DOI: https://doi.org/10.71317/kjard.2.8.2026.303
The Kashmir Journal of Academic Research and Development
Journal homepage: https://rjsaonline.org/index.php/KJARD

The Potential of Islamic Finance for Climate Change Adaptation in Pakistan

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ARTICLE INFO

Received:
June 19, 2026
Revised:
July 02, 2026
Accepted:
July 16, 2026
Available Online:
August 01, 2026

Keywords:
Islamic Green Finance, Climate Change, Social Finance, Resilient Investment

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ABSTRACT

This study explored how Islamic finance gave a boost to the capacity of the Pakistani government in the field of climate change adaptation capacity by focusing on climate resilient investment. The model, based on the concepts of Maqasid al-Shariah and financial intermediation theory, evaluated the impacts of Islamic green finance and Islamic social finance on climate-resilient investment and their impact on climate adaptation capacity. Partial least squares structural equation modeling was used to analyse data. The study resulted in two important findings: Islamic green finance and Islamic social finance significantly improved the climate-resilient investment and climate-resilient investment significantly improved the adaptation capacity. The results of the mediation analysis showed that both investment approaches conveyed the impact of climate-resilient investment to adaptation capacity. The study underscores the need for the integration of commercial and social Islamic finance, effective governance, and investing in resilient infrastructure, agriculture, water systems and vulnerable communities.

Introduction

Climate change has now emerged as a development and financing challenge in Pakistan on a systemic level. Agricultural productivity, infrastructure, public health and livelihoods and fiscal stability are at risk from recurrent floods, droughts, heatwaves, glacial hazards and water stress. The 2022 floods were an example of this vulnerability as they resulted in large scale human displacement and economic losses; and scientific evidence shows that the event was of a very high magnitude and has been associated with extreme precipitation, hydrological conditions and warming climate (Nanditha et al., 2023). The climate adaptation challenge is exacerbated by Pakistan's reliance on climate-sensitive agriculture, its high rate of urbanization, poverty and overall institutional capacity gaps (Masud & Khan, 2024; World Bank, 2022).

There is a lack of implementation due to fragmented governance, limited project-preparation capacity, and significant financing gap despite having a National Adaptation Plan and a National Climate Finance Strategy (Government of Pakistan 2023, 2024;

Masud & Khan 2024). According to the National Climate Finance Strategy, Pakistan needs around US$348 billion by 2030 for climate-resilient, climate-neutral and low carbon development (Government of Pakistan, 2024). Financing adaptation projects can be challenging, as the benefits – avoided losses, food security, water security and livelihood protection – are often public, spread over time and across space, making them less appealing to traditional private investors (Whittaker et al., 2026; World Bank, 2022).

Islamic finance provides a potentially important answer in that it combines asset-backed and risk-sharing finance with social redistribution and ethical investment. Islamic banking assets in the country already account for 22.9% of the banking-sector assets and Islamic banking deposits 27.8% of the total deposits as of the end of December 2025 (State Bank of Pakistan, 2025). The climate adaptation potential of this system however is not sufficiently examined.

In this study, the authors differentiate Islamic green finance and Islamic social finance. Islamic Green Finance, such as Green Sukuk and Shariah-compliant Project Financing, can catalyze green institutional financing for Resilient Infrastructure, Water Management and Climate-Smart Agriculture (Billah & Adnan, 2024). Islamic social finance could contribute to projects and vulnerable groups that have high social benefits but low commercial returns, such as zakat, waqf, qard al-hasan, and Islamic microfinance and micro-takaful (Ishak et al., 2025; Ma & Sukmana, 2025). However, finance can only enhance resilience when it is turned into assets and capabilities that are geared towards adaptation. Accordingly, this study situates climate-resilient investment as the link between the two types of Islamic financing and capacity for climate change adaptation. It therefore explores the impact of Islamic green finance and Islamic social finance on climate resilient investment and how this investment bolsters the country's ability to prepare for, absorb, recover and adapt to, climate shocks in Pakistan.

Literature Review and Hypothesis Development

Theoretical Underpinning

The proposed model is based on three theories; Maqasid al-Shariah and financial intermediation theory. The theory of financial intermediation and the theory of maqasid al-shariah have different emphases and serve different purposes. The theory of financial intermediation focuses on the mobilization, screening and allocation of financial resources to productive activity, while the theory of maqasid al-shariah explains the normative purpose of Islamic finance. They are suitable to be integrated with each other because the study is about the ethic orientation of finance and how finance is transformed into adaptation capacity.

The economic and financial activities must be carried out to achieve human welfare and to avoid harm as per Maqasid al-Shariah. The classical goals are to preserve life, the intellect, family or posterity, wealth and faith. In the modern interpretation of sustainability, scholarship focuses on these goals in a systemic way, acknowledging that the degradation of the environment poses a risk to human life, health, wealth, food systems and intergeneration's welfare. Therefore, the Islamic financial institutions should not only be on the formal side of complying with Islamic contracts but also focus on the positive social and environmental impact of the investments that they make (Auda, 2008; Jaiyeoba et al., 2025). Recent evidence shows that the concept of sustainability using the Maqasid approach involves considering both economic, social and environmental responsibilities, and not just profit maximization (Jaiyeoba et al., 2025). Resilient water, agriculture, housing and disaster-protection systems that maintain life and property, minimize vulnerability and secure future generations is consistent with this orientation, and also represents climate adaptation.

