

**AI-DRIVEN ESG CREDIT SCORING FOR SMES IN ISLAMIC FINANCE: A
CONCEPTUAL FRAMEWORK**

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ABSTRACT

Small and medium-sized enterprises (SMEs) frequently face financing constraints because conventional credit assessment depends heavily on audited financial statements, established credit histories and collateral. These requirements may disadvantage viable but information-poor SMEs. This conceptual paper develops a literature-derived framework explaining how alternative SME data may be translated into environmental, social and governance (ESG)-related signals and incorporated into artificial intelligence (AI)-assisted credit assessment within Islamic finance. The paper adopts a structured conceptual approach that integrates literature on SME information asymmetry, alternative-data credit assessment, proportionate ESG evaluation, explainable AI and Maqasid al-Shariah-based governance. The framework distinguishes raw operational data from credible business signals and ESG-related indicators. Signaling Theory explains how verifiable, relevant and context-sensitive operational records may reduce information asymmetry, while AI is positioned as a decision-support mechanism that integrates validated alternative signals with conventional financial information. Maqasid al-Shariah operates as an evaluative governance layer guiding data relevance, consent, fairness, explainability, human oversight and institutional accountability. The paper contributes by specifying the conceptual relationships connecting alternative data, ESG-signal formation, AI-assisted analysis and Islamic ethical governance. However, the framework has not undergone expert assessment or empirical validation. It therefore cannot claim improved predictive accuracy, fairness, financial inclusion or Shariah compliance. Instead, it provides a structured set of propositions for future operationalisation, testing and controlled institutional assessment.

Keywords: Artificial Intelligence, Alternative Data, Credit Scoring, SMEs, Islamic Finance

INTRODUCTION

Small and medium-sized enterprises (SMEs) contribute substantially to employment, innovation and economic development. In Malaysia, they constitute most business establishments and represent an important source of national output and employment (SME Corporation Malaysia, 2024). Despite their economic importance, many SMEs continue to have trouble obtaining external financing. This problem is particularly acute among microenterprises, newly established firms and digitally operated businesses that lack audited financial statements, established credit histories or sufficient collateral. Such information limitations increase the perceived risk of SME lending and complicate financial institutions’ ability to distinguish viable firms from genuinely high-risk borrowers (Berger & Udell, 2006; Beck et al., 2008).

Conventional credit assessments rely primarily on historical financial statements, repayment records, financial ratios and collateral values. Although these indicators improve consistency in lending decisions, their backward-looking nature may not adequately represent the current operational condition of information-poor SMEs. The expansion of digital business activities has consequently encouraged lenders to consider alternative data and artificial intelligence (AI)-assisted analytics as complementary assessment tools. Alternative data may include digital transactions, e-commerce sales, utility payments, wage payments and supplier payment records generated through routine business operations. Jagtiani and Lemieux (2019) demonstrated that alternative information and machine-learning techniques can complement traditional credit variables in borrower-risk assessment, although their evidence was derived from a consumer-lending platform. More directly, Cornelli et al. (2024) showed that fintech lending can broaden credit access for underserved small businesses. These studies establish the informational and inclusion potential of technology-enabled credit assessment, but their primary emphasis remains on credit-risk classification, lending outcomes and access to finance.

In parallel, environmental, social and governance (ESG) considerations have become increasingly relevant to financing and investment decisions. However, conventional ESG assessment generally relies on formal sustainability disclosures and reporting systems developed primarily for large corporations. These requirements are difficult to apply directly to SMEs, which often possess limited financial resources, technical expertise and organisational capacity. Setyaningsih et al. (2024) identified financial, technological, organisational and regulatory barriers that restrict SMEs’ ability to produce sustainability reports. Similarly, the OECD (2025) highlighted both the limited availability of granular SME sustainability data and the need for streamlined, proportionate and digitally supported indicators. These findings suggest that the absence of formal ESG reports should not automatically be interpreted as an absence of responsible or sustainable business conduct. Observable operational data may offer an

alternative means of identifying selected ESG-related behaviors, provided that the relevance and validity of each indicator are carefully established.

