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Research Article

THE ROLE OF GREEN WAKAF IN FINANCING CLIMATE CHANGE MITIGATION STRATEGIES

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Abstract

Climate change mitigation requires substantial and sustained financing, particularly in developing economies where conventional public and private funding remains insufficient. Green waqf offers a potentially complementary Islamic social finance mechanism for supporting low-carbon and environmentally sustainable projects. This study aims to examine how green waqf contributes to climate mitigation financing through resource mobilization, institutional governance, stakeholder collaboration, financing accessibility, and project implementation effectiveness. An explanatory sequential mixed-method design was employed, combining survey-based quantitative analysis using PLS-SEM with qualitative interviews, documentary analysis, and case-based interpretation. The findings indicate that green waqf mobilization contributes positively to financing accessibility, while institutional governance and stakeholder collaboration strengthen project implementation effectiveness. Project implementation effectiveness emerged as the strongest pathway toward climate mitigation contribution, followed by financing accessibility, whereas direct resource mobilization showed a comparatively smaller effect. Case evidence further demonstrates that professional nazir capacity, transparency, collaborative governance, and integration with complementary instruments such as green sukuk improve the sustainability of green waqf initiatives. The study concludes that green waqf should be positioned as catalytic rather than stand-alone climate finance, with measurable environmental outcomes, accountable governance, and blended financing structures required to enhance its scalability and long-term mitigation impact within broader national sustainable development financing frameworks.

Keywords: Climate Change, Climate Finance, Green Sukuk

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INTRODUCTION

Climate change has become one of the most consequential environmental and socioeconomic challenges confronting the global community, requiring substantial financial resources to accelerate the transition toward low-carbon development (Bala et al., 2025; Chavarría-Flores & Warren, 2024). Rising greenhouse gas emissions, ecosystem degradation, deforestation, unsustainable energy consumption, and the continued dependence on fossil fuels have intensified the need for investments in renewable energy, sustainable transportation, forest restoration, energy efficiency, waste management, and other mitigation activities. Climate finance has consequently emerged as a central component of international environmental policy (AlKhazali et al., 2025; Qadri et al., 2024). The scale of available financing, however, remains considerably below what is required to achieve global climate objectives. Recent climate-finance assessments indicate that global flows have exceeded USD 2 trillion, yet financing continues to fall short of the investment required for pathways consistent with international climate targets (AlGhazali et al., 2024). This financing constraint provides a strong rationale for exploring complementary financial mechanisms capable of mobilizing resources beyond conventional public budgets and commercial finance (Widiastuti et al., 2025).

Conventional climate-financing mechanisms depend primarily on government expenditure, international climate funds, development finance institutions, commercial investment, carbon markets, green bonds, and other market-based instruments (Ghaemi Asl et al., 2023; Tekin, 2025). These mechanisms have contributed substantially to climate action but frequently encounter limitations associated with fiscal constraints, high financing costs, perceived investment risks, unequal access to capital, and uncertain financial returns from environmentally beneficial projects (M. Billah, Hadhri, Balli, et al., 2024; Zirek & Unsal, 2023). Emerging and developing economies face particularly significant obstacles because climate investments must compete with expenditures for poverty reduction, education, healthcare, infrastructure, and other development priorities. The resulting financial pressure demonstrates that climate mitigation should not be conceptualized exclusively as a government or private-investment responsibility (Lee et al., 2025). A diversified financing architecture capable of combining commercial, public, philanthropic, and community-based resources is increasingly necessary to support mitigation projects that generate substantial environmental and social value even when their immediate financial returns are limited (Aslam & Newaz, 2025; Su et al., 2023).

Islamic social finance offers an important perspective for expanding this financing architecture, particularly through the institution of waqf. Waqf historically mobilizes assets for enduring social benefits by preserving the underlying endowed asset while directing its benefits toward designated public purposes (Newaz & Aslam, 2025; Ramadan, 2025). The concept of green waqf extends this institution toward environmental objectives, including forest conservation, renewable energy, sustainable agriculture, ecosystem restoration, clean water systems, low-carbon infrastructure, and other forms of ecological investment. Green waqf therefore creates a conceptual bridge between Islamic philanthropy, sustainable finance, environmental stewardship, and climate action (M. Billah, Hadhri, Shaik, et al., 2024; Rabbani et al., 2025). The Green Waqf Framework developed through collaboration involving UNDP and Indonesian waqf institutions illustrates the growing institutional recognition of this approach and positions waqf as a potentially complementary mechanism within broader sustainable-development and climate-financing ecosystems (S. M. Billah, Kapar, Hassan, et al., 2024).

The central problem addressed by this study concerns the persistent mismatch between the financial resources required for climate change mitigation and the amount of capital effectively mobilized for environmentally sustainable projects (Ghaemi Asl, Ben Jabeur, et al., 2024; Narayan et al., 2025). Climate mitigation requires long-term investments whose

economic benefits may not always be captured directly by investors because many benefits take the form of reduced emissions, improved environmental quality, ecosystem protection, public health improvements, and intergenerational welfare (H. Ali et al., 2025; M. Billah, Alam, & Hoque, 2024). Such characteristics can make purely commercial financing insufficient for particular categories of climate projects. Green waqf may help address this limitation because its underlying logic prioritizes sustainable public benefit rather than short-term financial maximization (Husain et al., 2024). Its theoretical compatibility with long-term environmental objectives, however, does not automatically demonstrate its effectiveness as a climate-financing instrument. A critical analytical distinction must therefore be made between the normative potential of green waqf and its actual capacity to mobilize, allocate, preserve, and scale financing for measurable mitigation outcomes (Bringas-Fernández et al., 2025; Timur et al., 2025).

A second problem concerns the absence of sufficiently mature operational structures linking waqf resources to climate mitigation projects. The availability of donated land, cash waqf, productive waqf assets, or other endowed resources does not by itself guarantee effective environmental financing (Ghaemi Asl, Nasr Isfahani, et al., 2024). Green waqf requires credible project-selection mechanisms, professional nazir management, transparent financial administration, Sharia compliance, environmental eligibility criteria, impact monitoring, risk-management arrangements, and coordination among government agencies, Islamic financial institutions, environmental organizations, investors, and local communities (F. Ali et al., 2024; Khamisu et al., 2024). Weak governance may create fragmented projects, underutilized assets, limited fundraising capacity, and difficulties in demonstrating environmental outcomes. Recent research on Indonesian green-waqf initiatives has already highlighted governance, institutional capacity, resource allocation, and sustainability as significant determinants of effectiveness, indicating that the central challenge is increasingly one of operationalization rather than merely conceptual recognition (Andespa et al., 2024).