This normative perspective is complemented by the financial intermediation theory. Financial intermediaries perform the following functions that help alleviate information problems, aggregate savings, analyse investment projects, and diversify risks and direct investment towards productive activities (Diamond, 1984). This allocation function is important in climate finance as adaptation projects can have unpredictable cash flow, long payback periods, less collateral and monetization difficulties. This financing problem can be tackled by various players such as Islamic banks, sukuk markets, takaful operators and Islamic social finance institutions. But, Islamic financial assets and collection of social funds do not ensure adaptation outcomes. The money should be spent on resilient infrastructure, technologies, livelihoods and institutional capacities. The key transmission mechanism of the proposed model is therefore Climate-resilient investment.

The two points that have been made theoretically, together, is that the Maqasid al-Shariah gives the moral imperative to safeguard the climate vulnerable people and productive systems, and the role of financial intermediation is explained on how Islamic financial institutions can mobilize the scattered commercial and philanthropic resources into investment for adaptation. This interpretation is also in line with cross-country findings that Islamic financial development fosters preparation for climate change adaptation, especially in the context of good governance and effective allocation and oversight (Ubandawaki et al.,

2026). It also aligns with evidence that well-governed financial markets deliver better national climate resilience than weakly-governed ones, while developed financial institutions do better than both developed financial markets and weakly-governed ones (Rao & Kumar, 2025).

Islamic Green Finance and Climate-Resilient Investment

Islamic green finance is a concept that specifically targets projects that have environmental and/or climate benefits and is carried out using a Shariah-compliant financing scheme. The main instruments it relies on are green and sustainability sukuk, green funds that comply with shariah principles, and contracts of project financing and partnership that are based on shariah (musharakah and mudarabah). They are also adaptable, in that they can be connected to assets and activities that are conducive to a climate-smart economy, such as flood protection, efficient irrigation, water storage, resilient transport, climate-smart agriculture, sustainable buildings and early-warning infrastructure.

In the context of Pakistan, green sukuk are particularly significant as they provide an avenue for institutional capital to be mobilized for long-term investment to be linked with specific projects. They can be more asset-based, which can enhance transparency on how assets are used, and certification and reporting can minimize environmental misallocation concerns. Billah and Adnan (2024) demonstrate that green sukuk have diversification and risk-hedging properties and are less impacted during times of global uncertainty. While the analysis is to the financial-market behavior and not the outcomes of adaptation, it shows that green sukuk can be credible and investible instrument in the sustainable Islamic capital markets.

More broadly, studies on green finance reveal the potential of finance to bolster climate resilience via investment and innovation mechanisms. For instance, Zhang et al. (2025) conclude that green finance has positive effects on agricultural climate resilience, and that green technology innovation and industrial upgrading serve as mediators. This is significant evidence as it shows that, resilience is not only driven by finance, but is also achieved through investments in technologies, productive systems and institutional transformation.

This relationship is further enhanced by the Pakistani context. Increased financing for sectors that are affected by climate change is needed for irrigation efficiency, inputs that are resistant to dry periods, climate-proof storage, protection from flooding and climate-proof infrastructure, but public budgets are limited. Along with agriculture and urban infrastructure, World Bank (2022) has listed Investments in water management, urban and rural municipal services, housing, and urban infrastructure as priority areas for private and public resilience investments. It is also noted that diversifying domestic resources, private finance and innovative instruments to climate-proof investment are among the core features of Pakistan's National Climate Finance Strategy (Government of Pakistan, 2024). Islamic green finance can thus increase the amount of dedicated capital available and mitigate the shortage of match between Shariah-sensitive investors and adaptation projects.

However, the impact is rooted in credible taxonomies, project pipelines and impact reporting and Shariah-environmental governance. If these safeguards are not put in place, Islamic green products could finance conventional projects that have marginal adaptation value. However, if well-designed, Islamic green finance could enhance the accessibility, affordability and institutional trustworthiness of the financing of climate-resilient assets. Therefore:

H1: Islamic green finance has a positive effect on climate-resilient investment in Pakistan.

Islamic Social Finance and Climate-Resilient Investment

Islamic social finance includes Zakat, Waqf, Sadaqah, Qard al-hasan, Islamic microfinance and micro-takaful. They can be used to finance people and projects that do not generate “market rate” returns, unlike commercial finance. This is a significant aspect of climate adaptation, as the climate exposed households and small farmers are often at the greatest risk and have the least collateral, savings and insurance cover. Small, uncertain, or non-commercial size and value of the adaptation measures, such as raised housing, water harvesting, resilient seeds, livelihood diversification and disaster-risk protection, may lead to significant welfare gains.

Zakat may be used to provide short term protection and livelihood rehabilitation to the affected households. Interest-free working capital for adaptive technology and post-disaster recovery can be offered via Qard al-hasan. Cash or land-based waqf can establish long-lasting funding sources for community water, health facilities, resilient housing and sustainable agriculture. Islamic microfinance can provide productive adaptation finance to the excluded households and micro-takaful can pool flood, crop loss and livestock death risk. These tools collectively expand the scope of adaptation finance from big projects to resilience at the community and household level.

This developmental potential is supported by recent literature and is linked to a gap in environmental research. While poverty alleviation, financial inclusion and the SDGs are given strong attention in Islamic social-finance publications, ecological sustainability is much less integrated thorough, according to a review conducted by Ma and Sukmana (2025) of 102 publications. This is significant, because when environmental shocks happen it causes poverty to grow and may reduce previous gains in social finance.

