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Environmental, Social, and Governance Practices and Microfinance Institutions Sustainability: A Global Study

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ABSTRACT

This study investigates how environmental, social, and governance (ESG) practices influence the financial sustainability of microfinance institutions (MFIs) worldwide. Drawing inspiration from Adam Smith's perspectives on moral sentiments and institutional cohesion, the research examines whether strategic integration of ESG dimensions can enhance the operational efficiency of MFIs. Using a global panel dataset of 966 MFIs across 97 countries between 2010 and 2018, the study adopts a two-stage approach. In the first stage, financial efficiency is assessed using data envelopment analysis. In the second, truncated regression models evaluate the effects of ESG dimensions on financial outcomes, with MFIs' size tested as a moderating factor. The results indicate that ESG performance significantly enhances financial efficiency. Environmental and governance factors have stronger effects among larger institutions, while the social dimension shows more complex patterns. These findings highlight the importance of tailored ESG integration and offer practical insights for improving institutional resilience through responsible finance.

JEL Classification: G21, M14, O16, Q56

1 | Introduction

Microfinance institutions (MFIs) play a crucial role in enhancing financial inclusion and promoting socio-economic development, particularly in emerging and developing economies. Rooted in the principles of ethical lending and social equity, MFIs aim to reach underserved populations that lack access to conventional banking services. Despite their expansive global outreach, which includes serving nearly 140 million clients, concerns persist regarding the financial sustainability of their business models and their ability to maintain operational resilience in the face of economic and social pressures (Banerjee and Duflo 2011).

The relevance of ESG, or Environmental, Social, and Governance principles, has grown in recent years across various sectors, including financial institutions. ESG frameworks help organizations align their operations with broader societal goals such as environmental protection, social justice, and ethical governance. While ESG has received substantial attention

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in the context of conventional financial institutions, its integration within the microfinance sector remains comparatively underexplored. Microfinance institutions, by nature, operate with dual missions, such as financial performance and social impact, which makes ESG integration not only relevant but potentially transformative (Marquis and Qian 2014; Ioannou and Serafeim 2015; Ashraf et al. 2022).

Although several studies have attempted to assess the relationship between ESG and financial outcomes in banking and investment sectors, the findings remain inconclusive (Azmi et al. 2021; Maama 2021; El Khoury et al. 2023). In the context of MFIs, few studies have investigated this nexus, and those that do often rely on traditional financial metrics like return on assets (ROA) or return on equity (ROE), which may not accurately reflect the operational efficiency of socially oriented institutions (Bharti and Chitnis 2016; Tanin et al. 2019; Daszyńska-Żygadło et al. 2021; Ashraf et al. 2022). Moreover, most studies have yet to systematically analyze how each ESG pillar, that is, environmental, social, and governance, contributes individually to the sustainability of MFIs. Additionally, the literature offers limited insight into how institutional factors such as MFI size moderate these effects (Bibi et al. 2018).

In response to these gaps, this study aims to offer a comprehensive empirical assessment of how ESG practices affect the financial sustainability of MFIs. It applies a two-stage analytical approach. First, we use data envelopment analysis (DEA) to measure the financial efficiency of 966 MFIs across 97 countries over the period 2010–2018. DEA is particularly suitable in this context as it captures the efficiency of institutions with multiple inputs and outputs, beyond what traditional ratio-based metrics allow (Cooper et al. 2011; Mia and Chandran 2016; Bibi et al. 2018). Second, we apply regression models to examine how ESG and its three pillars influence financial efficiency, with the size of MFIs included as a moderating variable.

Theoretically, our work is anchored in stakeholder theory, which posits that firms should serve the interests of all stakeholders, not just shareholders (Freeman 2010). ESG performance can help firms reduce reputational risk, increase stakeholder trust, and improve access to capital. Additionally, we draw on Adam Smith's notion of moral sentiments (Smith 1759), which emphasizes empathy, community well-being, and institutional trust. These moral underpinnings align with the social mission of MFIs and suggest that ethical governance and social investment are not only morally desirable but strategically beneficial. ESG initiatives, when designed thoughtfully, can reinforce an MFI's resilience by promoting environmental stewardship, social inclusion, and accountability.

In this context, our study pursues three primary objectives. First, we investigate the overall impact of ESG practices on MFIs' financial efficiency. Second, we explore the individual effects of environmental, social, and governance performance on financial sustainability. Third, we examine whether MFIs' size moderates the relationship between ESG practices and financial efficiency, given that larger MFIs may possess greater institutional capacity to implement ESG strategies effectively (Barry and Tacneng 2014; Wijesiri et al. 2017).

This study contributes to the existing literature in several ways. It introduces a customized ESG index using data from the MIX Market, suited for the unique structure of MFIs. It applies DEA as a more appropriate performance measure in the MFIs' context. It also examines the moderating role of MFIs' size, providing insights into how institutional characteristics influence ESG outcomes. These findings have practical implications for development partners, impact investors, and regulatory bodies, offering evidence-based guidance on how ESG integration can enhance the long-term viability of MFIs.

The remainder of the paper is organized as follows: The "Literature Review" in Section 2 explores the existing body of literature and formulates hypotheses; the "Methodology" in Section 3 outlines the research methodology and data sources; the "Findings and Discussions" in Section 4 offer the study's results and associated discussions; the "Conclusion" in Section 5 encompasses the study's conclusion, its limitations, and recommendations for future research; and finally, the "Implications and Recommendations" in Section 6 provide insights and suggestions.

2 | Literature Review

2.1 | ESG and Financial Sustainability

Microfinance institutions have long operated under dual mandates: financial self-sufficiency and social outreach. In recent years, the ESG framework has emerged as a means to align financial institutions with broader goals of sustainability, accountability, and ethical governance. Although ESG performance has been increasingly examined in mainstream financial sectors (A. Buallay 2019; Azmi et al. 2021), its application and implications in the microfinance context remain relatively understudied. Earlier studies assessing the ESG–performance link offer conflicting evidence. For instance, A. M. Buallay (2020) found a positive relationship between ESG and financial outcomes in banks, while Maama (2021) reported a negative association in the Ghanaian context. These contradictory findings raise questions about contextual factors, industry-specific mechanisms, and the appropriateness of financial metrics used. Most existing research relies on traditional profitability indicators such as return on assets or return on equity (El Khoury et al. 2023; Rangel-Pérez et al. 2023), which may not adequately capture the operational dynamics and developmental objectives of MFIs.