Nevertheless, the existing literature remains fragmented in three respects. First, research on AI and alternative-data credit scoring largely concentrates on predictive performance, default classification and expanded credit access, without sufficiently explaining how operational data may represent ESG-related conduct. Second, SME sustainability literature establishes the need for simplified and proportionate ESG assessment but offers limited explanation of how such indicators could inform credit assessment. Third, research on explainable credit scoring demonstrates the importance of transparency, auditability and model interpretability (Bücker et al., 2022), but technical explainability alone does not determine whether an alternative-data proxy is contextually valid, ethically appropriate or potentially discriminatory. Questions concerning data consent, proxy validity, sectoral differences, human review and institutional accountability therefore remain unresolved. These concerns are especially significant in Islamic finance, where financing practices are expected to uphold justice, transparency, accountability and the prevention of harm.

Accordingly, the central research question guiding this paper is: How can alternative SME data be translated into ESG-related signals and incorporated into an AI-assisted credit assessment framework governed by Islamic ethical principles? To address this question, the paper develops a literature-derived conceptual framework that connects alternative SME data, proportionate ESG-related indicators, AI-assisted credit analysis and Maqasid al-Shariah-based governance. AI is positioned as a decision-support mechanism that complements conventional financial assessment rather than replacing it or automating the final financing decision.

This paper makes three conceptual contributions. First, it shifts SME ESG assessment from dependence on formal sustainability disclosure towards the cautious use of observable business conduct. Second, it explains the proposed mechanism through which selected alternative data may be translated into ESG-related credit signals and combined with conventional financial information. Third, it positions Maqasid al-Shariah-based governance as a safeguard for data relevance, consent, fairness, explainability, human oversight and institutional accountability. The proposed framework is conceptual and has not been empirically validated. It should therefore be regarded as a structured set of propositions for future empirical testing and model development rather than an immediately implementable credit-scoring system.

LITERATURE REVIEW

2.1 SME Information Asymmetry and Alternative-Data Credit Assessment

SME financing is commonly affected by information asymmetry because lenders possess less reliable information about smaller firms than about established corporations.

SMEs frequently lack audited financial statements, long credit histories and sufficient collateral, making it difficult for financial institutions to differentiate viable firms from genuinely high-risk borrowers (Berger & Udell, 2006; Beck et al., 2008). Signalling Theory suggests that credible and observable information can reduce this asymmetry by allowing firms to communicate otherwise unobservable qualities to external decision-makers (Spence, 1973). In conventional SME financing, financial statements, repayment records and collateral serve as recognised signals of creditworthiness. However, these indicators may disadvantage newly established, informal and digitally operated SMEs whose economic activities are not adequately represented by conventional documentation.

The expansion of digital transactions and financial technology has increased the availability of alternative data for credit assessment. Such data may include payment transactions, e-commerce sales, utility payments, account activity and other operational records. Jagtiani and Lemieux (2019) demonstrated that alternative information and machine-learning techniques could complement traditional credit variables and enhance borrower-risk differentiation. However, their evidence was derived from the LendingClub consumer platform and therefore cannot be transferred directly to SME or Islamic-financing contexts. Cornelli et al. (2024) provide more direct evidence that fintech lending can broaden access to finance among underserved small businesses. Collectively, these studies support the informational and financial-inclusion potential of alternative-data lending.

Nevertheless, much of this literature evaluates alternative data according to predictive accuracy, default classification or credit access. It does not sufficiently examine whether the selected data represents responsible business conduct or sustainability-related characteristics. Alternative data are not inherently meaningful merely because they are digitally available. A utility-payment record, for example, may indicate payment discipline, but it does not automatically establish environmental efficiency. Similarly, regular wage payments may indicate workforce stability but cannot, without contextual evidence, demonstrate fair employment practices. Alternative operational data should therefore be treated as candidate signals whose relevance must be conceptually justified and empirically validated. This limitation provides the point of connection between alternative-data credit assessment and proportionate ESG evaluation.

2.2 From Alternative Data to Proportionate ESG-Related Signals

Environmental, social and governance factors may influence SME resilience through operating costs, regulatory compliance, workforce stability, reputation and managerial quality. Nevertheless, most established ESG frameworks rely on formal disclosures and sustainability reports that were developed primarily for large organisations. Their direct application to SMEs is problematic because smaller firms

often lack the resources, expertise and information systems required to produce extensive non-financial reporting.