With the right legal framework, professional management and institutional coordination, waqfs can help achieve sustainable agricultural development and contribute to generate social and environmental benefit, as shown by Ishak et al. (2025). In addition, research on green waqf shows that through this mechanism, the public has been shown interest in participating in environmental programs, provided that there is public awareness, trust and the credibility of the institution in carrying out the waqf. (Huda et al., 2024)

Islamic social finance has potential to complement government programs and commercial Islamic banking to finance decentralized adaptation in Pakistan. It has a comparative advantage in delivering to vulnerable beneficiaries and in tolerating social, not financial, returns. Its impacts can, however, be diminished by poor collection and disclosures and limited linkages to climate planning, as is currently the case. There would be a way to turn social transfers into productive investments for local governments and technical agencies if zakat and waqf institutions were linked to verified adaptation projects. Thus:

H2: Islamic social finance has a positive effect on climate-resilient investment in Pakistan.

Climate-Resilient Investment and Adaptation Capacity

Climate-resilient investment is investment in physical, technological, social and institutional assets that decreases exposure and/or sensitivity to climate hazards and enhances response and recovery. It comprises resilient infrastructure, climate-smart farming, water-security systems, early-warning technologies, disaster-risk financing, and adaptive skills and diversified livelihoods. Adaptation capacity is a follow-on capacity of institutions, communities and economic actors to predict hazards, withstand shocks, overcome losses, learn and adapt.

A distinction between investment and capacity is important. Finance is an input, resilient investment is the action of the input, and the outcome is adaptation capacity. The contribution of an irrigation system or a micro-takaful or flood resistant road to adaptation is only beneficial if it has a corresponding benefit in terms of preparedness, operational continuity, recovery or flexibility.

This transmission logic is supported by empirical evidence. The impact of green finance on agricultural resilience is realized through the green innovation and structural upgrading, as demonstrated by Zhang et al., (2025). According to Rao and Kumar (2025), financial institutions have a significantly positive impact on building climate resilience, especially in the presence of good governance. Additionally, Ubandawaki et al. (2026) find that Islamic financial development enhances the readiness of adaptation in lower and middle-income countries.

In Pakistan, investments must be made – not just in large-scale infrastructure but also in the capabilities that are inbuilt at the local level. However, Masud and Khan (2024) suggest that fragmented implementation, the lack of centralized decision-making and coordination are issues affecting adaptation and that investments in local planning, information, skills and institutional capacity are as critical as investments in physical assets. Investments should therefore be more effective in improving preparedness, minimizing losses, and speeding recovery when the investments are linked to local risks and supported by monitoring. Accordingly:

H3: Climate-resilient investment has a positive effect on climate change adaptation capacity in Pakistan.

Mediating Role of Climate-Resilient Investment

The argument for mediation proposed in the Islamic finance context focuses on the effect of Islamic finance in achieving the outcomes of adaptation. Islamic green finance is not a resilience outcome but a financing architecture, as is Islamic social finance. Their influence is limited if there is no transfer of money to the relevant assets and capabilities. The same separation is important to avoid the notion that growth of the financial sector will inevitably create climate resilience.

Islamic green finance starts with the mobilization and earmarking of capital. Green sukuk and project financing for Shariah purpose can augment the facilities to support resilient agriculture, water systems and infrastructure. Project screening and

asset linkage and reporting then funnel those resources into particular investments. These investments then enhance adaptation capacity by decreasing exposure, providing protection for productive activity, and providing recovery capacity. This indirect logic is supported by evidence on the green-finance impact on agricultural resilience that is transmitted via innovation and upgrading of industries (Zhang et al., 2025). Again, the underinvestment in adaptation markets suggests that project pipelines for financial investment are necessary steps between financial capital and resilience (Whittaker et al., 2026).

The mechanism is distributive and inclusive for Islamic social finance. In addition, there are several forms of Islamic finance that have the potential to mobilize resources for those who are not in the commercial mainstream, such as zakat, waqf, qard al-hasan, and Islamic microfinance. However, short-term transfers can provide short-term adaptation but not long-term. Their resilience effect is enhanced if resources are used to finance productive and preventive assets such as water harvesting, adaptable farming inputs, livelihood diversification, community infrastructure, and micro-takaful coverage. Professionally developed and governed endowed assets can produce sustainable benefits as seen in waqfs, which is used for sustainable agriculture (Ishak et al., 2025).

The mediator also explains the rationale for governance. Meanwhile, Ubandawaki et al. (2026) reveal that corruption control enhances the role of Islamic finance in adaptation readiness, and Rao and Kumar (2025) demonstrate that financial institutions' resilience is heightened by governance quality. Based on the findings, finance needs to go through credible allocation, implementation and monitoring processes. This substantive deployment stage is called climate-resilient investment, as governance is an important contextual condition.

In Pakistan, the mediation path of adaptation appears more feasible as the financial system has a strong Islamic banking capacity with limited financial resources for adaptation. A key policy question is not just whether Islamic finance is expanding, but whether it is moving towards projects that effectively mitigate climate vulnerability. On the basis of this concept:

H4: Climate-resilient investment mediates the relationship between Islamic green finance and climate change adaptation capacity in Pakistan.

H5: Climate-resilient investment mediates the relationship between Islamic social finance and climate change adaptation capacity in Pakistan.

