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Green Sukuk and Infrastructure Expansion: The Mediating Role of ESG Compliance In Pakistan's Sustainable Development

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Abstract

This paper discusses how Green Sukuk (GS) can be used to fund infrastructure expansion (IE) and sustainable development in Pakistan and specifically renewable energy sector. It also addresses the role played by Environmental, Social and Governance (ESG) compliance in enhancing the effects of Islamic finance on sustainability outcomes. The respondents were interviewed face-to-face and comprised 233 managers, investors, and policymakers who are engaged directly in the renewable energy projects and Sukuk financing. The hypothesised relationship among GS, ESG compliance and sustainable infrastructure development were tested by means of structural equation modelling (SEM). The findings show that GS would play a significant role in renewable energy IE, which would help in promoting the sustainable development agenda of Pakistan. Additionally, the compliance with ESG shows a high level of mediation, which improves accountability, transparency, and consistency with global sustainability-related standards. The results show that the potential of GS to lead renewable energy projects might not fully be achieved, unless it is integrated with ESG. The paper emphasises the role of integrating ESG frameworks within GS structures as a way of enhancing investor confidence, boosting international investment and expediting the process of making Pakistan a clean energy nation. This paper can offer a new approach to mobilising green capital and promoting sustainable infrastructure in an emerging economy by connecting Islamic finance and ESG principles to renewable energy markets.

Keywords: Green Sukuk, ESG Compliance, Renewable Energy, Infrastructure Expansion, Pakistan

INTRODUCTION

Sustainable development in emerging economies has become an increasingly pressing issue in recent decades as governments face the two-fold task of increasing the rate of infrastructure development and reducing the impact of environmental degradation. This dilemma is characteristic of Pakistan whose population is more than 240 million; the annual financing requirement of its infrastructure is estimated to be over USD 30 billion (Awad et al., 2025). Conventional fiscal borrowing and donor-sponsored projects have not been enough to fund the long-term infrastructure, and continued budgetary deficits and debt to service the external debt have weakened the state capacity to fund the infrastructure. It is on this basis that Islamic finance has been identified as a viable substitute, with Sukuk instruments providing both Shariah-compliant mobilisation of capital and attracting domestic and international investors (Awad et al., 2024). GS is one of the most important innovations in Islamic finance, combining capital markets with the aim of protection of the environment.

The issuance of GS and sustainable bonds has grown exponentially all over the world and hit USD 620 billion by 2024 (Nisrina & Pimada, 2024). Meanwhile, in parallel, the global ESG Sukuk market itself reached USD 50 billion, and Malaysia and Indonesia issued the most of them (Qadeer & Awad, 2025). Just a few years ago, Pakistan made its first foray into this sphere, with the inauguration of its sovereign GS in 2025 in the amount of PKR 30 billion (around USD 108 million), which is 5.4 times oversubscribed, to fund renewable energy and hydropower initiatives (Hussain, 2022). This type of issuance represents investor enthusiasm and serves as a reminder that GS is able to mobilize funds to invest in key infrastructures like dams, solar parks and transmission enhancements. Meanwhile, there is a deep-seated structural pressure in the energy and infrastructure sectors of Pakistan. There was 46.6 GW of installed electricity capacity in 2024 but less than 12% of the mix is renewable energy, with solar and wind combined making less than 6% of actual generation (Andespa et al., 2024). The grid bottlenecks, policy inconsistencies, and integration into the national supply do not correspond to the fivefold increase in imports of solar modules between 2022 and 2024 (Awad et al., 2025). We also have social differences: the wealthy have been over-satisfied with rooftop solar, and middle- and low-income families are still forced to use costly electricity via the grid (Awad et al., 2024).

These are some of the reasons why sustainable finance should invest in fair and sustainable power solutions. Although GS and ESG-related financing are subjects of increasing scholarly and policy attention, the available literature exposes a number of fundamental gaps that should be addressed through further studies. In the earlier literature, theoretical incompatibility of Sukuk structures with sustainable development has been mentioned, with special attention paid to the Shariah-compliant character of GS, and how they can be used to attract capital to finance environmentally responsible projects abroad (Qadeer & Awad, 2025). ESGs are employed to ensure ownership, purity and honesty among the stockholders (Aini et al., 2025). Malaysia, Indonesian and the Gulf empirical analyses confirm that it is feasible to have a subscription fee, reduced risk premiums or increased oversight of a project with addition of ESG (Al-sherman & Aldabousi, 2024). In Pakistan, the ESG systems are not so developed, disclosure regulations are inconsistent, and the regulations are not enforced at all (Qadeer et al., 2025). In the absence of proper

ESG implementation, GS streamlined to mere symbols with no real developmental value. It shall be proved that GS capable of executing the capital in the renewable energy and the infrastructural investment and receive financial and environmental payoff in Malaysia and Indonesia (Hussain, 2023). However, these works remain largely descriptive, in the form of issuance structures, regulation systems, and theoretical alignment with the SDGs, but fail to quantitatively assess developmental results.

Moreover, ESG compliance has been recognised as a widely accepted practise of improving transparency, investor trust and responsibility of projects (Hussain, 2022), but few empirical research studies have been conducted to test its mediating effect. Most studies either consider ESG as a normative set of practises or restrict the project to disclosure practises without connecting compliance with ESG to quantifiable developmental impact (Mohanty et al., 2023). Also, the studies in emerging markets, like Pakistan, have been in the underdeveloped stage relative to Southeast Asia and the Gulf, and few studies have focused on Sukuk performance, investor interest, or regulatory preparedness (Zulfiqar et al., 2024). These studies, too, tend to draw on secondary data or policy analysis and provide little information on how GS can be operationalized as a useful tool to achieve large-scale infrastructure expansion.