Within the microfinance literature, studies investigating ESG integration are sparse. Bharti and Chitnis (2016) and Tanin et al. (2019) found a positive relationship between ESG orientation and MFI sustainability, while Ashraf et al. (2022) highlighted the lack of consensus regarding its financial impact. These studies often rely on fragmented ESG proxies and fail to unravel the relative contributions of environmental, social, and governance dimensions. Moreover, the combined effect of ESG and organizational characteristics, such as institutional size or geographical presence, has received limited attention.

This study aims to contribute to the literature by adopting a customized ESG index constructed from MIX Market data tailored specifically for MFIs, addressing the limitations of generic

ESG metrics. By focusing on financial efficiency rather than profitability ratios, we offer a more accurate representation of institutional sustainability for socially oriented organizations. In addition, we explore the heterogeneity in ESG effects across different institutional sizes, an aspect that remains largely unexplored in previous research.

Theoretically, the relationship between ESG and financial performance in MFIs can be understood through the lens of stakeholder theory (Freeman 2010), which posits that long-term value creation depends on addressing the needs of all stakeholders, including clients, employees, funders, and regulators. ESG practices may enhance institutional trust, reduce reputational risk, and attract socially conscious investors, thereby improving financial stability. Moreover, drawing on Adam Smith's (1759) concept of moral sentiments, institutions that act with empathy and ethical awareness are likely to foster stronger relationships with clients and communities, leading to improved operational performance.

Empirically, our work aligns with recent calls for incorporating ESG principles into impact finance frameworks and sustainability-oriented financial strategies (Daszyńska-Żygadło et al. 2021; Gutiérrez-Ponce and Wibowo 2023). However, by shifting the focus toward financial efficiency and institutional configurations in the microfinance sector, this study introduces a novel perspective to the ESG–performance debate. Therefore, we formulate the following hypothesis:

Hypothesis 1. *The overall ESG performance positively influences the financial efficiency of MFIs.*

2.2 | Environment Performance and Financial Sustainability

Environmental sustainability is increasingly recognized as a strategic priority for financial institutions, including MFIs. As global attention intensifies on climate change, carbon emissions, and environmental degradation, financial actors are expected to play a proactive role in promoting green finance and mitigating environmental risks. For MFIs, many of which operate in environmentally vulnerable and resource-scarce regions, this role is particularly salient.

Existing literature suggests a mixed relationship between environmental practices and financial performance. Studies in the banking sector have shown that environmentally responsible behavior can lead to positive financial outcomes by reducing regulatory risks, enhancing brand image, and improving access to green capital (A. Buallay 2019; Zahid et al. 2023). On the other hand, some research has reported limited or negative effects, particularly when environmental initiatives impose short-term costs without immediate returns (Dragomir et al. 2022; Ersoy et al. 2022). These inconsistencies underscore the need for sector-specific analysis.

The microfinance sector, however, remains underrepresented in this stream of research. While Allet and Hudon (2015) offered a framework for integrating environmental practices into microfinance operations, such as offering green microloans, promoting sustainable agricultural practices, and incorporating environmental risk assessments, empirical studies examining their financial implications remain scarce. Tanin et al. (2019), La Torre et al. (2021), and Ayayi and Wijesiri (2022) attempted to explore these linkages, but their findings were often inconclusive due to methodological limitations, regional constraints, and the use of unidimensional performance indicators.

From a theoretical standpoint, the porter hypothesis argues that environmental responsibility can drive innovation and efficiency, enabling firms to improve both their sustainability and competitiveness (Porter and Van der Linde 1995). In the MFI context, environmentally proactive strategies, such as financing solar irrigation pumps or biodegradable packaging microenterprises, can lead to better loan repayment rates, stronger client loyalty, and broader social acceptance. Stakeholder theory also reinforces this argument by emphasizing that institutions perceived as environmentally responsible are more likely to gain legitimacy, funding support, and community goodwill.

Despite these theoretical justifications, few studies have rigorously assessed how environmental performance affects financial efficiency, particularly using non-profit-sensitive methodologies like data envelopment analysis. Our study addresses this gap by incorporating an environmental sub-index into a multidimensional ESG framework tailored to MFIs. This allows us to capture not only the presence of environmental initiatives but also their intensity and integration into institutional strategy. By focusing on MFIs across diverse geographic and regulatory contexts, this study provides novel insights into how environmental commitment influences efficiency outcomes in socially oriented financial institutions. Based on this, we hypothesize:

Hypothesis 2. *The environmental performance of MFIs positively affects their financial efficiency.*

2.3 | Social Performance and Sustainability

The social mission of microfinance institutions, including poverty alleviation, gender empowerment, and financial inclusion, is often considered their defining feature. However, the relationship between social performance and financial efficiency has been a subject of ongoing debate in academic literature. While some scholars argue that social orientation enhances institutional resilience and client loyalty, others caution that aggressive outreach efforts may undermine financial sustainability.

Empirical findings on this topic have been mixed. Shakil et al. (2019) and Maama (2021) found a positive association between social performance and financial indicators such as ROA and client retention. In contrast, Bătae et al. (2021) and Daszyńska-Żygadło et al. (2021) observed a curvilinear and even negative relationship, suggesting that beyond a certain point, deep outreach may reduce operational efficiency due to increased costs and credit risks. These inconsistencies signal a need for refined approaches to both measurement and interpretation.

Within the microfinance literature, social performance is often operationalized through proxies such as loan size per borrower,

the proportion of women borrowers, and rural outreach (Quayes 2015; Tanin et al. 2019). While these indicators offer some insight into the depth of outreach, they do not fully capture qualitative aspects such as empowerment, social cohesion, or the stability of borrower relationships. Hermes et al. (2011) warned against the assumption that broader outreach always translates into improved financial outcomes, pointing instead to potential trade-offs that depend on institutional context and risk management capacity.

