance and Management* 3/4 (January 1, 2010), 386–401. https://doi.org/10.1108/17538391011093315

Harvell, Liz et al. *Identifying Water Infrastructure Funding and Financing Options to Assure Safe, Clean, Affordable Water for All Michigan Citizens and Communities*. Environmental Finance Center at The University of North Carolina, 2020. https://efc.sog.unc.edu/resource/identifying-water-infrastructure-funding-and-financing-options-to-assure-safe-clean-affordable-water-for-all-michigan-citizens-and-communities/

Hayat, Imran et al. "The Role of Islamic Environmental Ethics in The Alleviation of Climate Challenges and The Preservation of Ecosystem." *Russian Law Journal* 11/11 (2023), 395–404.

Hiller, Bradley et al. *Rethinking Development Finance in Response to 21 St-Century Challenges: Islamic Climate Finance and Post-Conflict Recovery*. T20 Policy Briefs (2023). https://www.orfonline.org/research/rethinking-development-finance-in-response-to-21st-century-challenges

ICD, LSEG. *Islamic Finance Development Report 2023: Navigating Uncertainty*. ICD & LSEG, 2023. https://solutions.lseg.com/IslamicFinance_ICD_LSEG

IIFM. *Sukuk Report. A Comprehensive Study of the Global Sukuk Market 12th Edition* (2023).

Islamic Relief. *Climate Change Policy*. Islamic Relief, 2018. https://www.islamic-relief.org/wp-content/uploads/2018/11/ClimateChangeweb1.pdf

Kalogiannidis, Stavros et al. "Socio-Psychological, Economic and Environmental Effects of Forest Fires." *Fire* 6/7 (2023). https://doi.org/10.3390/fire6070280

Khalid, Fazlun. "Islam and the Environment – Ethics and Practice an Assessment." *Religion Compass* 4/11 (2010), 707–716. https://doi.org/10.1111/j.1749-8171.2010.00249.x

Lütkehermöller, Katharina. *The Little Book of City Climate Finance*. NewClimate Institute, 2023. https://newclimate.org/resources/publications/the-little-book-of-city-climate-finance

Lypiridis, Charis - Kuzio, Michael. *Innovative Finance Solutions for Climate-Smart Infrastructure New Perspectives on Results-Based Blended Finance for Cities.* Washington: International Bank for Reconstruction and Development / The World Bank, 2019. https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/917181563805476705/innovative-finance-solutions-for-climate-smart-infrastructure-new-perspectives-on-results-based-blended-finance-for-cities

Marwan, Syed et al. "Achieving the Maqasid of Islamic Finance through Social Impact Bonds (SIB) and Sustainable and Responsible Investment (SRI) Sukuk." *Proceedings of the 7th ASEAN Universities International Conference on Islamic Finance 7th AICIF - Volume 1*. 152–159. Indonesia: SciTePress, 2019. https://doi.org/10.5220/0010118501520159

Marwan, Syed. "Social Impact Bonds in Light of Maqasid Al-Shari'ah and Maslahah." *Journal of Islamic Economics, Banking and Finance* 11/4 (2015), 31–40.

Marwan, Syed - Haneef, Mohamed Aslam. "Does Doing Good Pay Off? Social Impact Bonds and Lessons for Islamic Finance to Serve the Real Economy." *Islamic Economic Studies* 27/1 (January 1, 2019), 23–37. https://doi.org/10.1108/IES-05-2019-0001

Maulana, Asep et al. "Blue Sukuk as a Solution to Indonesia Maritime Economic Crisis Due to the Global Covid Pandemic." *Journal of Islamic Finance* 10/1 (2021), 36–45. https://doi.org/10.31436/jif.v10i1.560

Myhre, Gunnar et al. "Frequency of Extreme Precipitation Increases Extensively with Event Rareness Under Global Warming." *Scientific Reports* 9/1 (November 5, 2019), 16063. https://doi.org/10.1038/s41598-019-52277-4

Obe, Sultan Choudhury. *Islamic Finance and the UN SDGs Retail Banking Customer Perspectives Global Survey 2023*. HM Treasury & UKIFC, 2023. https://www.ukifc.com/wp-content/uploads/2023/02/GEFI217_UKIFC_Report_v202302241221-1340_web.pdf

OECD. *How Islamic Finance Contributes to Achieving the Sustainable Development Goals*. OECD Development Co-Operation Policy Papers, No.30. Paris, 2020.

