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Validation of Loan Applicants Using Environmental, Social, and Governance Indicators

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Abstract

This study examines the impact of Environmental, Social, and Governance (ESG) indicators on the selection and ranking performance of corporate banking clients. Given the increasing importance of sustainability in financial systems, this research seeks to investigate the effects of ESG indicators on reducing credit risk and improving financial performance. The data utilized includes information from clients of selected banks in emerging markets and has been analyzed using advanced econometric methods. The results indicate that ESG indicators play a significant role in reducing financing costs and enhancing investor confidence. Furthermore, banks that are leaders in implementing ESG criteria have achieved more sustainable performance through better risk management. Finally, it is suggested that standardized policy and reporting frameworks be designed in developing countries to facilitate the implementation of ESG criteria.

Keywords: *ESG, financial sustainability, banking, credit risk, financial performance*

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1. Introduction

The direct relationship between investment and economic development plays a fundamental role in the progress of nations [1]. Optimal allocation of financial resources to economic sectors, particularly through financial institutions such as banks, is a key instrument for promoting social and economic welfare [2]. Among these, banks, as the principal actors in financial markets, are responsible for mobilizing and allocating resources [3]. However, inefficient allocation of resources can lead to capital waste, increased economic risks, and reduced productivity [4]. Therefore, designing and implementing efficient credit assessment systems to improve resource management and mitigate associated risks is of paramount importance [5].

Credit risk, one of the most significant challenges in the banking system, directly affects the financial and economic health of banks [6]. This risk refers to the likelihood of borrowers failing to repay their loans, which can lead to liquidity issues for banks and diminished public trust [7]. Managing this risk by identifying and categorizing clients based on their ability and willingness to meet obligations is a critical necessity for banks [8]. Employing efficient credit assessment systems can reduce default-related costs, enhance the efficiency of resource allocation, and direct loans toward lower-risk clients [2].

According to the Central Bank report, the total loans disbursed by banks increased to approximately 892.5 trillion tomans by the end of summer 2023, reflecting a 35% growth compared to the same period in the previous year. These statistics indicate that a significant portion of these loans—60%—was allocated in Tehran Province, followed by Isfahan and Razavi Khorasan provinces. Additionally, the total bank deposits reached 697.7 trillion tomans by the end of July 2023, marking an 8.5% increase since the beginning of the year. These figures highlight the growing demand and distribution of resources within the national banking network [9, 10].

The considerable concentration of credit in Tehran Province, while potentially justifiable for economic reasons, raises issues related to economic justice and regional balance [3]. This uneven distribution underscores the need for serious reforms in the existing credit assessment system to ensure fair resource allocation. Utilizing modern credit assessment systems that consider diverse criteria—including financial capacity, credit risk, and Environmental, Social, and Governance (ESG) factors—can improve this situation and enable a more equitable distribution of resources across the country [4].

In recent decades, ESG criteria have emerged as an effective tool for enhancing the credit assessment process for banking clients. These criteria enable banks to focus not only on profitability but also on social responsibility and sustainable development [5]. By integrating these criteria into decision-making processes, banks can identify clients who demonstrate greater commitment to transparency, resource management, and sustainability, thereby mitigating risks associated with lending [7]. This approach not only fosters public trust but also strengthens the social standing of banks.

Recent economic and social developments indicate that traditional credit assessment models are no longer sufficient to meet the needs of the banking system [1]. Banks must adopt more comprehensive models that consider both financial criteria and ESG dimensions. These models can improve economic justice, reduce public distrust, and strengthen the relationship between banks, clients, and investors [11]. Furthermore, employing these criteria enables banks to more accurately identify and manage risks associated with social, environmental, and governance factors [8].

The literature on ESG integration and credit evaluation in banking highlights diverse approaches and findings. Kasiri et al. (2024) developed a comprehensive reporting framework for Iranian banks, emphasizing transparency and reporting quality [9]. Mohammadi et al. (2024) identified financial literacy, governance, and modern technologies as pivotal for resource allocation [12]. Green banking models, as proposed by Zadfalah et al. (2024), stress environmental and ethical considerations, while Daneshman and Tarazi (2024) demonstrated how ESG activities mitigate lending declines during financial crises [13]. Studies like Andries and Sprincenian (2023) linked ESG adoption to reduced financing costs, with governance playing a dominant role [14], whereas Menicucci and Paolucci (2023) reported environmental criteria improving financial performance in Italy's banks [15]. In Middle Eastern contexts, Khoury et al. (2023) found ESG scores influenced by economic development and bank size. Advanced modeling techniques [16], such as those by Tolouei Ashleghi et al. (2021), integrated AI for credit risk prediction, achieving notable accuracy improvements [10]. Across these studies, the critical role of governance and social responsibility in enhancing financial stability and stakeholder trust emerges,

underscoring the potential of ESG criteria in revolutionizing banking practices globally.