Theoretically, stakeholder theory supports the notion that socially responsible institutions build trust among clients, donors, and communities, which can translate into improved repayment rates, reduced default risk, and long-term institutional stability (Freeman 2010). Additionally, Smith's (1759) moral philosophy, particularly his concept of sympathy, suggests that organizations attuned to the well-being of others foster moral capital, which is essential for enduring client relationships and reputational strength.

Despite these theoretical underpinnings, few studies have systematically assessed the impact of social performance on financial efficiency using techniques that reflect the non-profit nature of MFIs. Most prior work emphasizes profit-based measures, potentially overlooking how social engagement contributes to resource utilization and service delivery effectiveness. Our study addresses this by using a DEA framework, which evaluates financial efficiency through input–output optimization rather than profitability, making it particularly suited for mission-driven institutions. Moreover, this study introduces a composite social performance index that captures both quantitative outreach and qualitative engagement dimensions, offering a more holistic understanding of how social orientation influences financial performance. Accordingly, we propose the following hypothesis:

Hypothesis 3. *The social performance of MFIs positively affects their financial efficiency.*

2.4 | Governance Performance and Sustainability

Governance is a foundational element of organizational effectiveness, particularly for microfinance institutions that operate under social mandates and often face limited regulatory oversight. Effective governance structures, such as encompassing board composition, managerial oversight, transparency, and accountability, can significantly influence institutional performance and stakeholder confidence. In the microfinance sector, where informal lending relationships and donor dependencies are common, governance mechanisms are especially critical for ensuring both mission fidelity and financial discipline.

Empirical research has provided compelling evidence linking governance quality to financial performance across financial institutions. Menicucci and Paolucci (2022) and Komath et al. (2023) observed that strong governance practices, including independent board members and regular audits, correlate positively with firm profitability and resilience. In the context of MFIs, Strøm et al. (2014) found that board size and independence were associated with improved financial efficiency. Similarly, Chakrabarty and Bass (2014) and Augustine et al. (2016) highlighted the role of governance in aligning social and financial goals, though their findings also suggested regional variability and contextual sensitivity.

Despite this, many governance studies in the microfinance literature rely on narrow proxies, such as the number of board meetings or the presence of female board members, without exploring how broader governance practices interact with institutional strategy and stakeholder expectations. Moreover, while some studies have explored the relationship between governance and outreach or profitability, relatively few have addressed its influence on financial efficiency, particularly using methods suited for nonprofit-oriented institutions.

Theoretically, the agency theory posits that effective governance structures help align the interests of managers with those of stakeholders, thereby reducing inefficiencies and potential mission drift (Jensen and Meckling 2019). In the case of MFIs, strong governance not only mitigates operational risks but also ensures the organization remains accountable to both its financial supporters and its socially vulnerable clientele. This dual alignment is critical for building trust, improving donor relationships, and ensuring long-term sustainability.

Our study aims to contribute to this body of knowledge by constructing a multi-dimensional governance index that includes variables such as board independence, frequency of oversight, transparency in reporting, and gender diversity. Unlike prior studies that use singular or binary indicators, our approach captures the structural and procedural facets of governance. Furthermore, by linking governance quality to financial efficiency through DEA, we offer a fresh lens for understanding how institutional structure impacts resource utilization and service delivery in socially driven financial organizations. Thus, we propose the following hypothesis:

Hypothesis 4. *The governance performance of MFIs positively affects their financial efficiency.*

2.5 | Moderating Effect of Size in the Relationship Between ESG and Sustainability

The size of a MFI is a structural attribute that significantly shapes its resource base, managerial capacity, client reach, and technological adaptability. Existing literature has shown that institutional size plays a crucial role in determining both the efficiency and the social outreach of MFIs, yet its interaction with ESG practices remains largely underexplored.

Several studies have established that larger MFIs tend to be more financially efficient, benefiting from economies of scale, professionalized governance, and diversified funding sources (Wijesiri et al. 2017; Bibi et al. 2018). These institutions are often better positioned to integrate complex ESG strategies and to report on sustainability outcomes in a more systematic and verifiable manner (Bharti and Chitnis 2016). Conversely, smaller MFIs may face resource constraints, human capital limitations, or regulatory informality, which may hinder their capacity to

effectively implement ESG practices, even if they are socially motivated.

Empirical evidence supporting size-performance heterogeneity is robust. For instance, Bătae et al. (2021) observed that the impact of ESG initiatives in financial institutions can vary based on size, where larger firms are often more capable of absorbing the costs of ESG integration while leveraging their scale to amplify benefits. However, studies focusing on MFIs have rarely tested for interaction effects between ESG components and institutional size in shaping financial efficiency. This represents a critical gap in the literature, particularly given the global diversity of MFI business models and operating environments.

Theoretically, organizational contingency theory posits that the effectiveness of strategic initiatives, such as ESG implementation, depends on structural characteristics like size, age, and geographic scope. From this perspective, institutional size can moderate the relationship between ESG dimensions and performance outcomes, either strengthening or weakening those linkages depending on how well internal capabilities match external demands. For example, large MFIs may derive more benefit from environmental initiatives due to infrastructure and funding capacity, whereas social outreach may be more effective and efficient at smaller scales, where personal relationships and trust are easier to maintain.

This study extends the ESG–efficiency discourse by formally testing the moderating role of MFI size across each ESG dimension. By using interaction terms in the regression analysis and efficiency scores from the DEA model, we uncover whether size strengthens or dampens the effect of environmental, social, and governance practices on financial efficiency. Accordingly, we propose the following set of hypotheses:

Hypothesis 5. *MFIs' size moderates the relationship between ESG performance and financial efficiency.*

Hypothesis 5a. *MFIs' size positively moderates the effect of environmental performance on financial efficiency.*

Hypothesis 5b. *MFIs' size negatively moderates the effect of social performance on financial efficiency.*

Hypothesis 5c. *MFIs size positively moderates the effect of governance performance on financial efficiency.*

3 | Methodology

3.1 | Data and Sample

The study has been conducted through secondary data, collected from the World Bank database. Particularly, the dataset on which the World Bank collaborated with microfinance information exchange (MIX) has been used. This MIX is a reliable database that contains valuable information on MFIs, as it collects data from microfinance institutions globally. This study obtained an unbalanced dataset of 966 MFIs from 97 different countries between 2010 and 2018. The dataset available in the World Bank Data Catalog extends up to 2019 (World Bank 2025). We attempted to extend the panel beyond 2018; however, MIX Market reporting to the World Bank Data Catalog ends in 2019, and the ESG-relevant fields used to construct our indices are not consistently available thereafter. To preserve variable consistency and sample comparability, we restrict the analysis to 2010–2018 due to the data-availability limitation. However, this timeframe ensured reliable coverage of input, output, financial, and governance indicators essential for conducting the efficiency analysis and second-stage regression modeling. Additionally, the world development indicators database is also utilized for control variables such as inflation, GDP per capita growth, etc. The collected data have been edited, processed, and analyzed by the STATA software.