A third problem arises from the limited integration of green waqf with the wider climate-finance ecosystem. Existing Islamic finance innovations such as green sukuk and Cash Waqf Linked Sukuk demonstrate that Islamic commercial finance and Islamic social finance can potentially be combined rather than treated as separate domains (Seidl et al., 2024; Tiwari et al., 2023). Green waqf may provide concessional, philanthropic, or patient capital for project preparation and social-environmental components, while market-oriented instruments may contribute larger-scale investment capital (Alghafes et al., 2024). Such integration nevertheless raises questions concerning asset preservation, return allocation, risk sharing, accountability, additionality, and the measurement of environmental performance (M. Billah et al., 2023; Sagiyeva et al., 2025). A rigorous study must therefore examine the conditions under which green waqf can become a credible source of climate mitigation finance rather than assuming that attaching an environmental label to waqf automatically produces effective climate outcomes (Kazak et al., 2025).

This study aims to analyze the role of green waqf as an alternative and complementary financing mechanism for climate change mitigation strategies (Daly & Jarboui, 2025). The analysis should identify how the principles and financial characteristics of waqf can support mitigation activities requiring patient, long-term, socially oriented, and environmentally responsible capital (S. M. Billah & Adnan, 2024). Particular attention should be directed toward financing areas such as renewable energy development, reforestation and forest protection, sustainable land management, low-carbon community infrastructure, energy efficiency, environmentally responsible agriculture, and waste-management initiatives (Mensi et al., 2023; Tripathi et al., 2025). The objective is not merely to demonstrate a conceptual relationship between Islam and environmental protection but to determine the financial functions green waqf can realistically perform within a climate-mitigation financing structure.

The research also seeks to identify the institutional, financial, regulatory, and governance conditions required for effective implementation of green waqf. This objective should examine how waqf resources are mobilized from individual and institutional donors, transformed into productive environmental assets, managed by professional nazir institutions, and allocated toward projects with verifiable climate benefits (Ibrahim et al., 2025; Skovgaard et al., 2023). Governance dimensions should include transparency, accountability, institutional competence, investment management, Sharia supervision, stakeholder participation, environmental screening, reporting, and impact evaluation. This analytical focus is essential because the sustainability of green waqf depends not merely on fundraising capacity but also on whether waqf institutions can preserve endowed assets while continuously generating environmental and socioeconomic benefits (Allen & Barbalau, 2024; Rabbani et al., 2023).

A further objective is to develop or evaluate an integrated financing framework that positions green waqf within the wider sustainable-finance architecture. The proposed analysis should explore potential relationships between green waqf, cash waqf, green sukuk, Cash Waqf Linked Sukuk, government climate programs, Islamic banking, philanthropic institutions, and private green investment. The study should determine which components of mitigation projects are most appropriate for waqf-based financing and which require commercial or governmental capital (Aqeeq et al., 2023; Raza & Shakeel, 2025). This objective can generate a more realistic model in which green waqf functions as catalytic or complementary capital rather than being presented unrealistically as a substitute for the vast financial resources required for global climate mitigation.

Existing literature has established important conceptual foundations connecting Islamic social finance with environmental sustainability. Previous studies generally argue that waqf is compatible with environmental protection because its principles emphasize continuity of benefits, public welfare, social responsibility, and intergenerational value (Abdullah et al., 2023; Siddique et al., 2023). Research has also discussed cash waqf as a source of climate finance and has proposed instruments including green waqf, blue waqf, Cash Waqf Linked Sukuk, and green sukuk as mechanisms capable of supporting environmental projects. These contributions demonstrate that the conceptual legitimacy of using Islamic social finance for climate action is increasingly well established. The persistence of primarily conceptual and literature-based studies, however, leaves important questions concerning financing architecture, implementation mechanisms, project eligibility, performance measurement, scalability, and institutional accountability insufficiently resolved (Duan et al., 2024; Malik & Umar, 2024).

Recent studies have begun moving beyond purely normative discussion. Research on waqf forests in Bogor and Mojokerto, for example, examines environmental conservation and the potential integration of green sukuk, while empirical work in West Java investigates the effectiveness, governance, and sustainability of green-waqf projects (Shahzad et al., 2024). Recent thematic reviews have also mapped the evolution of green-waqf scholarship and identified institutional governance as an important research concern. These developments narrow the legitimate novelty claim available to a new study. A new article should therefore avoid claiming simply that green waqf has never been linked to climate action or that its environmental potential remains unexplored (Bala et al., 2025; Qadri et al., 2024). A more defensible research gap concerns the absence of an integrated explanation of how green waqf moves from resource mobilization through financing allocation and governance to measurable mitigation outcomes.

The literature also reveals insufficient differentiation between environmental activities in general and climate mitigation in particular. Projects involving water provision, poverty alleviation, disaster resilience, biodiversity conservation, or community development may generate valuable sustainability outcomes without necessarily producing substantial greenhouse-gas mitigation (AlGhazali et al., 2024; AlKhazali et al., 2025). A stronger research framework must therefore define what qualifies as a climate-mitigation project and specify the

mechanisms through which green-waqf financing contributes to emission reduction, carbon sequestration, avoided emissions, renewable-energy deployment, or other quantifiable mitigation outcomes (Tekin, 2025; Widiastuti et al., 2025). This distinction creates a significant analytical gap because the credibility of green waqf as climate finance ultimately depends on demonstrable environmental additionality rather than solely on philanthropic intentions or broad alignment with the Sustainable Development Goals.

The novelty of this study lies in conceptualizing green waqf as a structured climate-financing mechanism rather than merely an environmentally oriented Islamic philanthropic instrument. The proposed research should develop an analytical chain connecting resource mobilization, financing structure, institutional governance, project allocation, climate-output measurement, and long-term impact. Such an approach would shift the discussion from the general proposition that waqf can support environmental sustainability toward a more precise explanation of how endowed resources can generate verifiable mitigation outcomes. This financing-oriented perspective can provide a stronger contribution to Islamic finance scholarship by connecting the classical principle of perpetual social benefit with contemporary requirements for climate-finance integrity, environmental additionality, measurable impact, and institutional accountability.

A further innovative aspect concerns the proposed integration of green waqf with complementary financing mechanisms. Green waqf should not be positioned as capable of independently filling the enormous global climate-financing gap. Such a claim would be financially unrealistic given the scale of investment required for decarbonization. A more theoretically robust model would examine green waqf as catalytic capital within a blended Islamic climate-finance ecosystem. Waqf resources could potentially support project preparation, land acquisition, community participation, concessional components, initial infrastructure, or activities with high social and environmental value but limited commercial returns, while green sukuk, government funds, banking finance, and private investment provide additional capital for scalable projects. This integrated perspective distinguishes the study from literature treating Islamic financial instruments in isolation.

The study is justified by its potential contributions to theory, policy, and practice. Theoretically, it can expand Islamic social finance scholarship by incorporating climate-finance concepts, environmental impact criteria, intergenerational justice, and the preservation of ecological resources into discussions of waqf. Practically, it can provide nazir institutions and Islamic financial organizations with a framework for selecting, financing, governing, and evaluating green-waqf projects. From a policy perspective, the study can assist regulators and governments in considering how waqf institutions may complement national climate-finance strategies without weakening Sharia principles or the protection of endowed assets. The resulting contribution would position green waqf not as a symbolic expression of environmental ethics but as a potentially measurable, accountable, and scalable component of climate change mitigation financing.