This research aims to design an ESG-based credit assessment model for Iran's banking system. The model seeks to provide solutions for reducing credit risk, improving financial resource allocation, and enhancing the strategic position of banks at both national and international levels. Integrating ESG principles into the credit assessment process, in addition to promoting sustainable development, can help banks comply with global requirements and address challenges arising from social and economic changes. This study represents a step toward establishing a more efficient and responsible banking system in Iran.

2. Methodology

The research process begins with a literature review to identify theoretical foundations and initial indicators. Subsequently, thematic analysis is employed as a qualitative method to aggregate and categorize ESG indicators. To identify causal relationships among the indicators, the Fuzzy DEMATEL method is utilized. This approach analyzes the mutual relationships between indicators based on pairwise comparisons, determining the intensity of influence and dependence of each indicator.

In the next stage, corporate clients are ranked based on ESG indicators using the Fuzzy ARAS method. This method constructs a decision matrix and normalizes data to calculate the desirability of each option based on weighted criteria. The criteria weights are determined using the Best-Worst Method (BWM), where expert opinions are used to identify and weight the key criteria. Finally, the results of this process provide an accurate ranking of clients across various ESG dimensions, aiding decision-makers in formulating appropriate strategies.

The Fuzzy DEMATEL method is an effective tool for analyzing the interrelations and influence of criteria in decision-making processes, operating based on pairwise comparisons. Introduced by Fontela and Gabus, it aims to identify criteria with the most significant influence on other factors. The execution process of Fuzzy DEMATEL involves several steps. First, evaluation criteria are defined, and a scoring scale is established to assess the strength or weakness of relationships among factors. A fuzzy direct-relation matrix is then constructed based on expert opinions and pairwise comparisons. Subsequently, normalized and total-relation fuzzy matrices are developed. The final step involves defuzzification of the total-relation matrix to compute the intensity of influence and dependence of factors. These vectors are used to determine the causal or effect-based positioning of factors and to evaluate overall relationships among criteria.

The Fuzzy ARAS method is a multi-criteria decision-making technique designed for evaluating and selecting the best option based on multiple criteria, particularly in financial and credit-related contexts. Proposed by Zavadskas et al. in 2010, this method aims to identify the option with the greatest distance from negative factors and the least distance from positive ones. Fuzzy ARAS is widely used in evaluating stock companies and financial information and is comparable to methods like TOPSIS and VIKOR due to its simplicity. The process begins with constructing a decision matrix, where options are scored based on specified criteria. This matrix serves as the foundation for ARAS computations, aiding in the final analysis and selection of the optimal option.

Table 1. Linguistic Fuzzy Variables Used in This Study

Linguistic Terms	Trapezoidal Fuzzy Number for Option Evaluation
Very Low (VL)	(0, 0, 1, 2)
Low (L)	(1, 2, 2, 3)
Medium Low (ML)	(2, 2, 4, 5)
Medium (M)	(4, 5, 5, 6)
Medium High (MH)	(5, 6, 7, 8)
High (H)	(7, 8, 8, 9)
Very High (VH)	(8, 9, 10, 10)

Data normalization is a critical step that ensures standardization of diverse criteria for more accurate evaluations. Initially, a normalized decision matrix is constructed using techniques such as linearization and then converted into a weighted normalized matrix. Criteria weights are determined using methods like the Best-Worst Method (BWM), where experts' opinions are employed to identify the best and worst criteria and perform pairwise comparisons. The final steps involve calculating the desirability of each option (Si) and the degree of desirability

(Ki), enabling the identification of the best option with the highest desirability.

Incorporating fuzzification in these methods helps manage ambiguity and uncertainty in input data, resulting in higher validity and reliability of outcomes. The Best-Worst Method (BWM), as an advanced multi-criteria decision-making technique, focuses on pairwise comparisons of criteria to identify the most significant ones. By accurately selecting the best and worst criteria and comparing them against others, BWM ensures precise and logical weighting. When weights are correctly adjusted, and processes are reproducible, the results of this method are consistent and robust. In fuzzy versions of this model, the use of fuzzy numbers enhances uncertainty coverage and increases analytical precision.

Data is collected through questionnaires and expert interviews and then transformed into trapezoidal fuzzy numbers, contributing to greater flexibility in the analysis.

3. Findings and Results

This study involved 17 experts from banking and financial fields, including 9 men and 8 women, with an average age of 47.5 years for men and 39.3 years for women. The participants had work experience ranging from 6 to 27 years, with an average of 18.3 years, and held various positions such as university professors, bank managers, financial researchers, and banking specialists. In terms of education, 9 participants held doctoral degrees (primarily men), while 8 had master's degrees (primarily women). This diversity in gender, age, work experience, and educational background enriched the research with comprehensive perspectives, leading to more practical analyses and accurate results.