These papers indicate that there is an agreement that GS has potential, but systematic gaps remain in three dimensions: first, studies that directly test the influence of GS on the outcomes of infrastructure development are lacking; second, the literature has not examined the mediation role of ESG compliance as a driver of effectiveness; and third, the Pakistani context has been underrepresented, although the country is experiencing an increasing infrastructure financing gap and a recent sovereign issuance. As a result, international experience demonstrates potential, but does not reflect the intricacies of Pakistan renewable energy industry, grid limitations and policy. This also makes unanswered the main question of whether GS, strengthened by ESG compliance, can provide the Pakistan unique socio-economic and institutional context with tangible infrastructure expansion and sustainable development. The main aim of this research is to explore how GS can further the Pakistani sustainable development agenda through funding IE and in particular the mediating impact of ESG compliance. In order to fulfil this purpose, the research follows the following research objectives: to examine the impact of GS on IE in Pakistan**,** to evaluate the relationship between GS and ESG compliance**,** to analyze the effect of ESG compliance on IE, to assess the mediating role of ESG compliance in the relationship between GS and IE**.**

The work is very important because it covers one of the most burning problems facing Pakistan, namely, the financing of sustainable infrastructure in the context of increasing fiscal restraint, energy insecurity and climate vulnerability. The energy sector (which has been previously characterized by fossil fuel and hydro), is not only structurally inefficient but it is also in dire need of change. Given that electricity demand go beyond 50 GW by 2030 and that renewable energy will only supply less than 12 percent of generation mix, the financial gap in clean energy projects continues to be enormous. Traditional sources of borrowing are not adequate and sustainable and reliance on external borrowing has aggravated the debt load. In this regard, GS is a very important Shariah-compliant financial tool that can be used to drive domestic and international capital into renewable energy and infrastructural projects. With its emphasis on Pakistan, the study captures a setting where the stakes are unusually high: the nation is one of the most climate-sensitive countries in the world, whereas its sustainable finance capital markets are still in their infancy.

A narrow area of scope is subsequently described to investigate the correlation of GS, ESG compliance, and IE in the energy and Banking industry, specifically in renewable energy. The energy sector was selected due to the fact that the industry is the highest emitter of greenhouse gases and also due to the fact that the sector is key to the realisation of the United Nations Sustainable Development Goals (SDGs) in Pakistan. Furthermore, the banking sector constitutes the core focus of recent Sukuk issuances in the country, such as hydropower and solar projects, and thus it is the most appropriate sector to consider the developmental outcomes. The selection of respondents as policy-makers, investors and practitioners most directly interested in investing in the energy sector also "ives the scope of the research practical and empirical rigour. This study is unique as it combines the principles of Islamic finance with the concept of ESG compliance within the framework of a developing economy of South Asia. Although the empirical data in most previous studies has been focused on Malaysia, Indonesia, and the GCC (Aldabousi, 2022), the Pakistani data is lacking. This study, unlike the descriptive literature or conceptual literature, uses SEM to test the mediating value of ESG compliance between GS and IE with the goal of empirical study. The approach in question enables the study to go beyond theoretical hypotheses and produce statistically confirmed conclusions. There are two reasons behind the need to carry out this study. Firstly, it is because of the international acceptance of Islamic finance as the instrument of sustainable development and the unrealized prospects of GS in the developing economies. Second, it shows the peculiarities of development in Pakistan: the increasing shortages in infrastructure, the frequent energy shortages, and social inequalities that arise due to the unequal access to renewable resources. Through an exploration of the potential to improve the credibility and effectiveness of GS through ESG compliance, this paper seeks to suggest a viable remedy to the mobilisation of capital within a country where financing requirements are pressing and the traditional processes are not adequate. This paper has a quantitative research design. The author used a sample of 233 respondents representing key stakeholders in the energy sector including project developers, investors, regulators, and policymakers. There were four hypotheses that were tested using SEM to associate GS and ESG compliance with infrastructure expansion. It is a methodological rigour in which the findings are reached by empirical means rather than by a priori assumptions. The works of the study are practical and scholastic. It is a scholarly contribution in the sense that it contributes to the body of knowledge about Islamic finance, GS, and ESG by providing unique empirical data in Pakistan, which is an under-studied, but a highly pertinent, context. It is also a contribution to the body of theory by virtue of its testing of the mediating position of ESG compliance which has been underrepresented in previous literature. In practise, the findings are useful to policymakers, regulators, and investors as it shows that ESG-aligned Sukuk has the potential to raise long-term capital to fund renewable energy development. The research exposes Pakistan to the international stakeholders as a potential market to invest sustainably, and to the domestic institutions, the research would serve as a guide to accelerate the regulatory and governance mechanisms. Finally, the research would add to the world conversation on sustainable finance, as well as provide practical recommendations to frame the energy transition and sustainable development agenda in Pakistan.

THEORITICAL BACKGROUND

This study is conceptually framed based on integrating the Institutional Theory and the Stakeholder Theory, theories that, when synthesised, provide the full picture of how GS can trigger infrastructure development via the moderating role played by ESG compliance in the Pakistani energy industry. Institutional Theory points out that the activities conducted within organisations are influenced by coercive, normative and cognitive forces that establish legitimacy within a wider socio-regulatory landscape (Yahia Shams Eldin et al., 2025). No less important, the Stakeholder Theory is much more focused on the agency component of the firms meeting the expectations of the different constituencies, the investors, communities, regulators and civil society, and they are also becoming more interested in ensuring the integration of the financial pay into the management in order to merge the environmental stewardship and the social equity and responsibility into the management (Hussain, 2024).