Setyaningsih et al. (2024), through a systematic review of 37 studies, identify financial, knowledge and technology, organisational, regulatory and socio-environmental barriers to SME sustainability reporting. The OECD (2025) similarly observes that financial institutions lack sufficiently granular information on SME sustainability performance while SMEs face disproportionate reporting costs and capacity constraints. It consequently recommends more streamlined indicators, greater proportionality and the use of digital tools to facilitate SME sustainability assessment. These studies suggest that the absence of formal ESG disclosure should not automatically be interpreted as evidence of poor environmental, social or governance performance.

One possible response is to assess selected aspects of observable business conduct. Environmental signals might be derived from resource-consumption trends, waste-management records or regulatory compliance. Social signals may include wage-payment regularity, employee turnover, occupational-safety records and substantiated customer complaints. Governance-related signals may include tax compliance, supplier-payment behaviour, separation of personal and business accounts and transaction traceability. These indicators may reduce the reporting burden by using information generated through routine business operations. They may also extend ESG assessment beyond firms capable of producing formal sustainability reports.

However, the translation from operational data to ESG-related signals requires caution. A raw data point is not equivalent to an ESG indicator, and an ESG indicator is not necessarily a predictor of repayment capacity. The proposed relationship must be supported by a plausible mechanism. For example, persistent resource inefficiency may affect operating costs, while unstable payroll or repeated safety violations may indicate operational disruption and reputational risk. Governance weaknesses may be associated with poor internal control or agency risk. Even so, these relationships can vary across industries, locations and firm sizes. A manufacturing firm cannot be assessed against the same utility-use pattern as a digital service provider. Proportionate SME ESG assessment therefore requires sector calibration, data-quality checks and empirical testing. ESG-related signals should complement but not replace those financial analysis, cash-flow analysis and professional credit judgement.

2.3 Explainable AI, Fairness and Decision Accountability

Machine-learning techniques can process high-dimensional and frequently updated data more efficiently than static scorecards. Comparative credit-scoring research indicates that advanced classifiers may outperform traditional statistical methods in particular datasets (Lessmann et al., 2015). Nevertheless, predictive performance alone is insufficient in high-stakes financing decisions. Complex models may obscure how

variables influence an outcome, creating difficulties for applicants, credit officers, auditors and regulators.

Bücker et al. (2022) distinguish transparency, auditability and explainability as important requirements for machine-learning credit models. Their analysis shows that advanced models can retain predictive advantages while providing explanations accessible to relevant stakeholders. Explainability can help identify the variables influencing a decision, enable model review and allow credit officers to communicate adverse outcomes to applicants. It is therefore an essential component of responsible AI-assisted credit assessment.

However, an explainable decision is not necessarily a fair decision. A model may clearly explain that a particular variable reduced an applicant's score while still relying on an inappropriate or discriminatory proxy. Historical lending data may reproduce earlier patterns of exclusion, while alternative variables may indirectly capture protected or socioeconomically sensitive characteristics. Data completeness can also differ across SME segments, creating systematic disadvantages for less-digitised firms. Responsible assessment therefore requires more than post-hoc model explanation. It also requires justification of variable selection, consent and lawful data access, testing for disparate outcomes, continuous monitoring and access to human review.

Accordingly, AI should be positioned as a decision-support mechanism rather than an autonomous decision-maker. It may organise information, identify patterns and generate provisional risk assessments, but final accountability must remain with the financing institution. This distinction is especially important when alternative data are used as ESG-related proxies because both the credit relevance and ethical acceptability of those proxies must be evaluated. Technical AI-governance literature establishes the need for transparency and oversight, but it does not fully determine the ethical objectives against which the design and consequences of a financing system should be assessed. This creates a role for Maqasid al-Shariah within Islamic finance.

2.4 Maqasid al-Shariah and Ethical Governance in Islamic Finance

Islamic finance is not limited to the formal avoidance of prohibited contractual elements. Contemporary Maqasid scholarship argues that Islamic financial activity should also be assessed according to its purposes, processes and socioeconomic consequences. Dusuki and Abdullah (2007) relate Maqasid al-Shariah and *maslahah* to broader corporate responsibility, suggesting that Islamic institutions have obligations extending beyond shareholders and formal contractual compliance. Laldin and Furqani (2013) distinguish between the ends and means of Islamic finance and identify wealth circulation, fair and transparent financial practices, and justice at micro- and macroeconomic levels as important objectives. This approach provides a stronger foundation than a general assertion that Islamic finance is inherently ethical because it requires institutional practices to be evaluated against identifiable objectives.