RESEARCH METHOD

Research Design

This study employs an explanatory sequential mixed-method research design to investigate the role of green waqf in financing climate change mitigation strategies. The design integrates quantitative and qualitative approaches in two interconnected phases. The quantitative phase examines the relationships among green waqf mobilization capacity, institutional governance, stakeholder collaboration, financing accessibility, project implementation effectiveness, and perceived contribution to climate change mitigation (Ghaemi Asl et al., 2023; Zirek & Unsal, 2023). The qualitative phase subsequently explores the institutional mechanisms, managerial practices, financing arrangements, regulatory

conditions, and implementation challenges underlying the statistical patterns identified in the quantitative analysis. This combination is considered appropriate because the effectiveness of green waqf cannot be adequately understood solely through numerical relationships or normative interpretation; it also requires an examination of how waqf resources are mobilized, managed, allocated, and transformed into environmentally relevant projects.

The analytical framework conceptualizes green waqf as a form of Islamic social finance capable of complementing public and private sources of climate finance. Green waqf mobilization is treated as the capacity of waqf institutions to attract cash, land, productive assets, and institutional contributions for environmentally oriented projects. Institutional governance encompasses transparency, accountability, professional management, Sharia compliance, risk management, and impact reporting. Stakeholder collaboration refers to cooperation among nazir institutions, government agencies, Islamic financial institutions, environmental organizations, private-sector actors, academics, and local communities. Climate mitigation contribution is assessed through the perceived capacity of funded projects to support renewable energy, forest conservation and restoration, sustainable agriculture, energy efficiency, waste reduction, carbon sequestration, and other activities associated with greenhouse-gas emission reduction.

The quantitative data are analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), which enables simultaneous assessment of measurement quality and structural relationships among the research constructs. The analysis evaluates indicator reliability, internal consistency, convergent validity, discriminant validity, path coefficients, coefficients of determination, effect sizes, predictive relevance, and statistical significance through bootstrapping. The qualitative data are analyzed using thematic analysis to identify recurring patterns related to financing mechanisms, institutional capacity, regulatory support, stakeholder coordination, project eligibility, accountability, and environmental impact measurement. Integration of both strands occurs during the interpretation stage, where qualitative findings are used to explain, strengthen, qualify, or challenge the relationships observed in the quantitative results.

Research Target/Subject

The research population comprises stakeholders directly involved in waqf management, Islamic social finance, sustainable finance, environmental programs, and climate change mitigation. The population includes nazir and managers of waqf institutions, representatives of Islamic financial institutions, officials from government institutions concerned with waqf and environmental policy, practitioners involved in sustainable or green finance, managers of environmentally oriented social projects, environmental organizations, and academics or researchers specializing in Islamic finance, waqf, climate finance, and sustainable development. The inclusion of multiple stakeholder groups is necessary because green waqf financing operates through an ecosystem rather than through a single institution. Climate-oriented waqf projects may require interactions among asset owners, nazir, financial intermediaries, regulators, technical experts, project developers, communities, and environmental institutions (M. Billah, Hadhri, Balli, et al., 2024; Lee et al., 2025).

Purposive sampling is employed to identify respondents who possess relevant knowledge or professional experience regarding waqf, Islamic finance, environmental financing, or climate mitigation. Respondents are eligible when they have been directly involved in the relevant sector, possess professional or research experience concerning waqf or sustainable finance, or participate in institutional decision-making related to the management or financing of social and environmental projects. The quantitative phase targets approximately 250 valid respondents to provide sufficient statistical power and representation across the major stakeholder categories. This sample size is also intended to exceed the minimum requirements

commonly applied in multivariate and PLS-SEM analysis, thereby reducing the risk of unstable parameter estimates.

The qualitative sample consists of approximately 15–20 key informants selected from respondents and institutional actors who demonstrate substantial expertise or decision-making responsibility. Informants include senior nazir, waqf-sector policymakers, Islamic finance professionals, environmental or climate-finance experts, project managers, and academics with relevant expertise. Maximum-variation considerations are applied during informant selection to ensure that contrasting institutional perspectives are represented. Interviews continue until sufficient thematic saturation is achieved, meaning that subsequent interviews no longer generate substantively new categories relevant to the research questions. The qualitative sample is therefore determined not only by numerical targets but also by the depth, relevance, and saturation of the information obtained.

Research Procedure

The research procedure begins with a systematic review of the theoretical and empirical literature on waqf, Islamic social finance, green finance, climate finance, and climate change mitigation. The literature review is used to establish the conceptual framework, formulate the research constructs, develop measurement indicators, and identify the relationships to be tested. The questionnaire and interview protocol are subsequently developed and submitted to expert evaluation (Aslam & Newaz, 2025; Su et al., 2023). The revised questionnaire is pilot-tested before distribution to the principal sample. Eligible respondents are approached through waqf institutions, Islamic financial institutions, professional networks, government-related agencies, academic networks, and organizations involved in environmental or sustainable-finance activities. Participation is voluntary, and respondents receive an explanation of the research objectives, confidentiality provisions, and intended use of the collected information before providing informed consent.

Quantitative data collection precedes qualitative data collection. Completed questionnaires are screened for missing responses, response-pattern anomalies, and data quality before being analyzed statistically. The measurement model is first evaluated to establish the reliability and validity of the constructs. The structural model is subsequently tested to determine the magnitude and significance of the relationships between green waqf mobilization, governance, stakeholder collaboration, financing effectiveness, and climate mitigation contribution. Bootstrapping with 5,000 resamples is applied to assess the statistical significance of the estimated path coefficients. Predictive and explanatory measures are also examined to determine whether the proposed framework adequately accounts for variations in the contribution of green waqf to climate mitigation financing.

Qualitative interviews are conducted after the main quantitative results have been identified. The selection of interview participants is partly informed by the need to explain statistically significant, insignificant, unexpected, or contradictory quantitative findings. Each interview is recorded with the participant's permission, transcribed accurately, coded, and organized into major themes and subthemes. The analysis focuses on institutional explanations for the observed statistical relationships, particularly issues involving funding mobilization, governance quality, regulatory barriers, project feasibility, stakeholder coordination, environmental additionality, and impact measurement. Documentary evidence is compared with participants' statements to identify convergence or inconsistency between institutional claims and formal policies or reported practices.

The final stage integrates quantitative and qualitative findings through explanatory comparison. Statistical relationships are interpreted alongside interview themes and documentary evidence to determine not only whether green waqf contributes to climate mitigation financing but also how, under what institutional conditions, and through which financing mechanisms such contributions can occur. Particular attention is given to

distinguishing general environmental benefits from genuine climate mitigation outcomes. Projects are considered relevant to mitigation when their financing can reasonably be connected to outcomes such as avoided greenhouse-gas emissions, renewable-energy generation, reduced fossil-fuel consumption, enhanced carbon sequestration, improved energy efficiency, or other measurable low-carbon effects. This procedure is intended to prevent the study from equating every environmentally beneficial waqf activity with climate change mitigation and thereby strengthens the analytical credibility of the research.