Considered on its own, each theory sheds some light on the forces at work; but when combined they describe not only how issuers embrace ESG frameworks when issuing Sukuk (institutional legitimacy) but also how the frameworks contribute to greater investor trust and social contribution (stakeholder value creation). The two theories must be complementary to each other (Awad & Aldabousi, 2024). The Institutional Theory describes the current GS issuance of renewable energy projects in Pakistan as a result of coercive international sustainability policies (UN SDGs and Climate Bonds Initiative) and normative international Islamic financial centres (Malaysia and Indonesia) where Sukuk aligned with the ESG have established a new standard (Khemiri et al., 2024). Nonetheless, it cannot be attributed solely to institutional pressures that some GS manage to attract mass investor participation and some GS are symbolic. In this case, the gap filled by applying the Stakeholder Theory and proving that the issue of risk and disclosure is addressed and the benefit at the community level is provided in the form of affordable access to energy and safety of the environment (Khan et al., 2025). Quite to the contrary, all these theories overlap: institutions create the legitimacy framework that makes ESG adoption mandatory, and stakeholders decide how successful it by rewarding issuers that transcend compliance to real sustainability. As shown in Malaysia and Indonesia, well-established institutional support of ESG disclosures is a key factor to enhance the effectiveness of GS markets, but the effectiveness of the investor subscription rates is eventually determined by the trust of stakeholders in the credibility of these disclosures (Aldabousi, 2023). According to Gulf studies, regulation is justified but inadequately implemented; to achieve the pricing benefit of issuing Sukuk, issuers need to be meaningfully engaged with stakeholders through ESG-related governance and reporting (Awad, 2024).

On the other hand, the impact of fragmented adoption of ESG is evidenced in Pakistan, Hussain (2025) state that the inadequate implementation of regulations harms institutional legitimacy, and Awad (2024) states that it also affects stakeholders, and specifically, international investors are reluctant to be linked to the lack of transparency. Although there is oversubscription of the new sovereign GS in Pakistan, no sound mechanisms to ensure that ESG is complied with casts uncertainty on its effectiveness over time in terms of development. The ESG compliance mediating role can therefore be theorised more specifically. At the institutional level, ESG frameworks are signalling mechanisms which lessen information asymmetry, promote regulatory legitimacy and harmonise issuances with internationally acknowledged sustainability principles. ESG frameworks offer mechanisms of value creation as understood by stakeholders, in that, money collected with the help of GS invested in socially inclusive and environmentally-friendly projects. These two mechanisms are especially relevant in the energy sector of Pakistan. The adoption of renewable energy has been skewed towards the rich, as such, rooftop solar installation has benefited the poor neighbourhoods who have been caught in the high price grid power vicious cycle (Aldabousi et al., 2025). Large scale hydropower projects have been condemned as a source of social displacement and ecological loss. Compliance to ESG therefore moderates financial-development relation to ensure that GS-financed projects are not merely capital-raising instruments, but vehicles of equitable, open and sustainable infrastructural development. But there are gaps in theory, which are the subject of this study. To start with, there is little literature that has integrated the Institutional and Stakeholder theories, and it is not clear how external legitimacy pressure interacts with internal stakeholder negotiation to affect Sukuk results. Second, even though the existing literature provides evidence of positive relationships between ESG adoption and Sukuk performance, they usually fail to theorise the mediation channels by which ESG may influence performance, assuming that ESG is a form of compliance and, thus, a stagnant component. Third, Southeast Asia and the Gulf have been the focus of empirical research, whereas Pakistan, a country with a severe energy crunch, weak institutions and developing ESG were underrepresented. This study enhances the body of theory and adds to the discussion on sustainable Islamic finance globally by demonstrating that the institutional and stakeholder logics come together to define developmental influence through mediating the role of ESG compliance in a Pakistani energy-sector setting.

Green Sukuk and Infrastructure Expansion

One of the focal points in the emerging discussion on Islamic finance and sustainable development has been the connexion between GS and IE. It has been noted over and again based on empirical evidence that GS is a good source of life-long funds mobilisation to finance mega-scale infrastructural development, in particular renewable energy and transport (Awad & Ghonim, 2025). Awad (2025) established that the GS issuances in Malaysia were used to directly fund solar and hydropower projects, bypassing the common route to traditional debt markets and reducing the time necessary to start delivering the project. On the same note, Li & Khan (2025) derived the conclusion that the sovereign GS of Indonesia is capacity addition driver to renewable energies and the revenue is financed to finance energy efficiency, waste management and sustainable transport. According to these findings, not only GS generate capital, but also make project financing consistent with national sustainability agendas. Outside of Southeast Asia, Khan et al (2025) analysed Gulf economies and demonstrated that GS helped to bring various pools of investors, thus reducing the cost of capital when investing in infrastructure development and giving governments the opportunity to increase renewable energy grids. Mohanty et al (2023) also stated that Sukuk structure with the inbuilt Shariah-compliant risk-sharing components is well placed to finance long-term infrastructure, where the predictability and stability of returns are highly important. Yusuf et al (2025) describes proceeds as another demonstration of how GS support investor confidence because proceeds are correlated to real infrastructure benefits, which increase transparency and accountability relative to standard instruments. However, there are challenges that are also identified. In the absence of favourable institutional mechanisms, Aziz et al (2025) observed that Sukuk issuance will only be symbolic as it raises funds without guaranteeing that the proceeds translated into sustainable infrastructure development. This is close to the Pakistani context, where Ikhsan & Wulandari, (2024) found that even though sovereign Sukuk have been oversubscribed, the absence of effective ESG and governance, has restricted their developmental role. However, Hassan & Pandey (2020) observe, the infrastructure deficit and energy financing gap in Pakistan provide a good prospect of GS turning into transformative tools, unless their design is provided with a connexion to the project deliverables. GS have distinct potential to propel IE through capital mobilisation, low financing cost and increased investor confidence, yet the effectiveness of their development require that they are effectively aligned with project execution frameworks. On the basis of this empirical and theoretical work, the hypothesis is as follows:

H1: GS have a positive and significant impact on IE.