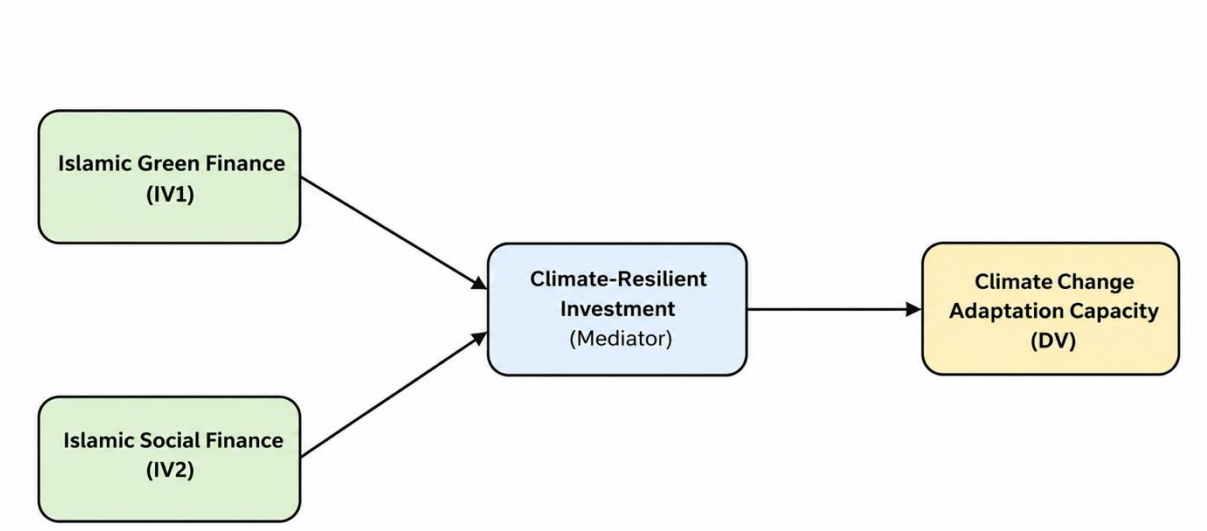

Figure 1: conceptual model

Methodology

Research Design

The study used an explanatory research design with a quantitative approach that involves a cross sectional design. The fact that it aims to test theoretically specified relationships among Islamic green finance, Islamic social finance, climate-resilient investment and climate change adaptation capacity calls for a quantitative design. The study is conducted using an explanatory orientation, which enables it to estimate both direct and indirect mediation effects.

A structured questionnaire was used to collect data from the key informants of Pakistan's Islamic finance and climate finance ecosystem. The institutional professional will serve as the unit of analysis since it is the unit of analysis for the constructs, which focus on organizational financing practices, investment allocation and adaptation capability, not individual religious preferences.

Cross sectional design was suitable for the first empirical test of the framework and the population was geographically dispersed. Causal language will be used sparingly, however, as data will be gathered at one time Future studies should use longitudinal or project-level designs; and the ordering of constructs, and mediation analysis driven by theory, will bolster inference, along with procedural controls.

Population, Sample and Sampling Technique

The target audience includes mid-level and senior professionals who have firsthand experience in Islamic finance, social finance, or sustainable investment or climate adaptation in Pakistan. The eligible respondents were selected from:

- Full-fledged Islamic banks
- The Islamic banking segment of conventional banks. Conventional banks' Islamic banking units.
- Islamic microfinance institutions
- Takaful operators
- Sukuk and investment organizations
- The institution of Zakat, Waqf and charity
- Financial regulators and relevant public agencies
- Climate departments at the federal and provincial levels.
- Any development organizations and NGOs conducting resilience projects

Respondents should possess at least two years of professional experience in the finance, design, approval, implementation and/or monitoring of climate-related or socially oriented projects or should have direct experience in such projects.

As there is no comprehensive national sampling frame which combines these institutional types, the study used a multistage stratified purposive sampling strategy. The first categorization ere among institutions to the four levels of commercial Islamic finance, Islamic social finance, public and regulatory bodies and climate-development organizations. Second, organizations were chosen from major administrative and financial centers of the country such as Karachi, Lahore, Islamabad/Rawalpindi, Peshawar and Quetta. Thirdly, respondents who were knowledgeable were identified through institutional directories, professional associations and official contacts. Excessive representation of commercial banks was avoided by having quotas.

A priori G*power analysis for a structural equation yields a minimum sample size of about 119 for an effect size of .15, a significance level of .05 and a statistical power of .95. However, this minimum would not be sufficient for PLS-SEM stability estimation, response rate and institutional differences and group comparisons. At least 400 questionnaires should be completed for the study, and at least 300 questionnaires should be usable.

Data Collection Process

The questionnaire was sent out by direct institutional contact. The instrument was assessed by a panel of 5-7 experts in the field of Islamic finance, climate policy, and quantitative research prior to the full administration. The experts evaluated the content validity, item relevance, and the wording and suitability for Pakistan.

The validity and reliability of the questionnaire was tested with the help of a pilot test with around 30-50 eligible respondents, which examined the clarity, time to complete the questionnaire, and preliminary reliability. Pilot responses were included in the final data set.

The final questionnaire was started with an information sheet detailing the academic rationale for the research, the fact that it is voluntary, the confidentiality and right to withdraw. There was no need to gather unnecessary personally identifying information. Questions that are screened were used to verify the respondents' background and institutional affiliation.

To minimize common method bias, several procedural steps will be undertaken. The predictor, mediator and outcome parts were separated, neutral and concise language was used, endpoints of the scales were well defined, and respondents were told that there are no right or preferred social answers. Data collection should start for around 6-8 weeks with 2 friendly reminder messages. Cross-submission, questionnaires filled out too rapidly and answers reflecting high-quality responses.

Measurement Instrument

All constructs were operationalized as reflective multi-item scales scored on a 7-point likert scale from 1 = strongly disagree to 7 = strongly agree. Content were cited from literature and a reformulated to suit the institutional context of Pakistan.