3.2 | First-Stage Data Envelopment Analysis (DEA) Estimation

We estimate the financial efficiency of MFIs using DEA. DEA is well suited for institutions that transform multiple inputs into multiple outputs without a known functional form, and it has been widely used in banking and microfinance efficiency studies (Cooper et al. 2011; Akçay et al. 2012; Sinha and Pandey 2019). Following the intermediation approach that treats MFIs as financial intermediaries, we specify inputs as operating costs, number of employees, and total assets, and outputs as gross loan portfolio and financial revenue. This specification aligns with earlier MFIs applications and captures the core production technology of MFIs (Widiarto and Emrouznejad 2015; Mia and Chandran 2016; Bibi et al. 2018).

An input-oriented model is adopted because managers typically have more control over reducing resource use than over expanding loan demand in the short run, and because the outputs are already defined by portfolio and revenue performance (Widiarto and Emrouznejad 2015; Mia and Chandran 2016; Bibi et al. 2018). We estimate variable returns to scale to allow for scale heterogeneity across MFIs operating in diverse markets and regulatory settings (Cooper et al. 2011). The DEA model used in this study is represented in Table 1.

This process is applied for each MFIs, and an optimal solution of θ yields an efficiency score for an MFI, where $\theta = 1$ indicates a fully efficient MFI and $\theta < 1$ an inefficient MFI. This first stage produces efficiency scores that serve as the dependent variable in the second-stage analysis. Using DEA rather than single financial ratios is consistent with prior microfinance research

TABLE 1 | Mathematical formulation of financial efficiency.

Financial efficiency (input-oriented model)	
$\theta, \lambda j^{\min} \theta$	
Subject to:	
$\sum_{j=1}^{n} \lambda_j Y_{rj} \geq Y_{rj}$	(Y is output, $r = 1,..., s$)
$\theta X_{ij} \geq \sum_{j=1}^{n} \lambda_j X_{ij} \geq Y_{rj}$	(X is input, $i = 1,..., m$)
$\sum_{j=1}^{n} \lambda j = 1$	(MFIs, $j = 1,..., n$)
$\lambda_j \geq 0$	

that seeks a more comprehensive view of sustainability under multiple inputs and outputs (Bibi et al. 2018; Widiarto and Emrouznejad 2015; Sinha and Pandey 2019).

3.3 | Second-Stage Regression Analysis

Following the first stage of DEA for estimating MFIs' sustainability (financial efficiency as a proxy for sustainability), this paper utilizes regression analysis to assess the impact of ESG on financial efficiency. The use of a second-stage regression after DEA estimation is consistent with prior applications in banking and microfinance (Hermes et al. 2011; Mia and Chandran 2016; Wijesiri et al. 2017; Bibi et al. 2018; Alam et al. 2022; López-Penabad et al. 2022). Given that DEA efficiency scores are fractional, bounded between 0 and 1, and derived from a common frontier, the truncated regression model offers a statistically appropriate approach to avoid biased inference that can arise with conventional OLS in this context (Simar and Wilson 2007). It also provides more reliable estimates than dynamic panel estimators such as GMM when the objective is to examine contemporaneous relationships without including lagged dependent variables, and when the outcome variable is bounded rather than continuous and unbounded (McDonald 2009). The truncated regression framework effectively handles the censored nature of the dependent variable, reduces bias from serial correlation in DEA scores, and allows for straightforward incorporation of fixed effects to address unobserved heterogeneity. Its suitability for DEA second-stage analysis is well established in the literature, making it an optimal choice for this study's design.

Furthermore, various performance tests, such as the Hausman and Wald tests, were executed to compare fixed effects (specifically, country-fixed effects and time-fixed effects) against random effects. The results consistently favored the inclusion of both time and country effects in most regression models. Given the panel nature of the data, neglecting country-specific fixed effects for each MFI could lead to biased outcomes. Therefore, both country and time fixed effects are incorporated rather than only including time effects, as is typically done in truncated regression (Bibi et al. 2018).

Control variables are chosen to ensure that the estimated association between ESG and efficiency is not confounded by macroeconomic and institutional factors commonly linked to MFIs' performance. Inflation captures price dynamics that affect the real value of repayments, operating costs, and product pricing, which can influence measured efficiency (Hermes et al. 2011; Mia and Chandran 2016). Log of per capita GDP (PGDP) proxies economic development and financial deepening, conditions that are associated with borrower income stability, demand for financial services, and the cost of doing business (Hermes et al. 2011; Quayes 2015). MFIs' Size, measured by the logarithm of total assets, controls for scale effects and capacity differences, since larger MFIs may achieve higher efficiency through resource optimization and diversification, although size-related complexities can also arise (Wijesiri et al. 2017; Bibi et al. 2018).