Meanwhile, Asutay and Harningtyas (2015) developed a Maqasid-based index to evaluate the social performance of Islamic banks and reported uneven achievement across institutions and dimensions. Their findings are important because they demonstrate that Shariah-compliant status does not automatically ensure the fulfilment of broader ethical and developmental objectives. Mergaliyev et al. (2021) further developed an augmented Maqasid framework to evaluate the ethical performance of Islamic banks, reinforcing the need to assess institutional outcomes rather than relying solely on formal compliance. These studies move Maqasid from a purely normative concept towards an evaluative framework capable of guiding and scrutinising institutional conduct.

The relationship between Maqasid and ESG must nevertheless be treated carefully. ESG and Islamic finance overlap in their concern for responsible conduct, accountability and stakeholder welfare, but they are neither identical nor interchangeable. ESG is generally organised around environmental, social and governance risks and impacts, whereas Maqasid provides a broader ethical evaluation of objectives and consequences. In AI-assisted SME assessment, Maqasid may therefore function as a governance layer that evaluates whether the system protects legitimate wealth, promotes justice and public interest, and prevents avoidable harm.

This position has direct implications for framework design. Justice requires testing whether data and model outcomes disadvantage particular SME groups without legitimate risk justification. Protection of wealth applies both to responsible financing decisions and to the security and proportional use of applicants' commercial data. Amanah requires traceable data sources, explainable decisions and clear institutional responsibility. Maslahah supports the use of innovation to widen responsible access to finance, while prevention of harm limits excessive surveillance, invalid proxies and fully automated rejection without meaningful review. Maqasid does not provide a mathematical credit-scoring algorithm; rather, it establishes evaluative criteria governing which data may be used, how models should operate and who remains accountable for their consequences.

2.5 Integrative Foundations and Unresolved Conceptual Linkages

The reviewed literature provides complementary but incomplete foundations for AI-assisted ESG credit assessment. SME-financing research explains why conventional information requirements may exclude viable firms, while alternative-data studies demonstrate the potential of digitally generated information to improve borrower assessment. Research on SME sustainability establishes the need for proportionate ESG indicators, while studies on explainable AI emphasise the importance of transparency, auditability and human oversight in AI-assisted credit assessment. Maqasid scholarship extends these concerns by requiring the objectives, processes and consequences of financing decisions to be evaluated in relation to justice, wealth protection, public interest and prevention of harm.

However, these streams remain insufficiently integrated. Existing research does not clearly explain how operational SME data may be translated into credible ESG-related credit signals, how those signals should complement conventional credit information, or how their use should be governed within Islamic finance. The conceptual framework developed in the following section addresses this fragmentation by connecting alternative data, ESG-signal formation, AI-assisted analysis and Maqasid-based governance within a single literature-derived and empirically testable structure.

FRAMEWORK DEVELOPMENT

3.1 Conceptual approach

This paper adopts a conceptual review approach to integrate insights from four related domains: SME financing constraints, alternative-data and AI-assisted credit assessment, proportionate ESG evaluation, and Maqasid-based governance in Islamic finance. The study is not intended as a systematic review and does not claim exhaustive coverage of the literature. Instead, relevant peer-reviewed studies and authoritative institutional publications were purposively selected based on their direct contribution to the research question and proposed framework.

The selected literature was examined to identify four forms of conceptual input: SME information constraints, observable operational data, ESG-related indicators and ethical-governance requirements. These elements were then compared and synthesised according to their relevance to SME credit assessment. Alternative-data studies informed the proposed data inputs; SME sustainability studies guided the identification of proportionate ESG-related signals; research on explainable AI informed the analytical and decision-support components; and Maqasid al-Shariah and Value-based Intermediation literature informed the governance layer.

Framework components were retained when they demonstrated conceptual relevance, potential observability at SME level, plausible credit relevance, compatibility with proportionate ESG evaluation, and consistency with explainability and Islamic ethical principles. This process resulted in four connected components: alternative SME data, ESG-related signal formation, AI-assisted credit analysis and Maqasid-based governance. The resulting framework is literature-derived but remains conceptually proposed and empirically unvalidated. It is intended to provide a foundation for subsequent expert assessment, operationalisation and empirical testing.