Thematic analysis in the environmental, social, and governance (ESG) domains revealed extensive findings regarding sustainability initiatives and practices.

In the environmental domain, companies aim to reduce environmental impacts by minimizing energy consumption, managing waste, and adopting renewable energy. Initiatives include investment in green technologies, resource efficiency, pollution reduction, biodiversity conservation, and green financing, all of which contribute to sustainable development and reducing the carbon footprint.

In the social domain, key areas include employee welfare, human rights promotion, customer relations, and participation in social projects and impact investments. Efforts such as ensuring workplace health and safety, equitable pay and working conditions, diversity and inclusion, and fostering professional ethics enhance employee and customer satisfaction while improving the social reputation of companies.

In the governance domain, transparency, accountability, and risk management are prominent themes. Companies strive to enhance performance and stakeholder trust by developing robust governance structures, ensuring board diversity, complying with regulations, and implementing anti-corruption policies. Transparent reporting and whistleblower protections also reflect a commitment to ethical and accountable behavior.

This comprehensive analysis highlights that focusing on ESG criteria can significantly contribute to sustainable development and improve organizational performance.

Table 2. Summary of Identified Criteria and Codes

Code	Environmental (E)	Code	Social (S)	Code	Governance (G)
E1	Sustainable practices	S1	Community engagement	G1	Corporate governance
E2	Climate change initiatives	S2	Employee welfare	G2	Transparency & accountability
E3	Resource efficiency	S3	Human rights	G3	Risk management
E4	Pollution control	S4	Customer relations	G4	Ethical leadership
E5	Biodiversity conservation	S5	Diversity & inclusion	G5	Compliance
E6	Green financing	S6	Social impact investment	G6	Stakeholder engagement
E7	Renewable energy adoption	S7	Labor rights	G7	Board diversity
E8	Supply chain responsibility	S8	Corporate ethics	G8	Auditing & oversight
				G9	Environmental reporting
				G10	Anti-corruption measures

The analysis of environmental criteria in banking using fuzzy DEMATEL matrices revealed complex interactions and the importance of these criteria in decision-making processes. Key criteria such as E1 (sustainable practices) and E7 (renewable energy adoption) were identified as critical, exerting significant influence on themselves and other criteria. The initial, reverse, and fuzzy matrices demonstrated the direct, indirect, and fuzzified impacts

under conditions of uncertainty. Criteria E1 and E7 consistently showed the highest levels of influence, underscoring their importance in sustainable development and environmental accountability.

This analysis emphasizes that for banks to align with ESG principles, they must understand the interactions between environmental, social, and governance criteria and implement localized policies. The findings support improved decision-making in the context of sustainable development and social and environmental responsibilities.

The fuzzy DEMATEL causal diagram, based on the influence (Di) and dependence (Ri) values, identified the role of criteria as either causes or effects within the system, highlighting the significance of comprehensive analyses for enhancing banking performance.

Table 3. Results of Fuzzy DEMATEL for Environmental Criteria

Criteria	Di (u, m, l)	Ri (u, m, l)	Di + Ri (u, m, l)	Di - Ri (u, m, l)	Non-Fuzzy Di + Ri	Non-Fuzzy Di - Ri
E1	4.2105, 1.2610, 0.4912	4.4126, 1.3708, 0.5456	8.6231, 2.6318, 1.0368	3.6649, -0.1099, -3.9215	3.5379	-0.0898
E2	4.4786, 1.3893, 0.5466	4.0649, 1.1603, 0.4167	8.5434, 2.5495, 0.9633	4.0619, 0.2290, -3.5183	3.4643	0.2140
E3	4.3654, 1.3716, 0.5457	4.4041, 1.3464, 0.5242	8.7695, 2.7180, 1.0699	3.8413, 0.0251, -3.8584	3.6190	0.0200
E4	4.0744, 1.1801, 0.4461	4.2638, 1.2801, 0.4889	8.3382, 2.4602, 0.9349	3.5855, -0.1000, -3.8177	3.3716	-0.0816
E5	3.9447, 1.1359, 0.4167	4.3918, 1.3693, 0.5469	8.3365, 2.5051, 0.9637	3.3978, -0.2334, -3.9751	3.4044	-0.2065
E6	4.3650, 1.3311, 0.5050	4.2233, 1.2743, 0.4832	8.5883, 2.6054, 0.9882	3.8818, 0.0567, -3.7183	3.5104	0.0634
E7	4.5559, 1.4245, 0.5652	4.0927, 1.2140, 0.4744	8.6485, 2.6385, 1.0396	4.0815, 0.2105, -3.5274	3.5463	0.2051
E8	4.3400, 1.3277, 0.5235	4.4813, 1.4059, 0.5602	8.8213, 2.7336, 1.0837	3.7798, -0.0781, -3.9578	3.6380	-0.0604

The fuzzy DEMATEL analysis examined the intricate and influential relationships among ESG criteria in banking, identifying key influential and dependent criteria. Factors such as climate change initiatives (E2) and renewable energy adoption (E7) emerged as primary drivers influencing other criteria. Meanwhile, criteria like sustainable practices (E1) and pollution control (E4) were more dependent, acting as receivers within the system. Supporting criteria like green financing (E6) and supply chain responsibility (E8) contributed to enhancing and implementing other criteria.