Islamic Green Finance

Islamic green finance was measured using five items assessing:

1. Shariah compliant green financial products are available.
2. Support for adaptation projects by the institutions (institutional commitment)
3. Use of environmental screening criteria
4. Accessibility of green sukuk and Islamic project finance
5. Clear rules on the use and reporting of green funds
6. The items were modified from Billah and Adnan (2024) and Zhang et al. (2025).

For example, one of the illustrative items is “Islamic financial institutions in Pakistan are able to offer appropriate financing for climate resilient projects.”

Islamic Social Finance

Islamic social finance was assessed using 5 or 6 items which focused on:

1. First, there is the mobilization of zakat for climate purposes. First, is mobilization of zakat for climate needs.
2. The Use of Waqf for Environmental & Community Projects
3. Availability of qard al-hasan
4. Women's participation in Islamic banking's inter-segmental linkages
5. Micro-Hadramawt for climate risks.

6. Governance and transparency of Islamic social funds
7. The items were adapted Ishak et al. (2025) and Ma and Sukmana (2025).

Illustrative item: "Islamic social-finance institutions can offer easily accessible resources for climate-vulnerable communities.

Climate-Resilient Investment

Five items were used to measure climate-resilient investment, related to the allocation of resources to:

1. Resilient infrastructure
2. Climate-smart agriculture
3. Conservation and management of water
4. Early-warning and disaster-preparedness systems
5. Protection of livelihoods via adaptive technologies

The items were based upon Whittaker et al. (2026), World Bank (2022) and Zhang et al. (2025).

Example item: “Money is being spent on projects that decrease vulnerability to climate hazards.

The ability of climate change adapters to adapt to climate change.

Climate change adaptation capacity was assessed using 6 items which covered the following:

1. One-stop solutions to climate hazards
2. Climate resilience in the form of absorption to climate shocks.
3. Continuity of essential activities
4. Speed of recovery
5. Institutional learning
6. Ability to adjust to future climate risks

The items guided by the following: Masud, Khan (2024); Rao, Kumar (2025); Ubandawaki et al. (2026).

Relevant institutions and communities can successfully bounce back from climate-related disruptions.” (Illustrative Item)

Control variables were collected for age of the respondent, age of the education, professional experience, organization type, province and organizational size.

Data-Analysis Techniques

The data were analyzed with SPSS and SmartPLS. Initial screening included missing values, duplicate cases, straight-lining, outlier(s) and descriptive statistics. If missing is random, then the missing data can be handled by using an expectation-maximization algorithm or multiple imputation, provided it is less than 5%. Those cases that have a significant amount of missing data were excluded. Nonresponse bias was compared between early and late respondents. With the model being prediction-oriented, mediation required, and potentially the data of the survey being non-normally distributed, partial least squares structural equation modelling (PLS-SEM) will be applied (Hair et al., 2022). The analysis was done to assess measurement model, structural model, and predictive relevance assessment.

Finding and Analysis

Measurement Model

The measurement model results showed that the reliability of the measurement instrument was good, convergent validity was good, and there were no serious concerns about multicollinearity. All the indicator loadings were within the range of 0.827–0.888, which is above the recommended value of 0.70. This suggested that each item was a good representation of each latent construct. The highest loading was for CRI3 and the lowest loading was for IGF4 among the indicators. However, all the indicators were left in place due to acceptable loadings. The internal consistency reliabilities of the constructs were also established. Cronbach's α for the items ranged from 0.907 to 0.928 and composite reliability ranged from 0.931 to 0.943. The values were significantly greater than the value of 0.70, which is the minimum established for consistency between items in the measurement. The reliability coefficients were acceptable but did not reach the critical value of 0.95 indicating that the indicators were not too repetitious.

Average variance extracted values were used to achieve convergent validity. The AVE values were between 0.723 and 0.753 which is higher than the recommended value of 0.50. Thus, more than 50% of the variance in these indicators was explained by each construct. The highest AVE was achieved by CR (+0.753) followed by CCAC, IGF and ISF. Lastly, the values of variance inflation factors were from 2.150 to 3.035. None of the values exceeded the typical of 5.00, nor the more conservative of 3.30. Therefore, there was no multicollinearity issue for the indicators. In general, the measurement model had good indicator reliability, internal consistency, convergent validity and collinearity assessment.

Table 1: Measurement Model Assessment

Construct	Item	Outer Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)	VIF
CCAC	CCAC1	0.867	0.928	0.943	0.735	2.871
	CCAC2	0.842				2.460
	CCAC3	0.831				2.384
	CCAC4	0.871				2.915
	CCAC5	0.864				2.774
	CCAC6	0.867				2.785
CR	CRI1	0.883	0.918	0.938	0.753	2.995
	CRI2	0.849				2.409
	CRI3	0.888				3.035
	CRI4	0.844				2.337
	CRI5	0.875				2.770
IGF	IGF1	0.858	0.907	0.931	0.728	2.535
	IGF2	0.866				2.531
	IGF3	0.871				2.647
	IGF4	0.827				2.150

	IGF5	0.844				2.370
ISF	ISF1	0.839	0.923	0.940	0.723	2.377
	ISF2	0.868				2.894
	ISF3	0.859				2.707
	ISF4	0.841				2.454
	ISF5	0.855				2.603
	ISF6	0.840				2.472

Note. CR = composite reliability; AVE = average variance extracted; VIF = variance inflation factor.