Green Sukuk and ESG Compliance

The correlation between GS and ESG compliance has become a topic of growing discussion as sustainable financial instruments are not only measured by their financial results but also deemed by their compliance with the environment and governance standards. As the case of Malaysia shows, GS is best issued in solid ESG models (Bayram et al., 2022). Wahid & Awad (2025) also discovered that the regulators in Malaysia were also thinking the ESG when designing the Sukuk and were making the decisions on how to turn it into a reality in a manner that it directly related to the environmentally friendly projects in the bid to increase the transparency as well as confidence in the market. On the same note, Boafo et al (2025) has opined that GS inherently institutionalise ESG concepts because Shariah-compliant contracts already focus on ethical investment and responsibility, making the transition between an Islamic finance system and a sustainability system more natural. Empirical evidence also indicates that GS may be utilised as drivers of intensified ESG practises in the emergent markets. According to Hussain et al (2022) issuing ESG-based Sukuk in the Gulf region motivated firms to pursue more rigorous disclosure policies because investors were increasingly insisting on demonstrable ESG compliance prior to subscribing. Hassan & Pandey (2020) showed that issuers incorporating ESG principles into Sukuk structures not only increased the variety of investors to their portfolio, but also minimised reputational risks and promoted a better regulatory legitimacy. This highlights the fact that compliance with ESG is not a trigger imposed externally, but an internal process in which GS acquire credibility and developmental salience.

However, there are still problems, especially in poorly developed regulatory settings. Brahmi et al., (2025) noted that in most emerging markets, such as Pakistan, the level of ESG integration is uneven, with most disclosed information being expressed as generalised comments as opposed to quantifiable benchmarks. As pointed out by Hasan et al (2024), though the issuance of sovereign Sukuk in Pakistan was an indication that the country was trying to be sustainable, the lack of proper implementation of ESG frameworks undermined its credibility among foreign investors. Likewise, Cai & Song (2024) observed that a significant obstacle to realising sustainability in Islamic financial instruments in

Pakistan is institutional gaps and the absence of a standardised system of ESG reporting. These results indicate that GS, by its very definition, is aligned with the principles of ESG but needs intentional institutional and market instruments to transform potential into practise. Summarising all this research it can be concluded that GS are two-sided: they are not only influenced by ESG compliance but they also facilitate its implementation by structuring financial markets in line with sustainability models. Issuance of Sukuk in strong institutional settings like Malaysia and Indonesia, including highly disclosed issuance, support ESG norms, whereas such issuance may stimulate regulatory and market learning by embedding ESG-related practises into capital markets in weak institutional settings like Pakistan. This dynamic makes GS as an outcome and vehicle of ESG compliance. On this basis, the hypothesis is as follows:

H2: GS have a positive and significant relationship with ESG compliance.

ESG Compliance and Infrastructure Expansion

Sustainable development finance and the investors and regulators now demand the infrastructure projects to be more than financially viable, they demand the project demonstrate that it is also environmentally and socially responsible. As the available literature suggests, in the vast majority of the settings, sustainability, inclusiveness, and efficiency of infrastructure development models might prove useful in enhancing this type of development over the long-term (Tufail et al., 2025). Maas et al (2024) highlighted the importance of ESG principles integrated in Islamic finance to create more efficient governance systems that would make the infrastructure projects funded by Sukuk environmentally sustainable and socially balanced. Shafi et al (2025) also observed that ESG-compliant framework-funded projects in Malaysia were more resilient and aligned in terms of serving national climate targets than traditional ones. In addition to compliance, the integration related to ESG has a direct impact on investor engagement and project implementation. Qadeer et al (2025) noted that disclosure of ESG boosted confidence of international investors in the infrastructure bonds significantly particularly in the emerging markets where degree of information asymmetry is high. Ghonim & Awad (2024) also indicated that the application of ESG not only builds financial credibility, but also reduces chances of project delays, cost increases, and reputational damage and, therefore, accelerates the process of IE. Additional evidence in Indonesia indicates that infrastructure projects funded by ESG-compliant Sukuk received widespread acceptance by stakeholders and were approved more quickly as communities viewed them as more socially responsible (Shafi et al., 2025).

Meanwhile, obstacles also emphasise the contingency of such a relationship. Saad et al (2025) commented that the IE in markets with weakly developed ESG that is poorly implemented would be unsustainable and both environmental and social externalities would disrupt further development. Within the Pakistani context, Ghonim et al (2025) observed that poor ESG frameworks have played a role in the ineffectiveness of large-scale hydropower and renewable project financed via Sukuk, which have raised concerns regarding social displacement and ecological harm. Suherman et al (2025) further claimed that the absence of standardised ESG reporting means that infrastructure projects cannot easily receive long-term international investment and thus cannot be scaled. However, Nasir et al (2024) proposed that outcomes in the places where ESG practises were adopted meaningfully, e.g. in small-scale solar and wind projects, were fairer and more developmentally effective, providing a prototype of how to scale sustainable infrastructure. In generalising all the results, it is clear that ESG compliance is a catalyst in the presence of IE in the sense that it increases governance, investor trust, and project alignment to long-term development and environmental goals. Though the impact of institutional enforcement can be diluted when institutional ESG integration is weak, there are signs that when institutional ESG integration is high not only does it enhance the legitimacy of the project, but it also leads to more capital and community-level support which is critical in the process of expansion of infrastructure in the Pakistani energy sector. The hypothesis proposed is, therefore, the following:

H3: ESG compliance has a positive and significant impact on IE.