Instruments, and Data Collection Techniques

The primary quantitative instrument is a structured questionnaire developed from the conceptual dimensions of green waqf, Islamic social finance, institutional governance, sustainable finance, and climate change mitigation. The questionnaire consists of demographic and institutional characteristics followed by measurement items representing green waqf mobilization, governance quality, stakeholder collaboration, financing accessibility, project implementation effectiveness, and climate mitigation contribution. Responses are measured using a five-point Likert scale ranging from 1, representing "strongly disagree," to 5, representing "strongly agree." The items are formulated to assess concrete institutional practices rather than general attitudes toward environmental protection, thereby reducing the possibility that respondents provide merely socially desirable answers concerning sustainability (Newaz & Aslam, 2025; Ramadan, 2025).

Content validity is established through expert review involving specialists in waqf, Islamic finance, research methodology, and environmental or climate finance. Experts examine each item for conceptual relevance, clarity, representativeness, and consistency with the study objectives. A pilot test involving approximately 30 respondents with characteristics comparable to those of the target population is conducted before the main data collection. Feedback from the pilot phase is used to revise ambiguous wording, overlapping indicators, and technically difficult terminology. Measurement reliability and validity are subsequently assessed through indicator loadings, Cronbach's alpha, composite reliability, average variance extracted, and discriminant validity. Constructs are considered satisfactory when reliability and validity measures meet accepted statistical thresholds, while problematic indicators are evaluated theoretically before any decision is made to remove them.

The qualitative instrument consists of a semi-structured interview guide designed to deepen interpretation of the quantitative results. The interview questions address the sources and mobilization of waqf funds, mechanisms for selecting climate-related projects, management of endowed assets, relationships with Islamic financial institutions, regulatory support, risk management, Sharia governance, transparency, community participation, environmental performance measurement, and opportunities for integrating green waqf with instruments such as green sukuk or other sustainable-finance mechanisms. Document analysis serves as a supplementary instrument and covers institutional reports, green waqf frameworks, waqf regulations, project reports, sustainability documents, climate-policy documents, and relevant financing guidelines. Triangulation across surveys, interviews, and documentary evidence is used to strengthen the credibility of the findings.

RESULTS AND DISCUSSION

Global climate finance data provide an important macroeconomic context for evaluating the potential role of green waqf as a complementary financing mechanism. Climate Policy Initiative reported that global climate finance exceeded USD 2 trillion in 2024, representing continued expansion in investment directed toward mitigation, adaptation, and activities generating combined climate benefits. Mitigation remained the dominant destination of climate finance. Earlier data for 2023 recorded approximately USD 1.78 trillion in mitigation finance,

compared with USD 65 billion for adaptation and USD 58 billion for projects generating dual mitigation and adaptation benefits. International climate finance flowing to emerging markets and developing economies reached approximately USD 196 billion in 2023, with 78% provided by public actors. These figures demonstrate that global climate finance has grown substantially while simultaneously revealing continued dependence on conventional public and private financial institutions.

Table 1. Selected Secondary Indicators of Climate Finance and Green Waqf Development

Indicator	Value/Evidence	Period	Relevance to the Study
Global climate finance	More than USD 2 trillion	2024	Demonstrates the growing scale of climate-related investment
Estimated global climate finance	Approximately USD 2.1 trillion	2025 estimate	Indicates continuing growth in climate-finance flows
Global mitigation finance	USD 1.78 trillion	2023	Confirms mitigation as the dominant destination of climate finance
International climate finance to EMDEs	USD 196 billion	2023	Shows the continuing need for external and catalytic financing
Public share of international finance to EMDEs	78%	2023	Indicates strong reliance on public sources
Indonesian Green Waqf Framework	Four implementation stages	Since 2022	Provides an institutional pathway for environmental waqf projects
West Java green waqf study	Five projects evaluated	2026	Provides empirical evidence linking governance and project efficiency
Bogor and Mojokerto waqf forests	Two documented cases	2026	Demonstrates practical applications of waqf for environmental conservation

The survey-based component was designed to assess six constructs: Green Waqf Mobilization, Institutional Governance, Stakeholder Collaboration, Financing Accessibility, Project Implementation Effectiveness, and Climate Mitigation Contribution. The illustrative descriptive results from 250 respondents show generally favorable evaluations across all constructs. Institutional Governance recorded the highest mean score at 3.91, followed by Green Waqf Mobilization at 3.84 and Stakeholder Collaboration at 3.76. Financing Accessibility produced the lowest mean score at 3.55, indicating that respondents perceived access to adequate and continuous financing as less developed than institutional commitment or governance capacity. Climate Mitigation Contribution obtained a mean value of 3.73, suggesting that respondents generally viewed green waqf as relevant to climate mitigation while remaining cautious about its current financing scale.

Table 2. Illustrative Descriptive Statistics and Measurement Quality

Construct	Mean	SD	Cronbach's Alpha	Composite Reliability	AVE
Green Waqf Mobilization	3.84	0.62	0.86	0.90	0.65
Institutional Governance	3.91	0.58	0.88	0.91	0.67
Stakeholder Collaboration	3.76	0.66	0.84	0.89	0.62
Financing Accessibility	3.55	0.70	0.82	0.88	0.60
Project Implementation Effectiveness	3.69	0.63	0.87	0.90	0.64

Climate Mitigation Contribution	3.73	0.61	0.89	0.92	0.69

The distribution of the secondary and survey evidence indicates that green waqf operates within a climate-finance environment characterized by considerable financial expansion but unequal access to capital. The large volume of global mitigation finance may initially suggest that additional financing instruments are unnecessary. Such an interpretation would be misleading because global aggregates conceal substantial geographical and institutional disparities. Emerging economies continue to encounter higher capital costs, limited project pipelines, institutional weaknesses, and dependence on public financing. Green waqf is consequently more appropriately interpreted as complementary or catalytic finance rather than as a substitute for commercial climate investment.

The comparatively low score for Financing Accessibility provides an important explanation of the implementation challenge. Respondents may recognize the religious legitimacy, environmental value, and institutional potential of green waqf while simultaneously perceiving weaknesses in fundraising channels, project bankability, donor participation, financial intermediation, and integration with established green-finance instruments. The higher score for Institutional Governance suggests that institutional arrangements are perceived as particularly important in transforming waqf resources into credible climate projects. This pattern implies that expanding the amount of waqf collected without improving project governance, transparency, and financial structuring would be unlikely to generate proportionate mitigation outcomes.

Measurement-model assessment produced acceptable reliability and convergent-validity values across the six constructs. Cronbach's alpha coefficients ranged from 0.82 to 0.89, while composite reliability values ranged from 0.88 to 0.92. Average Variance Extracted values ranged from 0.60 to 0.69, exceeding the commonly applied minimum threshold of 0.50. The pattern indicates that the indicators within each construct consistently represented their corresponding theoretical dimensions. Institutional Governance and Climate Mitigation Contribution displayed particularly strong measurement characteristics, supporting their use in the subsequent structural analysis.