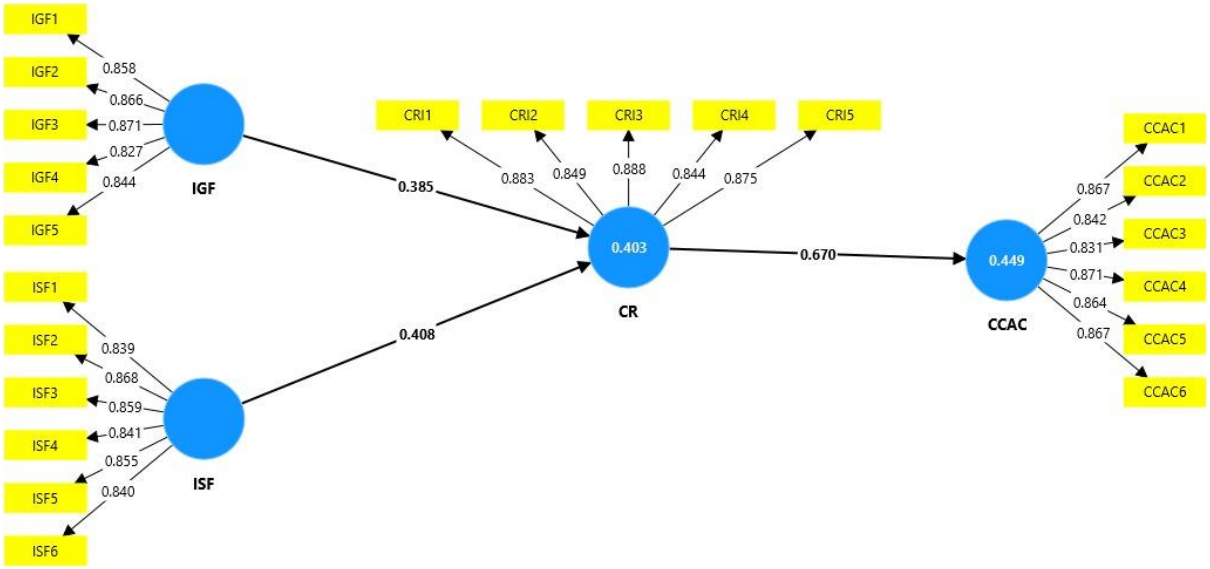

Figure 2: Measurement Model

Discriminant validity

All constructs had acceptable discriminant validities as indicated by the HTMT results. The range of values was between 0.309 and 0.725, which all were below the suggested level of 0.85 and the more lenient level of 0.90. The correlation between the two constructs CCAC and CR was observed as 0.725 (HTMT value), which means that there is a moderate relationship but there is no construct overlap. The best empirical distinctiveness was found between IGF and ISF with 0.309. Likewise, the other relationships were acceptable. Thus, the discriminant validity was successfully established for the measurement model used in this study as each construct measured a concept sufficiently different from the others.

Table 2: Heterotrait-Monotrait Ratio (HTMT) Matrix

Construct	**CCAC**	**CR**	**IGF**	**ISF**
CCAC				
CR	0.725			

IGF	0.526	0.547	
ISF	0.497	0.560	0.309

Note. HTMT values below 0.85 indicate satisfactory discriminant validity.

Structural Model

The results of the structural model showed that all relations were positive and statistically significant, both direct and indirect. CR significantly and positively affected CCAC (β = 0.670, t = 23.948, p < 0.001) which means that the higher the CR, the higher the CCAC. IGF also positively influenced CR (β = 0.385, t = 9.902, p < 0.001), while ISF demonstrated a slightly stronger positive effect on CR (β = 0.408, t = 10.880, p < 0.001). Both of these antecedents were found to be important in explaining CR and these findings were consistent with the literature. An additional mediation analysis also showed that the relationship between IGF and CCAC was also mediated by CR (β = 0.258, t = 8.643, p < 0.001). Likewise, the association between ISF and CCAC was also mediated by CR (β = 0.273, t = 9.308, p < 0.001). In general, all of the hypotheses were accepted, and that CR was an important mechanism that connects the IGF and ISF to CCAC.

Table 3: Structural Model Path Results

Path	Original Sample (O)	STDEV	T Value	P Values
CR → CCAC	0.670	0.028	23.948	0.000
IGF → CR	0.385	0.039	9.902	0.000
ISF → CR	0.408	0.037	10.880	0.000
IGF → CR → CCAC	0.258	0.030	8.643	0.000
ISF → CR → CCAC	0.273	0.029	9.308	0.000

Note: STDEV = standard deviation. P values below 0.05 indicate statistically significant paths.