3.2 Proposed AI-driven ESG credit-scoring framework for Islamic SME financing

Figure 1 presents four connected stages. First, the institution obtains verified conventional records and consented alternative data. Second, data are converted into transparent ESG-related indicators rather than treated as ESG evidence by default. Third, an AI model estimates risk, identifies the main contributing factors and produces an explainable output. Fourth, credit officers use the output to support approval, pricing,

facility design and monitoring. Maqasid-based governance applies across the analytical and decision stages through data minimisation, fairness testing, human oversight and Shariah and regulatory accountability.

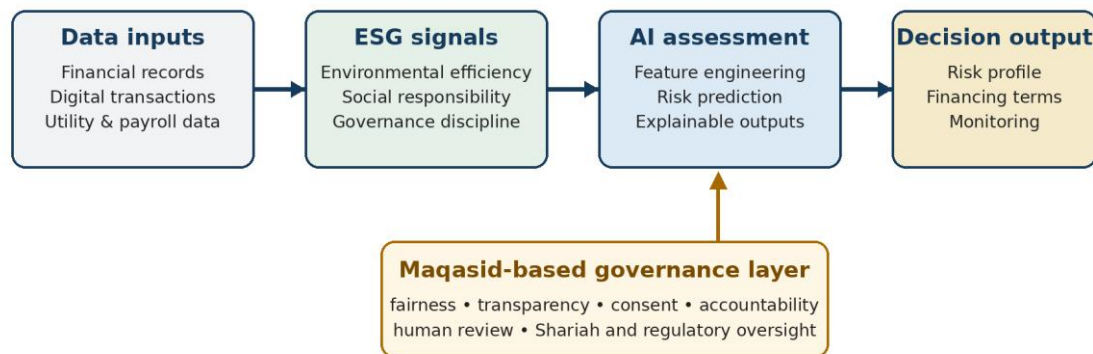


Figure 1. AI-driven ESG credit-scoring framework for Islamic SME financing

Proposition 1. *The use of relevant and verified alternative data increases the informational completeness of SME credit assessment by making selected operational and ESG-related behaviours observable.*

Proposition 2. *AI-assisted integration of financial and ESG-related signals improves the timeliness and discriminatory capacity of SME risk assessment relative to reliance on static financial records alone.*

Proposition 3. *Explainability, human review and Maqasid-based governance strengthen the fairness and accountability of AI-assisted SME financing decisions.*

Proposition 4. *An integrated AI–ESG assessment can expand financing consideration for information-poor but viable SMEs without removing conventional prudential controls.*

DISCUSSION AND IMPLICATIONS

The proposed framework offers an integrated explanation of how alternative SME data may contribute to credit assessment without treating all digitally available information as automatically meaningful. Its central argument is that alternative data become useful only through a theoretically and contextually justified transformation. Operational records must first be assessed for verifiability and relevance before they can function as credible signals. Selected signals may subsequently be mapped to environmental, social or governance dimensions, while AI assists in integrating those signals with conventional financial information. Maqasid al-Shariah-based governance

operates across these processes by evaluating the legitimacy of data selection, proxy construction, analytical use and institutional decision-making.

4.1 Data-to-Signal Transformation and Theoretical Logic

Signaling Theory explains why selected operational data may reduce information asymmetry between SMEs and financing institutions. SMEs possess operational qualities that may not be directly observable to lenders, especially when audited financial statements and established credit histories are unavailable. Digital records can make selected qualities more visible, but a data point becomes a credible signal only when it is verifiable, relevant to an underlying business characteristic and interpreted within an appropriate operational context.

For example, regular supplier payments may signal financial discipline and reliability towards business partners, while stable payroll records may indicate workforce continuity. Tax compliance and the separation of personal and business accounts may provide evidence of governance discipline and internal control. Nevertheless, the meaning of each signal remains context dependent. Irregular payments may reflect seasonal business conditions rather than weak financial discipline, while high utility usage may be normal for a manufacturing firm but unusual for a digital-service enterprise. Signal credibility therefore depends on sector calibration, firm size, data quality and the availability of an explicit behavioural explanation.

The transformation of alternative data into ESG-related indicators requires a further conceptual step. Resource-consumption data may provide an environmental-efficiency signal only when evaluated relative to output, sector and firm size. Payroll regularity, employee turnover and workplace-safety records may reflect selected aspects of social responsibility and operational continuity. Tax compliance, supplier-payment behaviour and transaction traceability may provide governance-related signals. By contrast, digital sales and cash-flow volatility are more appropriately classified as financial-behaviour signals rather than ESG indicators. The framework therefore distinguishes among raw operational data, financial-behaviour signals and ESG-related signals instead of treating all alternative data as equivalent evidence of sustainability.