Mediating Role of ESG Compliance

Although GS offer a potential solution to capital mobilisation, their success in stimulating the IE is determined by how they are incorporated into the ESG compliance models. With no ESG alignment, Sukuk will remain just a tower of moneymaking tools, which have no connexion with developmental results. Several papers emphasise the idea that ESG compliance is the channel of transmission via which financial innovation is transformed into sustainable infrastructure (Obadire & Moyo, 2024). Khemiri et al (2024), who found out that on top of producing large capital, ESG-compliant GS in Malaysia ensured proceeds were channelled into projects whose environmental contribution could be measured, thereby producing real developmental outputs. In the same manner, Awad et al (2024) pointed out that sovereign GS of Indonesia created global investor confidence exactly since the issuance was accompanied by rigid ESG disclosure and monitoring programmes. Hussain (2023) opined that issuing Sukuk not translate to sustainability unless the compliance frameworks are made to provide transparency, accountability, and environmental protection; only at this point can infrastructure projects be made legitimate and sustainable. Awad (2024) demonstrate, the ESG disclosure mediated the one-to-one connection between the sustainable financial products and the investor trust in the Gulf, which implied that the capital flows to the infrastructure was conditional on a plausible ESG integration. Aziz et al (2025) was that the supportive role of Shariah principles in the context of ethical finance needed to be reinforced by ESG frameworks, in order to transform Islamic finance into developmental infrastructure deliverables.;In less developed institutional environments, ESG compliance played an even more critical mediating role. Hussain (2024) cautioned that as long as there are no enforceable ESG standards, GS funds collected may be redirected to projects with little or no sustainability value. Hussain (2025) analysed the sovereign issuance of Sukuk in Pakistan and established that despite high subscription, the developmental legitimacy of the sovereign Sukuk was doubted by many countries abroad because of its weak environmental protection systems. In the same study, Shafi et al (2025) noted that investors were hesitant to invest in the energy sector of Pakistan on a long-term basis due to the lack of standardised ESG reporting, which constrained the developmental translation of Sukuk proceeds. Aini et al (2025) research revealed, where ESG principles were taken into account, e.g., solar micro-grids, projects could not only secure financing but also construct infrastructure in a rather equal manner, thus, leaving inequality behind in the context of access to energy. By combining these results, it becomes possible to consider the ESG compliance as the key mediating factor. GS generate the financial opportunity, but ESG frameworks help to make sure that this opportunity is converted into socially and environmentally responsible infrastructure. Put differently, Sukuk offer the capital foundation, whereas ESG offers the developmental direction of such capital. In the absence of ESG, the connexion between Sukuk issuance and infrastructure growth is weak; in the presence of ESG, it is strong, open, and sustainable. Within the Pakistani context, where institutional fragility and investor distrust are inherent, ESG compliance is that element that can turn GS into mere lip service symbols instead of meaningful tools to drive the energy sector growth. On this premise, the hypothesis below is formulated:

H4: ESG compliance mediates the relationship between GS and IE.

METHODOLOGY

Sample and Data Collection Procedure

This study sample was selected on the basis of Pakistani energy and financial sector that is a key field where sustainable infrastructure financing using GS would apply. Since the topic is new and specialised, a purposive convenience sample design was employed, as is typical of exploratory research when only specific respondents are accessible but specialised knowledge is needed (Ghonim & Awad, 2024). In order to achieve sufficient representation, 233 respondents were sampled among top managers, financial officers, sustainability officers, and project managers who actively participated in the infrastructure finance, renewable energy programmes, or ESG compliance in their respective organisations. The process of data collection was well formulated to improve validity and reliability. First contact was made via professional networks, industry associations and direct approach to organisations involved with energy financing, banking, and capital market activities. The participants received an invitation through formal email requests after obtaining the organisational acceptance and were thoroughly informed about the aims of the study, its voluntariness, and anonymity. The interview participants had the option of filling a structured paper-based questionnaire or taking an online survey (Google Forms), which would be convenient and easy to access. There were no monetary or material incentives provided, and the possibility of bias was limited, as a result, 350 invitations are sent, and 248 responses were received, achieving a response rate of 70.8% on organisational surveys in emerging markets. Out of the incomplete, inconsistent, or patterned responses, 233 valid responses were selected to proceed with the final analysis, which is more than the minimum recommended in SEM (Aldabousi, 2023). The normality, outliers, and multicollinearity tests were performed accordingly and were included in the data screening (Shafi et al., 2025). The sample was demographically varied. The respondents included representatives of public and private sector organisations with a substantial number being representatives of the banking sector and energy sector, where GS financing is most common. The percentage of gender was not high and the men were a little bit more dominant, which is also a tendency in the industry in Pakistan. The vast majority of participants were well-educated, having at least a bachelor's degree and many occupied mid-to-senior positions in management which makes their responses relevant to the study topic of financing, ESG integration and IE.

Table 1
Demographic Profile of Respondents (N = 233)

Characteristics	Category	Frequency (N)	Percentage (%)
Gender	Male	146	62.7%
	Female	87	37.3%
Age	20–30 years	58	24.9%
	31–40 years	102	43.8%
	41–50 years	51	21.9%
	Above 50 years	22	9.4%
Education	Bachelor's degree	128	54.9%
	Master's degree	79	33.9%
	MPhil/PhD	26	11.2%

Characteristics	Category	Frequency (N)	Percentage (%)
Position	Senior Managers/Executives	64	27.5%
	Middle Managers	89	38.2%
	Officers/Analysts	47	20.2%
	Technical/Operational Staff	33	14.1%
Sector	Energy (Renewable/Utilities)	97	41.6%
	Banking/Finance	83	35.6%
	Other Related Services	53	22.8%

Measures

Since the constructs involved in this study were first constructed and tested in English, a process of forward-backward translation was used to guarantee the linguistic and cultural correctness of the situation in Pakistan (Hussain, 2022). The instruments were originally translated to Urdu by two bilingual experts. The Urdu version was then translated by another group of bilingual professionals into the English language. The back and original versions were compared with each other to detect the discrepancies, which were resolved after several repetitions until semantic and conceptual similarity was established. To further refine the wording, ensure cultural appropriateness and to test reliability, a pilot test involving 30 respondents working in the energy and banking industries was done. Everything was rated using a five-point Likert scale (1 = strongly disagree, 5 strongly agree), which has been used in previous research on sustainable finance and ESG. An adapted version of instruments already used in Islamic finance and green bond research were used to measure GS (Hussain, 2024). The items identified the perceptions of respondents about GS as a financing mechanism of renewable energy sources and infrastructure projects and their compatibility with Shariah principles and long-term sustainability goals. According to the previous studies, the degree of reliability (>0.78) was acceptable in Southeast Asia and Gulf markets (Andespa et al., 2024; Awad, 2024). One of them has been listed below: Green Sukuk are critical in funding the energy projects that are environmentally friendly in Pakistan. The level of ESG compliance was assessed based on a scale modified on the basis of literature regarding sustainability disclosure and governance (Awad, 2025). The construct was an aggregate of three elements of environmental responsibility (e.g., carbon reduction, inclusion of renewables), social responsibility (e.g., communal participation, fair access), and governance (e.g., transparency, accountability). This has been a largely proven multidimensional framework in previous empirical research, with Cronbach alpha always exceeding 0.80 (Nasir et al., 2024; Sharma & Nagi, 2018). One example is the following: My organisation will ensure that the money collected by Green Sukuk is in accordance with the internationally accepted