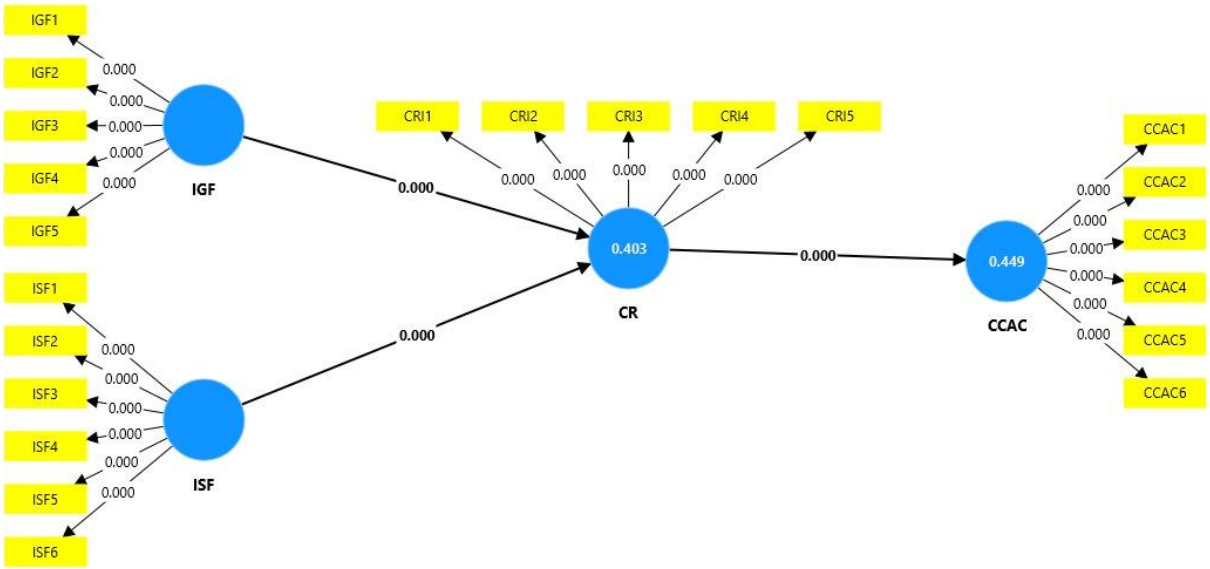

Figure 3: Structural Model

Coefficient of Determination, Effect Size, and Predictive Relevance

The structural model had good explanatory power, relevant effect sizes, and predictive validity. The R-squared was 0.449 and the adjusted R-squared was 0.448 for CCAC. This was the result of a moderate amount of explanatory power, with CR accounting for around 44.9% of the variance in CCAC. In the same way, the variance of CR was jointly accounted for by IGF and ISF with an adjusted R-square of 0.400 and 40.3% respectively. The change in R-square between the models and adjusted R-square was small, indicating that the model estimates were robust and not significantly affected by the number of predictors.

The effect size results indicated that the CR had a large effect size in CCAC with f-square value of 0.815. The effect of IGF on CR was moderate (f-square value of 0.229) while ISF had a comparatively better effect on CR with a moderate f-square value of 0.256. These results gave evidence of the substantive meaning of the relationships proposed.

The Q-square values were used for the assessment of the predictive relevance. The Q-square value for CCAC and CR were 0.326 and 0.300 respectively. Both of these values were positive, so the model is seen to be quite relevant with respect to the predictions made outside the sample. The results showed that the structural model had acceptable level of explanatory accuracy, meaningful predictor effects and satisfactory predictive capability.

Table 4: Coefficient of Determination, Effect Size, and Predictive Relevance

Construct	R-square	Adjusted R-square	Effect-size Path	f-square	SSO	SSE	Q^2 (= 1 – SSE/SSO)
CCAC	0.449	0.448	CR → CCAC	0.815	2400.000	1617.001	0.326
CR	0.403	0.400	IGF → CR	0.229	2000.000	1399.480	0.300
			ISF → CR	0.256			

Note: R^2 indicates explained variance, f^2 indicates effect size, and Q^2 values above zero indicate predictive relevance.

Discussion

The results set a clear pathway of financing, investing and adapting to climate change through Islamic green finance (IGF), Islamic social finance (ISF) and climate resilient investment (CR), which in turn bolstered climate change adaptation capacity (CCAC). In this context, IGF proved to be a positive factor in the CR ($\beta = 0.385$, $p < 0.001$) and it was suggested that Shariah-compliant green instruments can help mobilize and allocate capital for infrastructure development, water resources, and climate-smart agriculture and adaptation-related assets. This finding was in line with the evidence that green finance encouraged climate resilience through investment, technological innovation and structural upgrading, and not just the growth of finance (Zhang et al., 2025). Moreover, it aligned with the research findings that green sukuk would offer diversification and risk-management benefits, thereby enhancing their trustworthiness as instruments for sustainable capital mobilization (Billah & Adnan, 2024).

ISF also possessed a significant positive effect on CR ($\beta = 0.408$, $p < 0.001$) with its coefficient being slightly greater than IGF. The outcome indicated that adaptation in Pakistan would not be possible only through commercially viable projects, but also through inclusive financing mechanisms that would reach out to small farmers and vulnerable households and communities with less collateral. The water sector may benefit from decentralized investments through Zakat, waqf, qard al-hasan, Islamic microfinance and micro-takaful for livelihood diversification, resilient agriculture and disaster recovery. Indeed, the finding broadened the scope of Islamic social-finance research from the traditional focus on poverty alleviation and financial inclusion to environmental resilience. This interpretation would correspond with the findings of Ma and Sukmana (2025) in their observation of the lack of development of environmental dimensions of Islamic social-finance scholarship and Ishak et al. (2025) who showed the role of professionally-managed waqf assets in sustainable agricultural development.

The correlation between CR and CCAC had a strong structural relationship ($\beta = 0.670$, $p < 0.001$), and an effect size $f^2 = 0.815$. This meant that financial resources translate into adaptation outcomes of significance if it is translated into tangible assets, technologies, institutional systems and livelihood capabilities. The outcome confirmed financial intermediation theory as it demonstrated that the importance of Islamic finance was through effective allocation of resources, not just fund mobilization alone. It also favored the Maqasid al-Shariah viewpoint since investments that ensured safety of life, wealth, livelihood and the

next generation were substantive welfare benefits and not just compliance with the Shariah. Cross-country evidence also revealed that financial institutions made it more resilient to climate change and Islamic financial development made it more prepared to adapt, if the governance and control of corruption were higher (Rao & Kumar, 2025; Ubandawaki et al., 2026).