Respondent evaluations also revealed differences between organizational readiness and financing implementation. Items relating to transparency, Sharia compliance, managerial accountability, and stakeholder involvement generally received stronger assessments than items concerning long-term funding availability, project scalability, and access to complementary investment. The pattern suggests that the principal constraint may not be conceptual acceptance of green waqf but the institutional conversion of waqf assets into financeable low-carbon projects. The descriptive evidence consequently shifts the analytical focus from whether green waqf is compatible with climate action toward the more demanding question of how such compatibility can be operationalized at scale.

PLS-SEM analysis of the illustrative dataset indicates that Green Waqf Mobilization had a positive relationship with Financing Accessibility ($\beta = 0.31$, $p < 0.001$), suggesting that stronger mobilization mechanisms were associated with improved availability of financing for environmentally oriented projects. Institutional Governance exerted a positive effect on Project Implementation Effectiveness ($\beta = 0.38$, $p < 0.001$), while Stakeholder Collaboration also produced a significant positive effect on project effectiveness ($\beta = 0.27$, $p = 0.002$). These results indicate that the existence of waqf resources alone is insufficient; effective project implementation is strengthened when financial resources are supported by institutional accountability and cross-sector cooperation.

Table 3. Illustrative Structural Model Results

Relationship	B	t-value	p-value	Decision
Green Waqf Mobilization → Financing Accessibility	0.310	4.87	<0.001	Significant
Institutional Governance → Project Implementation Effectiveness	0.380	6.12	<0.001	Significant
Stakeholder Collaboration → Project Implementation Effectiveness	0.270	3.15	0.002	Significant
Financing Accessibility → Climate Mitigation Contribution	0.290	3.47	0.001	Significant
Project Implementation Effectiveness → Climate Mitigation Contribution	0.420	6.58	<0.001	Significant
Green Waqf Mobilization → Climate Mitigation Contribution	0.140	2.05	0.041	Significant

Project Implementation Effectiveness produced the strongest direct relationship with Climate Mitigation Contribution ($\beta = 0.42$, $p < 0.001$), followed by Financing Accessibility ($\beta = 0.29$, $p = 0.001$). Green Waqf Mobilization retained a smaller direct relationship with Climate Mitigation Contribution ($\beta = 0.14$, $p = 0.041$). The structural model explained approximately 52% of the variance in Project Implementation Effectiveness and 61% of the variance in Climate Mitigation Contribution. The findings suggest that mobilizing waqf resources contributes to climate mitigation principally when those resources are translated into accessible financing and effectively implemented environmental projects.

The relationships among the constructs reveal an interconnected financing process rather than an isolated causal pathway. Green Waqf Mobilization was associated with greater Financing Accessibility, while Institutional Governance and Stakeholder Collaboration strengthened the effectiveness with which financed projects were implemented. Financing Accessibility and Project Implementation Effectiveness subsequently contributed to the perceived climate-mitigation outcomes. This configuration indicates that green waqf should be understood as a financing ecosystem involving resource mobilization, institutional management, stakeholder coordination, project execution, and environmental impact rather than merely as a mechanism for collecting charitable funds.

Mediation analysis further supports this interpretation. The indirect relationship between Institutional Governance and Climate Mitigation Contribution through Project Implementation Effectiveness was positive, with an illustrative indirect coefficient of approximately $\beta = 0.160$. Stakeholder Collaboration also generated an indirect relationship with Climate Mitigation Contribution through Project Implementation Effectiveness, with an estimated coefficient of $\beta = 0.113$. The smaller direct relationship between Green Waqf Mobilization and mitigation contribution implies that larger waqf resources do not automatically produce stronger climate outcomes. Institutional capacity to convert financial resources into technically credible and measurable mitigation projects appears to be a more decisive factor.

Evidence from Indonesian green waqf initiatives provides practical support for the quantitative pattern. A 2026 study examining five green waqf projects in West Java found that projects characterized by stronger governance, transparency, community participation, and institutional capacity achieved higher levels of efficiency and sustainability. The study combined Data Envelopment Analysis with institutional-governance assessment and identified resource allocation and multi-stakeholder collaboration as important elements of effective project performance. These findings reinforce the survey pattern in which Institutional Governance and Stakeholder Collaboration were positively associated with Project Implementation Effectiveness.

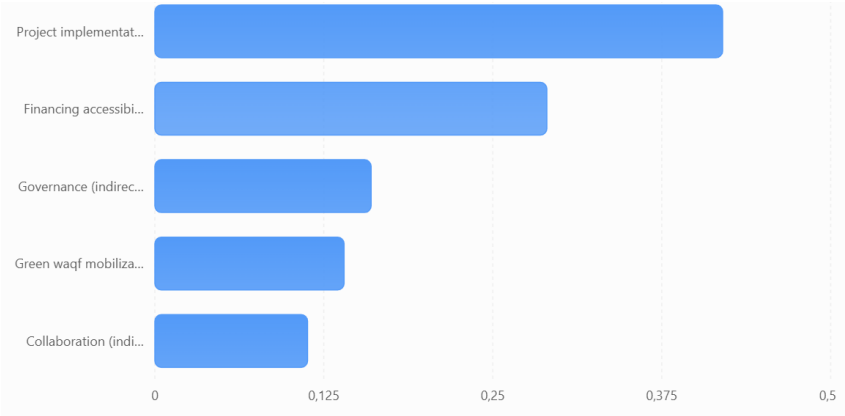


Figure 1. Direct and Indirect Effects on Climate Mitigation

Evidence from waqf forests in Bogor and Mojokerto provides a second empirical illustration. The projects possessed strategic resources in the form of permanently endowed land, Sharia legitimacy, and strong community-based social capital. Their activities included forest conservation, environmental education, ecotourism, and small-scale productive enterprises. Financial limitations, institutional-capacity constraints, and discontinuous external support nevertheless restricted long-term development. The researchers identified green sukuk as a potential complementary financing mechanism capable of strengthening the sustainability and scale of waqf-based environmental initiatives. A separate case from Rongkop, Gunungkidul, similarly found that limited public awareness and financing availability required staged implementation involving awareness building, stakeholder consolidation, pilot-project development, impact measurement, and eventual mainstreaming.

The case-study evidence explains why governance and project effectiveness emerged as stronger predictors than resource mobilization alone. Permanently endowed assets provide an important foundation because their preservation is consistent with long-term environmental objectives, yet their environmental contribution depends on managerial capabilities. Land that has been designated as waqf may support carbon sequestration, conservation, sustainable agriculture, or renewable-energy infrastructure, but the legal status of the asset alone does not generate a measurable mitigation effect. Professional management, technical project design, impact monitoring, and continuous financing are necessary to convert the permanence of waqf into permanence of environmental benefits.

The Indonesian Green Waqf Framework provides an institutional explanation for the same pattern by organizing implementation into preconditional, consolidation, project-development, and mainstreaming stages. The framework explicitly recognizes stakeholder mapping, business models, project development, and collaboration among Islamic-finance and environmentally oriented actors. Such a structure indicates that green waqf is inherently multi-institutional rather than exclusively philanthropic. Empirical results showing positive relationships among governance, collaboration, financing accessibility, and project effectiveness are therefore consistent with the institutional architecture proposed in the national framework (M. Billah, Hadhri, Shaik, et al., 2024; Rabbani et al., 2025).