ESG principles. The measurement of the IE was based on the indicators of renewable energy capacity establishment and grid modernization, as well as sustainable access to energy. The items were modified based on Cai & Song (2024) sustainable infrastructure models and the Islamic use of finance (Hussain, 2025; Almeer et al., 2024). The validity of similar items studied before in Malaysia and Indonesia has been confirmed with reliability coefficients greater than 0.75, with high construct validity in the context of Islamic financial instruments (Qadeer & Awad, 2025). One such item is: Green Sukuk financing has helped in the development of renewable energy infrastructure in Pakistan energy sector. The choice of the instruments was based on their validity and reliability in previous cross-cultural research on the subject of sustainable finance and infrastructure. The adjustment of validated measures made comparison with international studies possible and Pakistan culturally relevant. The pilot study proved the internal consistency, and all constructs showed Cronbach alpha above the required value of 0.70 (Khan et al., 2025). In addition, a five-point Likert scale allowed small responses without decreasing articulateness and interest of respondents, particularly when a sample comprised of energy and finance professionals.

Data Analysis

Initial analysis of the data was done using SPSS version 29 and SEM was done using AMOS. The first statistic calculated to summarise the demographic characteristics of the participants and determine the distributional qualities of the data were descriptive statistics. Then, the hypothesised relationships were tested using SEM because this method can estimate complex interdependencies between latent constructs and test hypotheses of both the measurement and structural models at the same time (Awad, 2025; Nagi et al.,2023).

Measurement and Structural Model

To test the reliability and validity of the constructs, the measurement model was evaluated. Several fit indices were used to assess model adequacy, among which the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR). The indices of all variables showed satisfactory levels of model fit, which confirmed that the latent variables of GS, ESG compliance, and IE were measured satisfactorily. The structural model was further tested to test the hypothesised paths (H1 through H4), with the mediating role of ESG compliance.

Common Method Bias

Since all data were gathered using the same respondents, common method bias (CMB) was also thoroughly considered (Li & Khan, 2025; Nagi & Mohammed Ali, 2020; Khalifa et al., 2020). Procedurally the participants were assured anonymity and confidentiality, told that there were no right or wrong answers and to answer their best. Besides this, psychological distance between constructs was achieved through the use of section breaks between measuring scales. The single-factor test as applied by Harman (done through the exploratory factor analysis) yielded statistically that the first variable accounted less than 40 percent of the variance, and therefore that CMB was not a concern. This result was congruent with claims made by Hussian (2025), and Awad et al (2024) that people should not overestimate the effect of method bias in cases where rigorous procedural remedies are applied.

Reliability and Validity

Cronbach alpha was used to measure the reliability of the constructs, and all values were greater than the suggested threshold of 0.70, which is strong internal consistency (Kasmad et al., 2024). The convergent validity was established because average variance extracted (AVE) values were above 0.50, and the discriminant validity was established because square roots of AVE are higher than inter-construct correlations. All of these findings support the sufficiency of the measurement model and the strength of the constructs in reflecting the underlying dimensions of sustainable financing and infrastructure results.

Table 2
Descriptive Statistics and Correlations (N = 233)

Construct	M	SD	1	2	3
GS	3.92	0.68	(0.91)		
ESG Compliance	4.08	0.73	0.58**	(0.89)	
IE	3.85	0.70	0.54**	0.62**	(0.93)

Notes: Values in parentheses are Cronbach's alpha coefficients. **p < 0.01. M = Mean; SD = Standard Deviation.

RESULTS

Measurement Model

To determine the internal consistency of all three constructs GS, ESG Compliance, and IE All alpha was calculated, and all alpha values were found to be above the recommended value of 0.70 (see Table 2) meaning they all exhibited high reliability. Three latent variables, and their observed measures were then defined. Confirmatory factor analysis (CFA) demonstrated that the measurement model fits very well: 2 = 196.27; 2 = 55; $p = 0.01$; Comparative Fit Index (CFI) = 0.97; Goodness-of-Fit Index (GFI) = 0.93; Tucker-Lewis Index (TLI) = 0.96; Root Mean Square Error of Approximation (RMSEA) = 0.05;

and Standardised root mean square residual (SRMR) The results confirm congruent validity by demonstrating statistically significant standardised loadings on the corresponding constructs by the three measurement indicators, ranging between 0.64 and 0.88 (t-values = 8.1214.05; p = 0.001). Higher than the recommended composite reliabilities (CRs) of 0.70 are 0.78 to 0.94 (Awad, 2025). The values of the AVE were between 0.53 and 0.72, which exceeded the stipulated limit of 0.50 (Shafi et al., 2025), and therefore validated convergent validity. The discriminant validity was also determined as the square roots of the AVE values were higher than the inter-construct correlations. The relation between the GS and ESG Compliance was moderate (r = 0.61) but the AVE score of both variables was far greater and it has showed the fact that each of the constructs had some variance that the rest did not share. On the basis of these findings, it can be concluded that the measurement model has convergent and discriminant validity and it serves as a valid basis to test the structural relationships between GS, ESG compliance, and IE in Pakistani energy sector.

Structural Model

SEM was used to test the proposed structural model, and overall fit statistics revealed that the model fitted the data very well: 2 = 842.36; 310; p = 0.01; CFI = 0.96; NFI = 0.95; TLI = 0.95; RMSEA = 0.046; and SRMR = 0.041. The values exceed the recommended levels, which proves that the model is sufficient to describe the assumed relationships between GS, ESG compliance, and IE. Adjusted multiple correlations (R 2) were used to identify that the integrated model explained 47.3 percent of the variation in ESG compliance and 56.4 percent of the variation in IE suggesting that the proposed framework has high explanatory power.