Moreover, Tobit regression is employed as a robustness check following Ahamad et al. (2023). Tobit regression is suitable when the dependent variable is censored on one or both sides, and efficiency scores span the range of 0–1. The Tobit model is appropriate for robustness analysis as financial efficiency scores of MFIs are censored at both bounds, with values limited within the 0–1 range. Additionally, Tobit estimation provides unbiased coefficient estimates in such contexts, unlike OLS, as demonstrated by McCarty and Yaisawarng (1993). However, the regression models estimated are as follows:

$$SUST_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 INF + \beta_3 GDP + \beta_4 CYR + \epsilon_{it} + \ldots \quad (1)$$

$$SUST_{it} = \beta_0 + \beta_1 ENV_{it} + \beta_2 INF + \beta_3 GDP + \beta_4 CYR + \epsilon_{it} + \ldots \quad (2)$$

$$SUST_{it} = \beta_0 + \beta_1 SOC_{it} + \beta_2 INF + \beta_3 GDP + \beta_4 CYR + \epsilon_{it} + \ldots \quad (3)$$

$$SUST_{it} = \beta_0 + \beta_1 GOV_{it} + \beta_2 INF + \beta_3 GDP + \beta_4 CYR + \epsilon_{it} + \ldots \quad (4)$$

where *SUST* is denoted as sustainability, *ESG* represents the combined effects of environmental, social, and governance. *ENV* is the individual effect of the environment, *SOC* is the social, and *GOV* is the governance consequently. *INF* as inflation and *GDP* as GDP per capita are denoted as control variables. *CYR* represents country and year fixed effect to control the country and time variation. Furthermore, to analyze the moderating effect of MFIs' size, the following equations have been used:

$$Sust_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 ESG_{it} + \beta_3 \left(SIZE_{it} \times ESG_{it}\right) + \sum_{it}^{n} \beta_{4,5} Control_{it} + \epsilon_{it} + \ldots \quad (5)$$

$$Sust_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 ENV_{it} + \beta_3 \left(SIZE_{it} \times ENV_{it}\right) + \sum_{it}^{n} \beta_{4,5} Control_{it} + \epsilon_{it} + \ldots \quad (6)$$

$$Sust_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 SOC_{it} + \beta_3 \left(SIZE_{it} \times SOC_{it}\right) + \sum_{it}^{n} \beta_{4,5} Control_{it} + \epsilon_{it} + \ldots \quad (7)$$

$$Sust_{it} = \beta_0 + \beta_1 Size_{it} + \beta_2 GOV_{it} + \beta_3 \left(SIZE_{it} \times GOV_{it}\right) + \sum_{it}^{n} \beta_{4,5} Control_{it} + \epsilon_{it} + \ldots \quad (8)$$

3.4 | Operational Definition and Measurement of the Variables

In the context of this research, ESG integration refers to the explicit establishment and public disclosure of policies by MFIs, which aim to address issues and improve transparency in the pursuit of ESG objectives. The creation of a representative index is a notable problem for most of the research that incorporates ESG elements. The MIX Market, operated by the World Bank, gathers comprehensive data pertaining to several aspects of ESG factors. Utilizing the available data, we constructed an ESG index that assigns equal weights to each of the three pillars of ESG. This index is calculated as the total of the weighted additive index for each pillar, serving as a proxy to assess the

TABLE 2 | Definition and measurement of the variables.

Specification	Indicators	Operational definitions	Notation
Dependent variable			
MFIs sustainability	Financial efficiency	Financial efficiency score estimated using input-oriented DEA	SUST
Independent variable			
ESG performance	Environmental performance	It is computed using equally additive index with four aspects from MIX market social performance database	Env
	Social performance	It is computed using equally additive index with three aspects from MIX market social performance database	Soc
	Governance performance	It is computed using equally additive index with four aspects from MIX market social performance database	Gov
	ESG combined score	Equally weighted additive index by using all three pillars	ESG_C
Macroeconomic variables (control)			
Moderating variable	Inflation	Inflation, as measured by the consumer price index, reflects the annual percentage change	INF
	GDP per capita	GDP per capita is gross domestic product divided by midyear population (Current US$)	PGDP
	Log of MFIs asset	Total value of resources controlled by the financial institution because of past events and from which future economic benefits are expected to flow to the financial institution	Size

degree of ESG integration. According to Deng et al. (2013), the utilization of this approach is more favorable compared to a simplistic additive methodology, which gives greater weight to pillars with a higher number of characteristics. Accordingly, the calculation of ESG may be expressed in the following manner (Table 2):

$$ESG_{it} = \sum_{f=1}^{n} \frac{\sum ASP_{it}}{\#\, of\, ASP_{it}}$$

where "*f*" represents the distinct pillars of ESG, whereas "ASP" denotes the diverse aspects within each specific pillar. All variables employed in this research are classified as positive-dichotomous, taking a value of one if the MFIs meet the disclosure requirement, and zero otherwise.

To address environmental integration, we offer environmental awareness programs, loan contracts with clauses to improve environmental practices/mitigate risks, the capacity to assess environmental impacts, and green financing options. To ensure social integration, we have incorporated 15 distinct dimensions, encompassing three main aspects. First, whether the MFIs have any stated target market: women, rural, or youth. Second, whether the MFIs have specific development objectives, such as the enhancement of education, health, housing, youth opportunities, gender equality, access to financial services, poverty reduction, job creation, or the creation of entrepreneurship start-up opportunities. Third, whether the MFIs have poverty objectives for clients who are impoverished, extremely poor, or low-income.

To deal with governance integration, we follow Augustine (2012) and focus on organizational practices affecting the demand side of MFIs' engagements, including aspects related to board orientation, HR policies and staff incentives, audit practices, and board members with social work experience. For the combined ESG score, we include all the ESG pillars.

4 | Findings and Discussions

4.1 | ESG Performance and the Financial Efficiency

The result section is divided into two subsections. First, the section presents the descriptive analysis along with the financial efficiency through the data envelopment approach. The second section presents the impact of ESG and its three pillars on MFIs' financial efficiency through a truncated regression model, while Tobit regression is used to check the robustness of the model. Table 3 shows the descriptive statistics of the study, which indicate that there are a total of 3485 observations, while inflation has some missing observations. However, MFIs' ESG components, such as the environmental index, social index, and governance index, all have mean values of 0.388, 0.511, and 0.307, respectively, whereas the combined ESG score has a mean value of 0.711. Standard deviations of 0.276, 0.23, 0.23, and 0.185 for the respective variables show that the data points are somewhat dispersed relative to the means. Moreover, this result also means that, on average, the social index is performing better than the

other two pillars of ESG. In addition, the combined ESG score has a lower value as it is created through a weighted additive index. The mean value of financial efficiency is 0.711, meaning that on average, 71% of MFIs are financially efficient.