OECD. *Taming Wildfires in the Context of Climate Change Policy Highlights* (2023).

Omar, Mohd Azmi et al. *Fundamentals of Islamic Money and Capital Markets*. Singapore: John Wiley & Sons, 2012. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119198963

Quantified Ventures. "Sharing Risk, Rewarding Outcomes: The Environmental Impact Bond." *Quantified Ventures*. October 31, 2018. Accessed July 2, 2024. https://www.quantifiedventures.com/blog/what-is-an-environmental-impact-bond

Rafay, Abdul et al. "Uniform Framework for Sukuk Al-Ijarah – A Proposed Model for All Madhahib." *Journal of Islamic Accounting and Business Research* 8/4 (2017), 420–454. https://doi.org/10.1108/JIABR-09-2015-0042

Raghibi, Abdessamad - Oubdi, Lahsen. "A Proposed Model for Social Impact Sukuk." *Turkish Journal of Islamic Economics* 8/2 (August 15, 2021), 501–516. https://doi.org/10.26414/A106

Ritchie, Hannah - Rosado, Pablo. "Natural Disasters." *Our World in Data*. https://ourworldindata.org/natural-disasters

Sapuan, Noraina Mazuin. *7th International Economics & Business Management Conference (IEBMC 2015)*. "An Evolution of Mudarabah Contract: A Viewpoint from Classical and Contemporary Islamic Scholars." *Procedia Economics and Finance* 35 (January 1, 2016), 349–358. https://doi.org/10.1016/S2212-5671(16)00043-5

Sapuan, Noraina Mazuin - Mohammad Rahmdzey, Roly. "Problem of Agency in Mudarabah Contract." *Global Journal Al-Thaqafah* 9/3 (2019), 57–67. https://doi.org/10.7187/GJAT122019-6

Securities Commission Malaysia, World Bank. *Islamic Green Finance Development, Ecosystem and Prospects*. Kuala Lumpur: Securities Commission Malaysia, 2019. www.sc.com.my

Sekreter, Ahmet. "Sharing of Risks in Islamic Finance." *IBSU Scientific Journal* 5/2 (December 6, 2011), 13–20.

Syed Azman, Syed Marwan Mujahid et al. "An Empirical Comparison of Sustainable and Responsible Investment Ṣukūk, Social Impact Bonds and Conventional Bonds." *ISRA International Journal of Islamic Finance* 14/3 (January 1, 2022), 256–273. https://doi.org/10.1108/IJIF-04-2021-0074

Trotta, Annarita. "Environmental Impact Bonds: Review, Challenges, and Perspectives." *Current Opinion in Environmental Sustainability* 66 (February 1, 2024), 101396. https://doi.org/10.1016/j.cosust.2023.101396

UN. *Mobilising Islamic Banking for Climate Action*. Geneva: United Nations Environment Programme Finance Initiative, 2023. https://www.undp.org/arab-states/publications/mobilising-islamic-banking-climate-action

Wellenstein, Anna - Afanasieva, Inga. "Have You Heard of Impact Bonds?" *World Bank Blogs*. Accessed July 1, 2024. https://blogs.worldbank.org/en/sustainablecities/have-you-heard-impact-bonds

Wong, Angela. *Strategies to Advance Investments in Coastal Resilience Solutions in Boston*. Massachusetts Institute of Technology. Department of Urban Studies and Planning, Master's Thesis, 2019. https://dspace.mit.edu/handle/1721.1/7582

Yerrou, Hafssa - Oumaima, Bezoi. "Sukuk and Waqf: Proposal of Structures During the Crisis Linked to Covid-19 Pandemic – Case of Morocco." *2023*. https://doi.org/10.31436/jif.v12i2.820