Hypotheses Testing

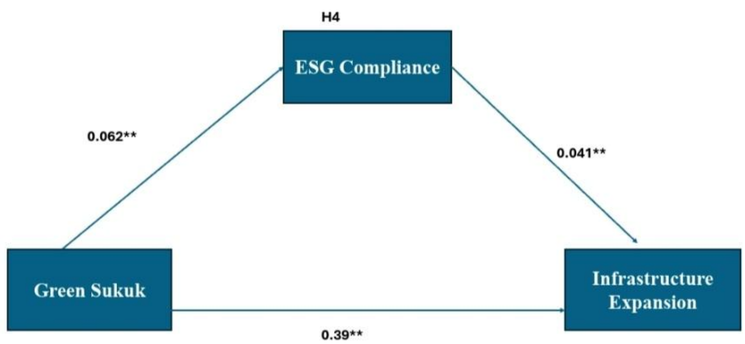
The GS to IE (H1) was positive and statistically significant (b = 0.39, t = 10.21, p < 0.001), which underlines the claim that Sukuk-based financing has a direct positive impact on the infrastructure growth. Similarly, the relationship between GS and ESG compliance (H2) was very significant (= 0.62, t = 14.47, p < 0.001), which confirms that the issuance of Sukuk encourages sustainable investment practices in accordance with ESG standards. In H3, the ESG compliance was found to be a significant predictor of IE (= 0.41, t = 9.78, p < 0.001), which means that the ESG compliance is a predictor of the sustainable development of energy and infrastructure projects. Lastly, the mediating role of ESG compliance (H4) in the correlation between GS and IE was also tested by bootstrapping. P = The indirect route was meaningful (=0.25, t = 7.15, p = 0.001), which”shows partial mediation. This implies that although the contribution of GS to IE is direct, a significant part of this influence works via the reinforcement of ESG practises. Taken together, these findings not only affirm that GS are effective financial tools to mobilise capital, but they are also a mechanism that instils sustainability compliance, increasing their developmental effect in the banking and energy sector within Pakistan.

Table 3
Structural Path Estimates

Path	Path Estimate (β)	t-value	Hypothesis Testing
H1: GS → IE	0.39	10.21	Supported
H2: GS → ESG Compliance	0.62	14.47	Supported
H3: ESG Compliance → IE	0.41	9.78	Supported
H4: GS→ ESG Compliance → IE	0.25 (indirect)	7.15	Supported

Source: Authors' own work

Figure 1
Mediation Analysis



DISCUSSION

The results of this research provide strong empirical evidence on the existence of relationships between the hypothesised variables of GS financing, ESG compliance, and IE in the Pakistan energy and Banking industry. The findings demonstrate that GS is a significant contributor to IE, both directly and indirectly along the mediator of ESG compliance, in turn justifying the hypothesised mechanisms informed by Institutional Theory and the stakeholder theory. Besides the fact that these findings confirm the hypothesised structural model, the findings have the added advantage of contributing to the growing literature on sustainable Islamic finance, ESG-based investment practises, and infrastructure development in emerging economies. The GS and IE relationship is positive, as prior studies have found. In indicative terms, Saad et al (2025) and Yusuf et al (2025) affirmed the channeling of necessary resources to projects with long payback period in the infrastructure sector and more so renewable energy through Shariah compliant financing instruments. Similarly, Aziz et al (2025) and Hussain et al (2022) concluded that the

Islamic debt instruments provide governments with a feasible, moral, and sustainable alternative to conventional borrowings, therefore, enabling the expansion of the energy infrastructures at the cost of fiscal constraints. These similarities also support the notion that Green Sukuk is not a tool with small niche, the instrument could be developed and used to foster sustainable infrastructure. The evidence of the study also shows that the issuance of GS has a positive effect on its compliance with ESG, which is consistent with Zulfiqar et al (2024) and Qadeer et al (2025) who stated that Islamic financing mechanisms are internally compatible with its environmental stewardship, social justice, and ethical governance. This coincidence is explained by the very structure of Sukuk which does not allow investing in socially or environmentally disastrous or exploitative actions. Besides, the report by Cai & Song (2024) and Hasan et al (2024) also stated that Sukuk is not only a tool to promote the compliance with Shariah principles but also promotes transparency, accountability, and governance frameworks that also correlate with the dimensions of ESG. The present results support these arguments by empirically showing that ESG compliance is greatly enhanced in organisations financed by GS. The findings also suggest that ESG compliance and IE have a powerful positive connexion, which aligns with international evidence by Yusuf et al (2025) who concluded that organisations that are more compliant with ESG standards attract more investment, minimise risk at the project level, and gain better acceptance of their infrastructure projects by society members. Evidence has shown that ESG compliance assists in reducing financing costs, reputational risks, and increasing stakeholder trust, all of which are key in large scale IE where these issues play a critical role in sensitive sectors such as energy. The results in this paper, therefore, substantiate the compliance of ESG as not just an ethical requirement, but also as a practical facilitator of infrastructure development in Pakistan. Probably the most importantly, the research confirms the mediating effect of ESG compliance in the relationship between GS and IE. According to this mediation, although GS has a direct effect on infrastructure projects, its effect is strong when issuers are characterised by high levels of ESG compliance. These are the same findings that Mohanty et al (2023) and Zulfiqar et al (2024) have proposed, which contend that ESG compliance increases the credibility and acceptability of Sukuk to local and foreign investors and, therefore, the financial base to fund infrastructure projects. This observation also echoes the sentiments of Ghonim & Awad (2025) and Hussian (2025) who emphasised that ESG-based Sukuk are becoming considered as low-risk and socially useful tools, a fact that explains their rising popularity across the globe. All of the findings, in general, are in agreement with the prior research, all of which lead to the same convergent evidence that Islamic sustainable financing, especially GS, in combination with ESG compliance, is an effective tool to speed up the infrastructural development.