Pairwise correlation matrix is shown in Table 4, which indicates that all the variables have insignificant relationships with financial efficiency except for the log of per capita GDP and size. However, ESG and its components are negatively correlated with financial efficiency except for governance index, although the result is statistically insignificant.

MFIs size is positively correlated with all the variables except for per capita GDP. In addition, size is positively and significantly correlated with governance and environmental index. Moreover, ESG and its components are significantly correlated with each other. Furthermore, the association between the other variables in the model is also displayed through the Pearson correlation analysis. A common method for identifying multicollinearity among variables is correlation analysis. Kennedy (2008) proposed that a correlation coefficient of no more than 0.8 is appropriate. The correlation coefficients are found to be within an acceptable range in Table 4. This means that none of the variables in the models exhibit multicollinearity. Furthermore, Table 5 extends the issue of multicollinearity with the variance inflation factor (VIF) test.

In Table 5, the VIF test shows that all independent variables have less than 5 VIF, meaning that independent variables are moderately correlated with each other. Moreover, the Social index has a higher VIF because of its two dimensions: poverty target (depth) and target market (breadth). Table 5 also represents the degree of tolerance (1/VIF). The lower the tolerance, the higher the level of multicollinearity. So, Table 5 shows that the tolerance level of multicollinearity is not close to zero, meaning that existing collinearity among the variables is tolerable.

Table 6 reports the baseline truncated regression results examining the relationship between ESG performance and the financial efficiency of MFIs. The coefficient for the overall ESG index is positive and statistically significant, indicating that MFIs with stronger ESG practices tend to achieve higher efficiency scores.

TABLE 3 | Descriptive statistics.

Variables	Obs.	Mean	SD	Min.	Max.	Skew.	Kurt.
Financial efficiency	3485	0.711	0.192	0.235	1	−0.385	2.52
Combined ESG score	3485	0.402	0.185	0.02	0.81	−0.011	2.339
Environmental index	3485	0.388	0.276	0	1	0.385	2.467
Social index	3485	0.511	0.23	0.06	0.94	−0.262	2.162
Governance index	3485	0.307	0.23	0	0.75	0.363	2.328
Poverty target (depth of outreach)	3485	0.535	0.352	0	1	−0.121	1.801
Target market (Breadth of outreach)	3485	0.499	0.151	0.25	0.75	0.001	2.74
Log of per capita GDP	3481	3.426	0.37	2.714	4.149	0.152	1.945
Inflation	3413	5.733	3.936	−0.93	20.471	1.352	5.569
MFI size (log of assets)	3485	16.502	1.896	12.224	21.011	0.102	2.691

TABLE 4 | Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) FE	1.000									
(2) ESG	−0.001	1.000								
(3) Env	−0.014	0.105*	1.000							
(4) Soc	0.002	0.694*	0.045*	1.000						
(5) Gov	−0.010	0.109*	0.427*	0.065*	1.000					
(6) Depth	0.014	0.471*	0.044*	0.739*	0.042*	1.000				
(7) Breadth	0.025	0.385*	0.000	0.574*	0.020	0.357*	1.000			
(8) LPGDP	0.192*	−0.054*	−0.083*	−0.041*	−0.114*	−0.029	−0.003	1.000		
(9) INF	0.025	0.048*	−0.039*	0.034*	−0.106*	0.027	0.012	−0.336*	1.000	
(10) size	0.214*	0.006	0.197*	0.005	0.101*	0.002	0.040*	0.064*	−0.076*	1.0

*Significance at $p < 0.05$.

TABLE 5 | Variance inflation factor.

Variables	VIF	1/VIF
Social index	4.113	0.243
Poverty target	2.257	0.443
Combined ESG score	1.976	0.506
Target market	1.525	0.656
Environmental index	1.267	0.789
Governance index	1.258	0.795
Log of per capita GDP	1.161	0.861
Inflation	1.157	0.864
MFI size (log of assets)	1.053	0.95
Mean VIF	1.752	.

This suggests that embedding environmental stewardship, social outreach, and sound governance into operational strategies enables MFIs to optimize resource allocation and service delivery, thereby improving sustainability outcomes.

When the ESG components are examined individually, environmental performance is positively associated with efficiency, implying that initiatives such as green lending policies, reduced resource wastage, and climate risk mitigation can improve cost-effectiveness and operational resilience. Social performance also shows a positive and significant relationship, consistent with the idea that broader outreach, gender inclusion, and community engagement enhance repayment rates and customer loyalty, translating into operational gains. Governance performance likewise exhibits a positive association, reinforcing the notion that transparency, board oversight, and accountability mechanisms foster more prudent financial and risk management practices.

TABLE 6 | Regression results for financial efficiency.

	Truncated regression				Tobit regression			
	ESG	Env	Soc	Gov	ESG	Env	Soc	Gov
Combined								
ESG score	0.029**				0.019			
	[0.013]				[0.012]			
Environmental index		0.037***				0.029***		
		[0.009]				[0.010]		
Social index			0.025**				0.017*	
			[0.010]				[0.010]	
Governance index				0.024**				0.020
				[0.012]				[0.012]
MFI size	0.022***	0.021***	0.022***	0.022***	0.015***	0.015***	0.015***	0.015***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
GDP	0.076	0.084	0.075	0.075	0.131**	0.135***	0.130**	0.129**
	[0.060]	[0.060]	[0.060]	[0.060]	[0.051]	[0.051]	[0.051]	[0.051]
Inflation	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Constant	0.147	0.132	0.148	0.144	0.094	0.085	0.095	0.094
	[0.205]	[0.205]	[0.205]	[0.205]	[0.178]	[0.178]	[0.178]	[0.178]
Observations	3413	3413	3413	3413	3413	3413	3413	3413
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors are in brackets.
Abbreviations: GDP = log of per capita GDP; MFIs size = log of assets.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

These findings align with stakeholder theory, which posits that balancing the interests of multiple stakeholders creates long-term value, and with the resource-based view, which frames ESG practices as intangible capabilities that enhance competitive advantage. Empirically, the results are in line with previous studies that find positive ESG–efficiency relationships in MFIs and financial institutions more broadly (e.g., Wijesiri et al. 2017; Alam et al. 2022; Boubaker et al. 2023). However, this study extends the literature by employing a multi-country sample of 966 MFIs from 97 countries over a nine-year period, integrating DEA-based efficiency scores with ESG indices, and explicitly distinguishing the effects of environmental, social, and governance dimensions rather than relying solely on composite scores.