4.2 Conceptual Propositions

The first proposed relationship concerns the capacity of observable operational records to reduce SME information asymmetry. Signaling Theory suggests that lenders can form more informed assessments when firms provide credible evidence of otherwise difficult-to-observe qualities. However, the informational value of these records depends on their reliability and contextual relevance. **Proposition 1:** When observable SME operational data are verifiable, contextually relevant and sufficiently resistant to manipulation, they can function as credible signals that reduce information asymmetry in SME credit assessment.

The second relationship concerns the validity of ESG-proxy construction. Raw data should not be classified as an ESG indicator solely because it relates to environmental, employee or governance activity. A defensible proxy requires an explicit mechanism connecting observed conduct to an ESG dimension and must account for differences in sector, scale and operating conditions. **Proposition 2:** The translation of alternative SME data into ESG-related signals is more conceptually valid when the proposed proxies are supported by an explicit behavioural mechanism and calibrated according to sector, firm size and operating context.

The third relationship concerns the role of AI. AI does not independently determine the meaning of a variable or establish its ethical acceptability. Instead, it can assist in integrating heterogeneous data, identifying patterns and producing explainable risk insights. The expected contribution is improved informational completeness and analytical consistency, not an automatic guarantee of greater predictive accuracy or financial inclusion. **Proposition 3:** AI-assisted integration of conventional financial information and validated ESG-related signals can provide a more comprehensive basis for SME credit assessment than reliance on either information source alone.

The fourth relationship concerns governance. The use of relevant data and an explainable model do not, by itself, ensure that the assessment process is ethically legitimate. Institutional safeguards are required throughout data collection, proxy formation, model analysis and the final financing decision. **Proposition 4:** Maqasid-based governance strengthens the procedural and institutional accountability of AI-assisted credit assessment by requiring data relevance, consent, fairness, explainability, human review and evaluation of potential harm.

These propositions describe theoretically expected relationships and do not constitute empirically tested hypotheses. They provide a basis for subsequent operationalisation, expert assessment and empirical validation.

4.3 The Added Governance Role of Maqasid al-Shariah

Maqasid-based governance complements rather than replaces general ethical-AI principles. Ethical-AI frameworks commonly emphasise fairness, transparency, privacy, explainability and accountability. Maqasid al-Shariah adds a purpose- and consequence-oriented evaluation by connecting these requirements to the institutional objectives of Islamic finance. It requires consideration not only of whether a model operates transparently, but also of whether data practices protect legitimate wealth, whether model outcomes prevent avoidable harm and whether technological innovation contributes to equitable access to responsible financing.

This distinction gives Maqasid a specific function within the framework. The protection of wealth requires financing institutions to safeguard applicants' commercial data and avoid decisions that expose either the institution or SME to irresponsible financing risk. Justice requires examination of whether proxies and model outcomes

systematically disadvantage groups without legitimate risk justification. Amanah requires traceable data sources, understandable explanations and clear institutional responsibility. Maslahah supports the use of technological innovation to address genuine information gaps, while the prevention of harm limits excessive surveillance, invalid proxies and fully automated rejection without meaningful review.

Maqasid is therefore not treated as a credit-scoring variable, statistical predictor or moderator. It functions as an evaluative governance framework that shapes which data may be used, how indicators are constructed, how model outputs are interpreted and who remains accountable for the resulting decisions. This extends the framework beyond procedural compliance by requiring the purposes and consequences of AI-assisted financing assessment to be considered.

4.4 Practical and Institutional Implications

For future pilot assessment, Islamic banks may begin with a narrowly defined SME segment and a limited number of auditable candidate indicators. Each indicator should have a documented data source, behavioural rationale, expected relationship with credit risk and specified circumstances in which it should not be used. Credit-risk specialists, sustainability officers and Shariah reviewers should jointly assess whether the proposed indicators are relevant, proportionate and ethically acceptable.

Candidate indicators should subsequently be tested for data quality, stability, incremental informational value and disparate outcomes across relevant SME groups. Their performance should be compared with a transparent conventional baseline and examined separately according to sector and firm size. Importantly, variables used to estimate repayment capacity should be distinguished from those used for sustainability engagement. An SME should not be denied financing solely because an experimental ESG-related proxy has not yet been validated.