Nevertheless, the present research contributes to the body of literature by placing such dynamics within the framework of the Pakistani energy industry, where financing, regulatory, and sustainability issues intersect. In contrast to the previous studies that were mostly performed in Malaysia, Indonesia, or the Gulf states, this study emphasises the role of GS and ESG compliance based on the unique socio-economic environment in Pakistan, its regulatory framework, and energy transition challenges. Simultaneously, the results should be critically reflected. Although the observed strong positive relationships are similar to the findings of previous empirical studies, one should not overgeneralize (Nagi & Mohammed Ali, 2020). The results of infrastructure development based on GS and ESG compliance depend on contextual aspects including the quality of governance, investor trust, regulatory practises, and cultural acceptance of Shariah-compliant instruments. Indicatively, although the positive impacts described in Hassan & Pandey (2020) and Brahmi et al (2025) were similar in Southeast Asian markets, institutional capacity differences can affect whether the same results can be replicated in Pakistan. With these caveats, the findings indicate that the energy sector in Pakistan has the potential to experience significant improvement through the upscaling of the GS issuance coupled with ESG frameworks. In so doing, the nation does not only overcome its long-term infrastructure deficit, but also establishes itself as a leader in Islamic sustainable finance in the region.

The study has considerable theoretical, practical, policy, managerial, and social implications and contributes to both scholarly and practical discourse. It offers a fine-tuning construct applicable in the light of the realities of the emerging institutions of the economies yet relates to the sustainability considerations broadly through the connexions of GS, ESG compliance and IE.

Theoretically, the results move the combination of the Institutional Theory and the stakeholder theory forward. The institutional theory emphasises the importance of normative and regulatory forces in determining compliance to ESG standards within organisations and the stakeholder theory describes how distinctive resources (sustainable Islamic financial instruments) can create long-term competitive advantage. A combination of these two schools of thought will make the study relevant to a better theoretical insight into the role of financial innovation in helping to develop infrastructures as dictated by ethical and environmental imperatives. The validation of ESG as a mediating mechanism has added theoretical value, demonstrating that financing tools cannot work in isolation without governance and compliance arrangements that are in accord with sustainability imperatives. This adds value to the current literature by emphasising ESG as not only an outcome, but also a strategic facilitator, which intensifies the developmental effect of Islamic finance.

The practical implications are also very powerful. The cue that GS has a viable funding mechanism on infrastructure is on the practitioners, the concerns are on renewable energy and on transport and sustainable urban development. It is companies that include the ESG models and issue Sukuk that have a higher likelihood of gaining investor trust, reducing the cost of financing and also ensuring the viability of the project in the long-term. It is up to practitioners therefore to transcend the conventional financial imperatives and embrace ESG-inculcated frameworks in designing and packaging Green Sukuk instruments. The same finding directly applies to banks, investment firms, and corporations in Pakistan, as it indicates that ESG-based Sukuk not only meet Shariah requirements but also have access to the global sources of socially responsible investment capital.

On the policy level, the research gives governments and regulators a roadmap to achieve a stronger ecosystem of Islamic sustainable finance. Certain regulators like the State Bank of Pakistan and the Securities and Exchange Commission of Pakistan may create more specific guidelines and incentives on ESG-friendly Sukuk, such as tax advantages, credit facilities, or green certification systems. This would not only liberalise capital markets but would also redirect private investment to national developmental priorities especially in the energy sector. Other developing economies around the world can implement similar policies internationally to ensure that capital market instruments are used to meet international sustainability objectives, thus, becoming SDGs contributors. The managerial implications are also huge. Corporate managers are to view ESG compliance as a strategic advantage and not as a regulatory liability. The inclusion of ESG values in corporate governance, risk management, and reporting strategies builds trust among stakeholders and increases the effectiveness of Sukuk issuance. It is anticipated that energy and infrastructure managers in particular will enter into open ESG reporting frameworks, coordinate projects with the Shariah and sustainability standards, and lead the way in engagement with investors and communities. Such dual compliance leads to trust and reduced reputational risk and resistance of the project to unstable market conditions. Last but not least, the work has deep social implications. The issuance of Green Sukuk and eSG compliance can not only generate benefits based on financial returns but also generate beneficial effects on society. ESG-compliant Suk that fund infrastructure projects directly result in cleaner access to energy, job creation, and better public services to promote inclusive growth and social equity. Furthermore, since the tools are linked to social justice and ethical governance in financial decision-making, they have a positive relationship with the Islamic moral value and international concerns of sustainability. Such dual legitimacy builds societal confidence in financial markets, increases financial inclusion and amplifies the role of finance as a driver of sustainable development. This study provides a holistic approach to the emergence of sustainable Islamic finance and infrastructure development by combining theoretical knowledge with practical suggestions to the practitioners, policymakers, managers and the society. It highlights the reality that GS as a financing mechanism coupled with compliance with ESG is not a mere financing facility, but a transformative facility that will align economic growth and ethical, environmental and social requirements.

CONCLUSION

This study analyzes the relationship between Green Sukuk (GS), ESG compliance, and infrastructure expansion (IE) in Pakistan's banking and energy sectors, emphasizing the mediating role of ESG practices. Drawing on Institutional and Stakeholder theories, the paper shows that GS serves not only as a financing tool but also as a strategic driver of sustainable development when aligned with ESG principles. Based on responses from 233 participants, findings confirm that GS positively influences both ESG compliance and infrastructure growth, while ESG compliance itself significantly boosts infrastructure development. Moreover, ESG acts as a mediator that strengthens the developmental impact of Sukuk financing.

The study highlights that Islamic finance, through its Shariah-based ethical framework, effectively bridges financial growth with environmental and social responsibility. In Pakistan's context of weak infrastructure and energy insecurity, ESG-compliant GS can accelerate clean energy and fair development. Theoretically, it integrates institutional pressures and firm-level resources to explain sustainable finance in emerging markets; practically, it offers guidance for policymakers to improve ESG frameworks, promote GS issuance, and attract investments. Despite methodological limits, the findings affirm that GS's true potential lies not merely in mobilizing funds but in aligning finance with sustainability goals—positioning Islamic finance as a cornerstone for sustainable development in emerging economies.

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