From a policy perspective, the results imply that strengthening ESG practices is not merely an ethical choice but a strategic approach to improving operational sustainability. For practitioners, these findings highlight the value of targeted ESG initiatives, such as refining governance structures or expanding social outreach that can yield measurable efficiency gains, especially in competitive and resource-constrained environments.

4.2 | Findings on Moderating Analysis

Table 7 examines how MFIs' size influences the relationship between each ESG dimension and financial efficiency. The findings show a mixed pattern. While size amplifies the positive effects of environmental and governance practices on efficiency, it appears to reduce the efficiency benefits associated with social initiatives. This variation across ESG pillars highlights that aggregated ESG scores may obscure the distinctive ways in which institutional scale interacts with sustainability practices, a topic that has received limited attention in microfinance research.

The positive moderation of size in the environmental dimension suggests that as MFIs expand, they can leverage their greater resource base to invest in environmentally responsible practices such as green technologies, energy-efficient operations, and sustainable lending programs. Larger institutions are also better positioned to secure climate finance at competitive terms, and the fixed costs of such initiatives can be spread over a wider operational network. In contrast, smaller MFIs may struggle to absorb these costs, leading to a weaker or delayed impact on efficiency (Ersoy et al. 2022; El Khoury et al. 2023; Zahid et al. 2023).

In the case of the social dimension, the negative moderation effect implies that social programs tend to yield stronger efficiency gains for smaller MFIs than for larger ones. Smaller institutions often maintain close community ties and personalized engagement with clients, which can enhance repayment rates and operational sustainability. When such socially intensive approaches are scaled within larger organizations, the benefits may diminish due to increased administrative layers, reduced client intimacy, and higher monitoring costs (Bătae et al. 2021; Dragomir et al. 2022).

The positive size–governance relationship indicates that governance reforms contribute more to efficiency in larger MFIs. Comprehensive governance structures, including diverse boards, formal audit mechanisms, and rigorous compliance protocols, typically require substantial upfront investment. While smaller MFIs may find these costs prohibitive, larger institutions can capitalize on such frameworks to improve decision-making quality, risk control, and stakeholder confidence, ultimately enhancing financial efficiency (Strøm et al. 2014; Menicucci and Paolucci 2022; Komath et al. 2023).

Taken together, these results suggest that the efficiency gains from ESG practices are not uniform but depend on the interaction between institutional size and specific ESG dimensions. Recognizing these characters is critical for both policy and practice. For smaller MFIs, emphasis should be placed on maintaining the strengths of socially oriented strategies while gradually introducing affordable environmental practices. Larger MFIs, in contrast, should focus on scaling environmental and governance initiatives while redesigning social programs to minimize the potential for efficiency erosion. This pillar-specific and scale-sensitive approach extends recent literature (Bătae et al. 2021; Ersoy et al. 2022; El Khoury et al. 2023; Komath et al. 2023; Zahid et al. 2023) by demonstrating that the efficiency implications of ESG integration are shaped by organizational scale in ways not previously documented.

4.3 | Additional Analysis on Social Dimension

Table 8 separates the social construct into breadth (target market coverage of youth, women, and rural clients) and depth (poverty targeting of poor, very poor, and low-income clients). Both dimensions are positively associated with financial efficiency. The truncated model shows a positive and significant coefficient for breadth, and the Tobit model confirms this result with a slightly larger magnitude. Depth is also positive and significant in both estimators. These findings indicate that MFIs that expand access to underserved groups and that deliberately reach poorer clients tend to utilize resources more effectively, consistent with the idea that social engagement can strengthen repayment discipline, client loyalty, and information flows that reduce operational frictions (Quayes 2015; Tanin et al. 2019).

The size interactions qualify these benefits. For depth, the interaction with size is negative and statistically significant in both truncated and Tobit models, indicating diminishing efficiency returns to poverty targeting as institutions become larger. For breadth, the interaction is negative and statistically significant in the Tobit model and negative but not significant in the truncated model, suggesting a similar pattern that is more pronounced under censoring. Together, these results imply that the efficiency gains from social outreach are strongest among small and medium MFIs and taper at higher scales. A plausible mechanism is that personalized monitoring and strong community ties, which support low default and high repayment regularity, are easier to maintain in smaller organizations but become costlier to replicate in large networks due to additional administrative layers and weaker client intimacy. This interpretation aligns with cautions in the microfinance literature about outreach–cost trade-offs when programs scale without commensurate productivity improvements (Woller 2007; Hermes et al. 2011) and is consistent with recent evidence of non-linear or cost-sensitive social effects in financial institutions (Bătae et al. 2021; Dragomir et al. 2022).

TABLE 7 | Regression results for moderating effect of "MFIs size".

	Truncated regression				Tobit regression				Marginal effect		
	ESG	**Env**	**Soc**	**Gov**	**ESG**	**Env**	**Soc**	**Gov**	**Minimum**	**Mean**	**Maximum**
Combined											
ESG Score (ESG)	0.117				0.050						
	[0.109]				[0.102]						
ESG × Size	−0.005				−0.002						
	[0.007]				[0.006]						
Environmental index		−0.171**				−0.062			−0.02	0.03	0.08
		[0.073]				[0.075]					
Size × Env		0.012***				0.005					
		[0.004]				[0.004]					
Social index			0.235***				0.185**		0.08	0.02	−0.04
			[0.088]				[0.083]				
Soc × Size			−0.013**				−0.010**				
			[0.005]				[0.005]				
Governance index				−0.192**				−0.208**	−0.03	0.02	0.08
				[0.089]				[0.088]			
Size × Gov				0.013**				0.014***			
				[0.005]				[0.005]			
MFI size	0.024***	0.016***	0.029***	0.018***	0.016***	0.013***	0.021***	0.011***			
	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]			
GDP per capita	0.075	0.085	0.074	0.070	0.131***	0.134***	0.130**	0.122**			
	[0.060]	[0.060]	[0.060]	[0.060]	[0.051]	[0.051]	[0.051]	[0.051]			
Inflation	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001			
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]			
Constant	0.115	0.210	0.040	0.234	0.083	0.122	0.009	0.192			
	[0.209]	[0.207]	[0.210]	[0.209]	[0.182]	[0.181]	[0.183]	[0.182]			
Observations	3413	3413	3413	3413	3413	3413	3413	3413			
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			

Note: Standard errors are in brackets.
**$p < 0.05$.
***$p < 0.01$.