Indirect pathway effects were significant, with CR as the primary pathway for the indirect pathway (IGF: $\beta = 0.258$, $p < 0.001$; ISF: $\beta = 0.273$, $p < 0.001$). This research helped them understand why it is not enough to have Islamic financial assets or social funds in order to build financial resilience; financing must go through the process of credible project selection, implementation, monitoring and impact verification. The moderate R^2 values of CR (0.403) and CCAC (0.449), with positive Q^2 values, suggested a good level of explanatory and predictive relevance, but there remained room for governance, institutional capacity and policy coordination to account for more of the variations. In the Pakistani context, the specific challenges encountered in fragmentation and coordination have limited the ability of the adaptation policy delivery (Masud & Khan, 2024), making this qualification significant.

Theoretical Implications

The study made a theoretical contribution by connecting the concept of Maqasid al-Shariah with financial intermediation theory by introducing the climate-resilient investment as a direct pathway of the financial intermediation. While recent studies often showed connections between Islamic finance and sustainability, social welfare or climate readiness at an overall level, the present framework provides insights into how financing was transformed into adaptation capacity. Results of the major IGF–CR and ISF–CR roads revealed that rather than an alternative, commercial and redistributive Islamic finance existed as complementary systems of resource allocation. The connection between strong CR and CCAC relationship further highlighted the results of the adaptation outcomes being dependent on the productive use of resources into resilient assets and capabilities. The mediation outcomes confirmed the relationship between finance and resilience, in that they were unable to assume that the finance variable had an automatic effect on the resilience variable and revealed that investment allocation was the mediation mechanism. The framework also expanded on the concept of Maqasid from formal shariah compliance to measurable protection of life, wealth, livelihoods and intergenerational welfare, and extended the theory of financial intermediation to climate-vulnerable beneficiaries and those who are financially excluded (Auda, 2008; Ubandawaki et al., 2026).

Practical Implications

The results provided a practical foundation for developing climate finance programs for Pakistan integrated with Islamic finance. Policymakers and development agencies need to establish tried and tested adaptation project pipelines to accommodate commercial Islamic funds and Islamic social funds. Financing of bankable infrastructure projects, irrigation, and climate-smart agriculture and water projects can be achieved by, among others, green sukuk and project financing under Sharia, while community level interventions can be financed by different means such as zakat, waqf, qard al-hasan, microfinance and micro-takaful. Funds mobilized alone should not be used as an indicator of success of climate resilient investment as it is the best predictor of adaptation capacity. Standardized climate taxonomies, project-screening criteria and beneficiary safeguards and impact-reporting templates would make things more comparable and reduce greenwashing. The State Bank of Pakistan, climate ministries, provincial departments, Islamic banks, and social-finance institutions could also work together to address the fragmentation in the implementation of adaptation in Pakistan (as identified by Masud & Khan, 2024; Government of Pakistan, 2024).

Managerial Implications

The findings meant for Islamic bank managers, takaful operators, waqf institutions and development institutions suggested that innovation in the financial products must be closely linked to the measurable adaptation outcomes. Climate financing units should be created to identify projects, carry out Shariah and environmental due diligence, assess physical climate risks, and monitor post-financing performance, at the level of the manager. The high ISF effect indicated that social finance is not simply about disbursing charity, but about organizing the zakat and waqf resources based on productive, preventive and recovery-oriented investments to vulnerable communities. Islamic banks can integrate concessional social funds with commercial loans, thereby further minimizing project risk and making it more affordable. Households protected, water saved, infrastructure climate-proofed, livelihoods rebuilt, recovery time cut should all be a part of a performance dashboard. Good governance and transparency in fund tracing and independent assessment of impact verification would be crucial, as governance quality was found to enhance the link between financial development and climate adaptation outcomes (Ubandawaki et al., 2026; Rao & Kumar, 2025).

Limitation and future research recommendations

Some limitations qualified the findings, providing suggestions for future research. First, the cross-sectional design limited causal inference, and being unable to observe how long it takes financing to have an impact on adaptation outcomes. Long-term analysis is needed to assess if resilient investments fostered long-term capacity building pre- and post-climate shocks. Second, data relied on professional assessments and may have been influenced by common-method or social-desirability bias; future research could include both surveys and audited financial allocations, project records and objective measures of resilience. Third, the purposive sampling approach might restrict the generalizability of the results. Companies, such as banks, takaful companies, social finance institutions, regulators and development institutions, could be compared as multi-group analysis. Fourth, the direct IGF–CCAC and ISF–CCAC routes were not recorded, making it impossible to know if mediation was total or partial. The direct paths need to be tested in future models and the moderators and additional mechanisms should be governance quality, digital finance, institutional trust and project readiness (Masud & Khan, 2024; Ubandawaki et al., 2026).

Conclusion

The study highlighted that if the financial resources are transformed into climate-resilient investments, Islamic financing can help the capacity of Pakistan to adapt to climate change. Islamic green finance and Islamic social finance contributed to the increase of resilient investment, with Islamic social finance showing a slightly more effect. Climate-resilient investment then had the greatest impact on adaptation capacity, and also significantly mediated the impacts of both types of investment. The results indicated that the expansion of Islamic finance was not enough; the adaptation value was reliant on credible allocation to resilient infrastructure, water management, climate-smart farming, livelihood protection and institutional capacities. Based on the integration of Maqasid al-Shariah and financial intermediation theory, the study gave an explanation that was based on ethics and explained the process whereby Islamic finance could be able to protect life, wealth and future welfare. Hence, the framework was found to have an appropriate pathway to integrate Pakistan's growing Islamic financial system with the country's priorities on climate finance, if it is possible to enhance the project pipelines, enhance governance, increase monitoring and enhance institutional coordination (Government of Pakistan, 2024; Rao & Kumar, 2025).

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