AI outputs should initially operate as decision support alongside professional credit judgement. Institutions should document model explanations, adverse decisions, human overrides and applicant appeals. Monitoring may include changes in model performance, override rates, complaints and outcomes among previously unscorable SMEs. The financing institution must remain accountable for the final decision and should not transfer responsibility to the technology provider or algorithm.

For regulators and Shariah committees, the framework highlights the need for data-provenance checks, privacy safeguards, bias assessment, periodic revalidation and accessible review mechanisms. Shariah governance should therefore examine not only the contractual structure used after financing approval but also whether the assessment process reflects fairness, transparency, protection of wealth and prevention of harm.

4.5 Limitations and Validation Pathway

The framework remains literature-derived and empirically unvalidated. Candidate ESG proxies may vary across industries and may sometimes measure financial discipline more strongly than sustainability. Access to digital data may also favour highly digitised SMEs and create new forms of exclusion for firms operating through informal or cash-based systems. Furthermore, the proposed relationships do not establish that the inclusion of ESG-related signals will necessarily improve predictive accuracy, reduce default or expand financing access.

Future research should first subject the data-to-signal mappings and governance criteria to expert assessment involving credit-risk specialists, SME practitioners, sustainability professionals and Shariah scholars. Subsequent studies may operationalise the proposed indicators using SME-level data, test their incremental value against conventional credit models and examine differences across sectors and firm sizes. Further research should also compare interpretable algorithms with more complex models and investigate whether Maqasid-based governance improves perceived fairness, applicant trust and institutional accountability. Until such validation is undertaken, the framework should be treated as a structured conceptual proposition rather than an operational credit-scoring model.

In this section, please present the results of the research that has been conducted. Include any relevant tables or figures. All tables and figures should be cited or mentioned in the preceding paragraph. The discussion should compare the results obtained with existing theories. Compare the results obtained with those of various previous studies. Avoid a discussion that relies solely on the author’s logic without comparing the findings to those of other researchers. In this section, the author should be able to explain the “why” behind each result obtained.

CONCLUSION

This paper develops a literature-derived conceptual framework explaining how alternative SME data may be translated into ESG-related signals and incorporated into AI-assisted credit assessment under Maqasid al-Shariah-based governance. Its theoretical contribution lies in clarifying a mechanism that has remained fragmented across SME-financing, alternative-data, ESG, explainable-AI and Islamic-finance research. In particular, the framework applies Signaling Theory to distinguish raw operational data from credible business signals and, subsequently, from ESG-related indicators. This distinction is important because digital availability alone does not make a variable a valid signal, while an operational signal does not automatically constitute evidence of environmental, social or governance performance. The framework further positions AI as a mechanism for integrating conventional financial information with validated alternative signals rather than as an autonomous decision-maker.

The paper also specifies the conceptual role of Maqasid al-Shariah. Maqasid is not proposed as a credit-scoring variable, a statistical predictor or a substitute for general ethical-AI principles. Instead, it functions as an evaluative governance layer that connects data relevance, consent, fairness, explainability and human oversight to the wider objectives and consequences of Islamic financing. Its proposed value lies in requiring financing institutions to consider whether data practices protect legitimate wealth, whether assessment processes avoid preventable harm and whether institutional decisions remain consistent with justice and public interest.

Several conceptual boundaries must be recognised. The proposed indicators are candidate proxies rather than validated ESG measures, and their relevance may vary according to industry, firm size, location and data availability. Some alternative variables, including digital sales and cash-flow patterns, may represent financial behaviour more directly than ESG performance. The framework is designed for AI-assisted assessment and does not support fully automated financing decisions. It also does not imply that Maqasid-based governance, Shariah compliance and ESG performance are equivalent concepts.

Most importantly, the framework has not been subjected to expert validation, operational testing or empirical analysis using SME loan-performance data. Consequently, this paper cannot claim that the proposed framework improves predictive accuracy, produces fairer decisions, expands financial inclusion or ensures Shariah compliance. These remain theoretically anticipated possibilities that require independent testing. Future research should validate the proposed data-to-signal mappings, develop measurable indicators, compare the framework with conventional credit-assessment models and examine its outcomes across SME sectors and demographic groups. Expert assessment involving credit-risk professionals, SME practitioners, sustainability specialists and Shariah scholars is also required before any controlled institutional pilot. The framework should therefore be understood as a structured basis for future empirical investigation rather than an operationally validated credit-scoring model.

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