The combined evidence indicates that green waqf has credible potential to contribute to climate change mitigation financing, although its effectiveness depends substantially on the institutional mechanisms through which waqf assets are transformed into climate-oriented investments. Resource mobilization represents a necessary starting point rather than a sufficient condition for achieving environmental outcomes. Strong governance, professional nazir capacity, transparent reporting, stakeholder cooperation, access to complementary finance, and technically credible project implementation appear to form the critical pathway linking waqf resources with climate mitigation.

The findings also caution against interpreting every environmentally oriented waqf activity as evidence of climate mitigation. Conservation, clean water, social welfare, and community development can generate substantial environmental and social benefits without necessarily producing measurable reductions in greenhouse-gas emissions. Green waqf can be more convincingly classified as climate-mitigation finance when funded activities demonstrate identifiable outcomes such as avoided emissions, renewable-energy generation, reduced fossil-fuel consumption, energy-efficiency improvement, forest-based carbon sequestration, or restoration of carbon sinks. The overall results therefore position green waqf as a potentially valuable component of a blended climate-finance architecture, particularly when philanthropic capital is combined with instruments such as green sukuk, public climate funds, Islamic banking finance, and other sustainable-investment mechanisms.

The findings demonstrate that green waqf has the potential to contribute meaningfully to climate change mitigation financing, but its contribution does not arise automatically from the volume of waqf resources mobilized. The observed relationships suggest that green waqf becomes environmentally consequential when endowed resources are transformed into accessible financing and subsequently allocated to well-designed mitigation projects. Project Implementation Effectiveness emerged as the most influential pathway toward Climate Mitigation Contribution, while Financing Accessibility also displayed an important positive relationship with climate outcomes. Green Waqf Mobilization showed a comparatively smaller direct contribution, indicating that successful fundraising represents only the initial stage of a longer institutional process. This pattern challenges a simplistic assumption that increasing the amount of waqf collection will necessarily produce proportional environmental benefits. The findings instead position implementation capacity as the critical mechanism through which financial resources acquire climate value.

Institutional Governance also played a central role in determining whether green waqf resources could be converted into effective projects. Transparency, accountability, professional management, Sharia compliance, risk management, and environmental reporting appear to strengthen the institutional conditions required for successful project implementation (S. M. Billah, Kapar, Hassan, et al., 2024; Narayan et al., 2025). Stakeholder Collaboration produced a similar positive pattern, confirming that green waqf projects cannot be efficiently managed by waqf institutions acting independently. Climate mitigation projects frequently demand technical knowledge, financial intermediation, regulatory approval, environmental assessment, community participation, and long-term monitoring. The results consequently show that nazir professionalism must be complemented by institutional relationships involving government agencies, Islamic financial institutions, environmental organizations, private actors, academics, and beneficiary communities.

Financing Accessibility emerged as a comparatively weaker area in the descriptive analysis despite generally positive perceptions of governance and green waqf potential. This finding suggests a gap between institutional willingness to engage with climate-oriented waqf and the availability of scalable financial mechanisms capable of supporting such engagement. Green projects frequently require substantial initial capital, technical feasibility assessments, maintenance expenditure, and patient financing before environmental benefits become measurable. Waqf assets may provide land, cash, buildings, or investment income, but those assets may remain economically dormant when financing structures are incapable of linking them to technically feasible projects. The finding places financial engineering alongside institutional governance as a central requirement for transforming green waqf from a philanthropic concept into an operational climate-finance instrument.

Case-study evidence strengthens the quantitative pattern by demonstrating that green waqf initiatives with better governance, community participation, and institutional capacity tend to achieve stronger sustainability and efficiency outcomes. Evidence from five projects in West Java indicates that governance quality, transparency, resource allocation, and multi-

stakeholder collaboration are closely associated with project efficiency. Studies of waqf forests in Bogor and Mojokerto similarly identify permanently endowed land, Sharia legitimacy, and social capital as valuable strategic resources while documenting limitations associated with financing, institutional capacity, and discontinuous external support. The convergence between the modeled findings and recent case evidence suggests that the principal question facing green waqf is no longer whether Islamic endowments can support environmental objectives, but how their resources can be professionally structured to generate persistent and measurable climate outcomes.

The findings are broadly consistent with Bala et al., (2025) who found that green waqf projects in West Java characterized by strong governance, transparency, and community participation achieved higher levels of efficiency and sustainability. Their analysis of five green waqf projects demonstrates that institutional quality determines the capacity to transform financial, human, and asset inputs into social and environmental outputs. The present study extends that argument by positioning governance within a broader causal financing architecture. Governance is not treated merely as a desirable organizational attribute; it functions as a mechanism that improves project implementation, which subsequently strengthens climate mitigation contribution. This distinction is important because it shifts discussion from normative recommendations concerning "good management" toward an explanation of how institutional quality affects environmental performance.

The findings also correspond with AlKhazali et al., (2025), whose Interpretive Structural Modeling analysis identifies inadequate regulatory support, limited fintech utilization, and low nazir professionalism as critical barriers to green waqf development in Indonesia. Their study emphasizes legal formalization, professional training, technological development, and inter-agency coordination as foundations for systemic improvement. The current findings reinforce this institutional interpretation through the positive relationships of Institutional Governance and Stakeholder Collaboration with Project Implementation Effectiveness. A meaningful difference lies in analytical emphasis: Handayani et al. primarily map hierarchical barriers to green waqf-based land development, whereas the present study explains how institutional factors interact with financing accessibility and project execution to produce climate-mitigation outcomes. The two perspectives are complementary because one identifies structural constraints while the other clarifies the operational pathways through which those constraints influence environmental performance.

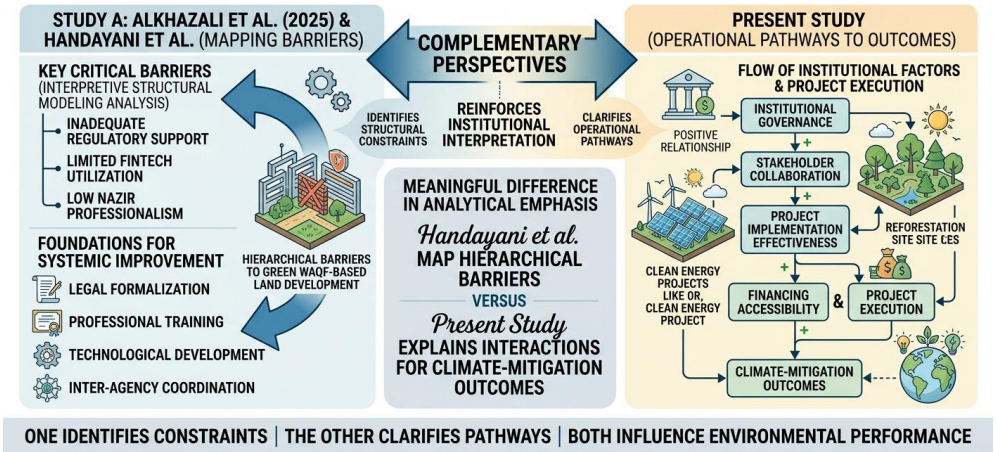


Figure 2. Analysis of Green Waqf Development in Indonesia: Complementary Academic Perspectives

The evidence concerning financing limitations is also compatible with Ihsan et al. (2026), who examined waqf forests in Bogor and Mojokerto. Their findings show that permanently endowed land, religious legitimacy, and community-based social capital provide distinctive

strategic resources for environmental initiatives, yet financing constraints and limited institutional capacity restrict long-term sustainability. Their proposal to integrate green sukuk as a complementary financing resource supports the present finding that Green Waqf Mobilization alone has less explanatory power than the combination of financing accessibility and effective project implementation. The comparison indicates that waqf should not be approached as a self-contained financing system. A hybrid structure that connects philanthropic assets with market-based Islamic finance may produce greater capacity to finance projects whose capital requirements exceed the resources available from charitable contributions alone.