TABLE 8 | Impact of social index (breadth and depth) on efficiency.

	Truncated regression		Tobit regression	
	Breadth	**Depth**	**Breadth**	**Depth**
Breadth (target market)	0.268**		0.309**	
	[0.137]		[0.128]	
Breadth × size	−0.013		−0.016**	
	[0.008]		[0.008]	
Depth (poverty target)		0.111*		0.116**
		[0.058]		[0.055]
Depth × size		−0.006*		−0.007**
		[0.003]		[0.003]
MFI size	0.029***	0.026***	0.024***	0.019***
	[0.004]	[0.002]	[0.004]	[0.002]
GDP per capita	0.073	0.076	0.127**	0.131**
	[0.060]	[0.060]	[0.051]	[0.051]
Inflation	0.001	0.001	0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Constant	0.034	0.092	−0.040	0.033
	[0.216]	[0.208]	[0.188]	[0.181]
Observations	3413	3413	3413	3413

Note: Standard errors in brackets.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$. Country and Year Fixed Effect.

These patterns sit well with stakeholder theory, which predicts that socially responsive practices can create efficiency gains through trust and cooperation, while organizational contingency perspectives suggest that the effectiveness of such practices depends on structural characteristics like size. In this sense, Table 8 refines earlier mixed findings on social performance by showing that the positive association with efficiency documented in studies such as Quayes (2015) and Tanin et al. (2019) is size dependent. For practice, the results point to careful design of social programs as institutions grow, with stronger attention to delivery models and cost control so that outreach does not erode efficiency at scale.

5 | Conclusion

This study examined the relationship between environmental, social, and governance practices and the financial efficiency of MFIs across 97 countries from 2010 to 2018, applying a two-stage approach that combined data envelopment analysis with truncated regression. The findings indicate that while overall ESG engagement positively influences MFI efficiency, the effects vary considerably across the three ESG dimensions. Environmental and governance initiatives consistently enhance financial efficiency, whereas the social dimension demonstrates mixed effects depending on institutional size.

The moderating analysis reveals that MFIs' size amplifies the benefits of environmental and governance practices but can diminish the efficiency gains from social initiatives. This suggests that larger MFIs may be better positioned to leverage environmental and governance frameworks due to stronger resource bases and operational capacities, while smaller MFIs may retain advantages in delivering targeted, community-focused social programs. These results contribute to the microfinance and sustainability literature by unpacking the heterogeneity of ESG impacts, an area that remains underexplored compared to studies focusing on ESG as a single aggregate measure.

From a theoretical perspective, the results support resource-based and stakeholder theories, demonstrating that ESG-oriented resources and stakeholder relationships can translate into operational efficiency when aligned with organizational capacities. The disaggregated ESG findings further refine these theories by showing that not all ESG components generate uniform efficiency outcomes, highlighting the importance of contextual and organizational factors in sustainability–performance linkages.

This paper also offers methodological contributions by applying a robust two-stage DEA–truncated regression framework in a large-scale cross-country microfinance study, addressing

potential estimation biases and incorporating both time and country effects. The approach enables a more precise estimation of how ESG practices affect efficiency while accounting for structural and contextual variations across MFIs.

However, the study is subject to certain limitations. First, the analysis relies on MIX Market data available up to 2019, with complete ESG and governance indicators only consistently reported until 2018. This limits the scope for assessing post-2018 trends. Second, while the sample covers a broad range of MFIs globally, the dataset is restricted to reporting institutions, potentially excluding smaller, non-reporting organizations. Finally, although the study controls for several institutional and macroeconomic factors, unobserved variables may still influence the results.

Future research could extend this work by exploring post-2018 ESG developments, incorporating additional institutional quality measures, and examining the role of country-level sustainability regulations. Longitudinal case studies could also complement cross-sectional findings by revealing how MFIs embed ESG principles into their operations over time. These insights naturally lead to practical implications, as the findings on disaggregated ESG dimensions and firm size offer valuable guidance for MFIs, policymakers, and development agencies seeking to balance sustainability goals with financial performance.

6 | Implications and Recommendations

The findings of this study carry several important implications for microfinance institutions, policymakers, and development partners. First, the positive relationship between overall ESG engagement and financial efficiency suggests that integrating sustainability into the core operational strategies of MFIs can strengthen their performance. Policymakers and MFI managers should approach ESG adoption as a strategic driver of efficiency and competitiveness rather than a mere compliance requirement. Regulatory bodies could encourage the adoption of ESG reporting frameworks designed specifically for the microfinance sector, enabling institutions of different sizes to implement measurable and context-appropriate practices.

Second, the disaggregated results show that environmental and governance dimensions consistently improve efficiency, particularly for larger MFIs. This indicates that investing in environmentally responsible lending practices, energy-efficient operations, and strong governance systems such as transparent reporting, effective oversight, and active stakeholder engagement can produce both financial and social benefits. Development agencies and investors may consider providing targeted funding or technical support to help MFIs adopt and expand these practices.

Third, the social dimension, although central to the mission of MFIs, produces mixed efficiency effects when moderated by size. Larger MFIs may need to reassess their social initiatives to ensure that they remain impactful without overextending operational resources, possibly by partnering with local organizations to deliver community programs more efficiently. Smaller MFIs, on the other hand, are often better positioned to maintain socially intensive programs due to their closer connections with communities, but they may need additional financial and technical resources to scale these programs effectively.

Finally, the moderation effects of firm size highlight that uniform ESG policies may not be equally effective for all institutions. Regulators and funders should develop differentiated ESG strategies that consider institutional capacity and scale. For example, environmental and governance enhancements may be prioritized for larger MFIs with wider operational coverage, while socially focused interventions may be better aligned with the capabilities and strengths of smaller, community-based MFIs.

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