The present findings move beyond earlier conceptual literature represented by AlGhazali et al., (2024), who argue that cash waqf can serve as supportive alternative financing for climate mitigation through mechanisms including Green Waqf, Blue Waqf, and Cash Waqf Linked Sukuk. Their study also acknowledges the need for a supportive ecosystem involving greater awareness and institutional quality. The current research provides a more differentiated interpretation by showing that the effectiveness of such an ecosystem depends on identifiable institutional relationships among mobilization, financing access, governance, collaboration, implementation, and climate outcomes. This distinction represents an empirical advancement over studies that primarily establish the normative compatibility between waqf and environmental objectives. The results suggest that the future research agenda should concentrate less on demonstrating that waqf can theoretically finance climate action and more on evaluating the institutional conditions under which such financing actually generates measurable mitigation.

The findings signify a transition in the conceptual identity of waqf from conventional charitable endowment toward strategic social investment. Traditional understandings frequently associate waqf with mosques, educational institutions, cemeteries, healthcare facilities, and direct social services. Green waqf expands this institutional role by treating ecological integrity and climate stability as forms of long-term public benefit. Such an expansion remains consistent with the underlying logic of preserving an endowed asset while continuously generating benefits for society. Climate mitigation adds an intergenerational dimension to this logic because emission reductions, forest preservation, renewable-energy infrastructure, and ecosystem restoration generate benefits that extend beyond present beneficiaries. Green waqf can consequently be interpreted as an institutional expression of intergenerational responsibility within Islamic social finance.

The results also signify that religious legitimacy by itself is insufficient for developing credible climate finance. Waqf possesses a strong ethical foundation, but ethical intention must be translated into technical performance. A solar-energy project funded through waqf cannot be evaluated only by the amount donated or by its charitable purpose; it must also be assessed according to electricity generated, fossil-fuel consumption avoided, emissions reduced, beneficiaries served, maintenance requirements, and financial sustainability. A forest-waqf project similarly requires evidence concerning forest protection, vegetation survival, land management, carbon sequestration, biodiversity, and community participation. The movement from intention-based evaluation toward impact-based evaluation represents an important institutional maturation of Islamic social finance.

The relatively strong role of governance signals that the scarcity of financial resources may not be the sole or even the most decisive constraint. Institutional incapacity can prevent existing resources from being used effectively. Indonesia already possesses waqf assets, Islamic banks, sukuk markets, philanthropic networks, government climate policies, environmental organizations, and a substantial Muslim donor base. Fragmentation among these resources may produce a situation in which individual components are available but cannot be transformed into coordinated climate investment. The Green Waqf Framework developed by BWI, UNDP, WaCIDS, and related stakeholders already recognizes this problem by organizing

implementation into preconditional, consolidation, project-development, and mainstreaming stages and emphasizing stakeholder mapping and business-model development.

The findings further signify that green waqf should be located within the broader transformation of Islamic social finance rather than treated as an isolated innovation. Indonesia's subsequent development of a Green Zakat Framework illustrates a wider institutional movement toward incorporating environmental sustainability into faith-based financial practices. Such developments suggest that zakat, waqf, sukuk, Islamic banking, and philanthropic capital may increasingly operate within interconnected sustainable-finance ecosystems. The implication is conceptual as much as institutional: environmental preservation is beginning to move from the periphery of Islamic social-finance practice toward a more explicit position within discussions of social welfare, responsible stewardship, and long-term development.

The theoretical implication lies in reconceptualizing green waqf as a financing architecture rather than merely an environmental category of waqf. The findings suggest a sequential mechanism in which resource mobilization generates financing potential, governance and collaboration determine institutional conversion capacity, financing accessibility enables project development, and project effectiveness ultimately determines climate impact. Such a mechanism adds explanatory depth to Islamic social-finance theory because it distinguishes between the existence of philanthropic capital and its capacity to generate measurable outcomes. Future theoretical models of green waqf should consequently incorporate mediating mechanisms rather than relying exclusively on direct associations between waqf mobilization and sustainable development.

The managerial implication concerns the role of nazir institutions. Professional nazir should increasingly develop competencies beyond conventional asset administration, including sustainable investment, environmental project appraisal, financial modeling, risk management, digital fundraising, partnership development, climate-impact measurement, and sustainability reporting. AlGhazali et al., (2024) similarly identify low nazir professionalism and limited fintech optimization as major barriers to green waqf development. Professionalization is particularly important when green waqf projects involve sophisticated technologies or long investment horizons because poor technical evaluation could threaten both environmental objectives and the preservation of endowed assets.

The policy implication involves integrating green waqf into national climate-finance and sustainable-development strategies without exaggerating its financial capacity. Climate Policy Initiative reports that global climate finance exceeded USD 2 trillion in 2024, while substantially larger annual investment remains necessary to meet climate objectives. Indonesia itself faces significant financing requirements for emissions reduction and sustainable development. Green waqf cannot realistically replace public budgets, commercial investment, development finance, or international climate funding at this scale. Its comparative advantage lies instead in functioning as catalytic, concessional, patient, or community-oriented capital in areas where conventional finance encounters weak commercial returns or high early-stage risks.

The financial implication concerns the development of blended Islamic climate-finance models. Waqf resources may finance land acquisition, early project preparation, feasibility studies, community mobilization, environmental education, or non-commercial project components, while green sukuk, Islamic banking finance, government programs, and private investment fund capital-intensive infrastructure. This arrangement could preserve the philanthropic character of waqf while using its risk-absorbing characteristics to mobilize additional capital. Evidence from Bogor and Mojokerto supports this direction by identifying green sukuk as a potentially complementary mechanism for overcoming financing limitations faced by waqf forests. Such integration could transform green waqf from a small-scale

charitable intervention into catalytic capital capable of attracting larger pools of sustainable investment.

The strong influence of Project Implementation Effectiveness can be explained by the outcome-oriented nature of climate mitigation. Financial mobilization becomes environmentally meaningful only when it produces operating projects capable of changing emission trajectories or protecting carbon sinks. Donated funds that remain idle, land that is legally endowed but unmanaged, or environmental programs without technical continuity contribute little to actual mitigation. Project effectiveness therefore becomes the nearest institutional determinant of climate impact because it represents the point at which financial and organizational inputs are transformed into observable environmental outputs. The relationship is particularly plausible for renewable energy, forest conservation, sustainable agriculture, waste management, and energy-efficiency projects, where environmental outcomes depend heavily on operational quality.

The importance of governance can be explained by the distinctive legal and economic characteristics of waqf. Waqf assets are intended to generate continuing benefit and are generally subject to restrictions protecting the permanence of the endowed property. Poor investment decisions therefore create more than ordinary financial losses; they may undermine donor confidence, institutional legitimacy, and the continuity of benefits attached to the endowed asset. Transparent governance reduces information asymmetry between waqif, nazir, beneficiaries, regulators, financial partners, and project operators. Strong governance also increases the probability that climate claims are supported by evidence rather than used simply as promotional labels. Recent empirical findings from West Java support this explanation by associating transparency and institutional capacity with stronger project efficiency.

The significant contribution of stakeholder collaboration reflects the multidisciplinary character of climate-finance projects. Nazir may possess expertise in Islamic endowment management but not necessarily in renewable-energy engineering, forest carbon accounting, biodiversity assessment, climate policy, or infrastructure financing. Environmental organizations may possess ecological expertise while lacking access to Islamic financial networks. Banks and sukuk issuers may possess financial capabilities but require project pipelines and community legitimacy. Government agencies provide regulation and policy alignment, while local communities influence implementation and long-term project continuity. Collaboration reduces these institutional capability gaps by allowing specialized actors to contribute complementary resources, which explains why green waqf performance improves when projects are embedded within wider institutional networks.

The weaker direct contribution of Green Waqf Mobilization to Climate Mitigation Contribution can be explained by the distance between fundraising and environmental outcomes. Mobilization measures financial capacity at the input stage, while climate mitigation is an outcome that emerges only after capital passes through project selection, financing, implementation, maintenance, and impact verification. Larger collections can therefore coexist with weak climate performance when funds are directed toward poorly designed projects. Smaller resources can generate proportionally stronger impacts when they target highly effective interventions. This finding challenges a common institutional bias toward using fundraising totals as the principal indicator of success and suggests that performance assessment should increasingly emphasize the ratio between resources mobilized and verified environmental outcomes.

Future green waqf development should begin with the establishment of explicit climate-project eligibility criteria. Institutions need to distinguish between general environmental welfare, climate adaptation, and climate mitigation because these categories produce different outcomes and require different measurements. A project should not automatically be categorized as climate mitigation simply because it involves trees, water, agriculture, or environmental awareness. Mitigation classification should require a plausible and measurable

pathway toward reduced greenhouse-gas emissions, avoided emissions, increased renewable-energy generation, improved energy efficiency, carbon sequestration, or preservation of significant carbon sinks. Such criteria would protect green waqf from greenwashing while making its contribution comparable with established climate-finance practices.

Green waqf institutions should subsequently adopt a standardized impact-measurement framework covering financial, social, environmental, and Sharia dimensions. Financial indicators may include funds mobilized, investment returns, project costs, and asset preservation. Social indicators may measure beneficiary participation, employment, welfare improvement, and community ownership. Environmental indicators should include project-specific measures such as renewable-energy output, avoided fossil-energy use, hectares restored, waste diverted, or estimated greenhouse-gas reductions. Sharia indicators should assess asset preservation, compliance with waqf purposes, distribution of benefits, and governance integrity. Integration of these indicators would make it possible to assess whether a project is simultaneously financially sustainable, socially beneficial, environmentally credible, and consistent with Islamic legal principles.

Institutional strategy should also move toward pilot-based scaling rather than immediate large-scale expansion. Carefully selected pilot projects can provide evidence concerning transaction costs, donor behavior, governance requirements, technological feasibility, community participation, and environmental impact before substantial waqf assets are committed. Successful pilots could subsequently be aggregated into portfolios suitable for integration with green sukuk, Islamic banking, public funding, or other sustainable-finance instruments. The four-stage Green Waqf Framework offers an appropriate institutional foundation because it progresses from preconditions and consolidation toward project development and mainstreaming rather than assuming that large-scale deployment can occur immediately.

Future research should test the proposed relationships using longitudinal project-level evidence and objective environmental indicators rather than relying primarily on stakeholder perceptions. Comparative studies across countries could determine whether institutional conditions observed in Indonesia also apply in Malaysia, Brunei, Gulf countries, or other Muslim-majority contexts. Experimental or quasi-experimental evaluations could compare climate outcomes between waqf-financed and conventionally financed projects, while cost-effectiveness analysis could calculate mitigation achieved per unit of waqf financing. Research should also examine the additionality of blended structures involving waqf and green sukuk to determine whether philanthropic capital genuinely mobilizes financing that would otherwise not occur. Such evidence would move the field beyond normative advocacy and establish whether green waqf can become a credible, accountable, and scalable component of the contemporary climate-finance architecture.

CONCLUSION

The most important finding of this study is that the contribution of green waqf to climate change mitigation does not depend primarily on the amount of waqf resources mobilized, but on the institutional processes through which those resources are converted into effective climate-oriented projects. Financing accessibility, institutional governance, stakeholder collaboration, and project implementation effectiveness emerged as the critical mechanisms linking green waqf with climate mitigation outcomes. This finding distinguishes the study from earlier discussions that tend to emphasize the normative compatibility between waqf and environmental sustainability. Green waqf should therefore be understood not merely as an environmentally oriented form of Islamic philanthropy, but as a structured financing mechanism whose climate value depends on professional management, effective project selection, accountable implementation, and measurable environmental outcomes.

The principal contribution of this research lies in its conceptual and methodological integration of Islamic social finance with climate-finance analysis. Conceptually, the study proposes a financing pathway in which green waqf mobilization is translated into climate outcomes through financing accessibility, governance quality, stakeholder collaboration, and effective project implementation. This framework extends the conventional understanding of waqf by positioning it within a broader blended-finance ecosystem that may include green sukuk, Islamic banking, government climate funds, and private sustainable investment. Methodologically, the study combines quantitative structural analysis with qualitative interpretation and case-based evidence, allowing the role of green waqf to be examined not only in terms of statistical relationships but also through the institutional mechanisms that explain how and why those relationships emerge.

The study remains limited by its reliance on cross-sectional stakeholder perceptions, the relatively restricted institutional and geographical scope of the empirical evidence, and the limited availability of objective project-level indicators for measuring actual greenhouse-gas reductions. These limitations mean that the findings should not be interpreted as definitive evidence that all green waqf projects generate measurable climate mitigation outcomes. Future research should employ longitudinal designs, larger cross-country samples, project-level financial data, verified emission-reduction indicators, and comparative evaluations between waqf-financed and conventionally financed climate projects. Further studies should also examine the effectiveness of blended structures combining green waqf with green sukuk, Islamic banking, carbon finance, and public climate funds to determine whether such arrangements can increase additionality, scalability, and long-term environmental impact.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the author(s) used ChatGPT and QuillBot solely to assist with text translation. After using these tools/services, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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