This analysis revealed that green financing, climate change initiatives, and resource efficiency are directly interconnected, while supply chain responsibility plays a fundamental role in achieving environmental and social objectives. Understanding these complex relationships enables banks to adopt comprehensive strategies aligned with governance principles, improving their performance toward sustainable development.

Table 4. Results of Fuzzy DEMATEL for Social Criteria

Criteria	Di (u, m, l)	Ri (u, m, l)	Di + Ri (u, m, l)	Di - Ri (u, m, l)	Non-Fuzzy Di + Ri	Non-Fuzzy Di - Ri
S1	3.8660, 1.1386, 0.4309	4.3172, 1.4041, 0.5746	8.1832, 2.5428, 1.0055	3.2913, -0.2655, -3.8863	3.3913	-0.2349
S2	4.1322, 1.2986, 0.5015	3.9041, 1.1262, 0.4009	8.0364, 2.4248, 0.9024	3.7314, 0.1724, -3.4026	3.2813	0.1437
S3	4.1166, 1.3152, 0.5104	4.1220, 1.2816, 0.4962	8.2387, 2.5968, 1.0066	3.6204, 0.0335, -3.6116	3.4348	0.0196
S4	4.0698, 1.2777, 0.5195	4.1944, 1.3364, 0.5304	8.2641, 2.6141, 1.0499	3.5394, -0.0588, -3.6749	3.4545	-0.0528
S5	4.0801, 1.2935, 0.5144	4.3142, 1.3953, 0.5706	8.3943, 2.6888, 1.0850	3.5095, -0.1019, -3.7998	3.5254	-0.0989
S6	4.2556, 1.3326, 0.5138	3.8214, 1.1489, 0.4221	8.0769, 2.4814, 0.9359	3.8335, 0.1837, -3.3075	3.3282	0.1786
S7	4.3510, 1.4020, 0.5688	3.9052, 1.1972, 0.4699	8.2562, 2.5992, 1.0387	3.8811, 0.2049, -3.3365	3.4424	0.1927

S8	4.0301, 1.2336, 0.4694	4.3228, 1.4020, 0.5640	8.3530, 2.6356, 1.0334	3.4661, -0.1684, -3.8535	3.4793	-0.1499

Social indicators in banking, including community engagement, employee welfare, human rights, customer relations, diversity and inclusion, social impact investment, labor rights, and corporate ethics, play critical roles in enhancing the social performance of banks. Indicators like community engagement (S1) and human rights (S3) demonstrate high levels of influence and dependence, significantly affecting other criteria. Additionally, indicators such as diversity and inclusion (S5) and social impact investment (S6) are of particular importance due to their extensive interactions with other criteria.

This analysis suggests that improving these indicators can strengthen the social performance of banks, align them with sustainable development principles, and enhance public trust.

Table 5. Results of Fuzzy DEMATEL for Governance Criteria

Criteria	Di (u, m, l)	Ri (u, m, l)	Di + Ri (u, m, l)	Di - Ri (u, m, l)	Non-Fuzzy Di + Ri	Non-Fuzzy Di - Ri
G1	5.3606, 1.6043, 0.6123	5.0190, 1.4680, 0.5440	10.3795, 3.0723, 1.1563	4.8165, 0.1362, -4.4067	4.1895	0.1285
G2	5.0211, 1.4605, 0.5404	5.3260, 1.5937, 0.6007	10.3471, 3.0542, 1.1411	4.4204, -0.1332, -4.7856	4.1711	-0.1324
G3	5.0839, 1.5432, 0.6084	5.1557, 1.4968, 0.5436	10.2397, 3.0400, 1.1519	4.5404, 0.0464, -4.5474	4.1470	0.0190
G4	5.1858, 1.5337, 0.5738	5.2558, 1.5637, 0.5943	10.4417, 3.0974, 1.1681	4.5916, -0.0300, -4.6820	4.2163	-0.0356
G5	5.1677, 1.5461, 0.5934	4.9926, 1.4401, 0.5176	10.1603, 2.9862, 1.1109	4.6501, 0.1060, -4.3992	4.0952	0.0895
G6	5.0391, 1.4852, 0.5497	5.3248, 1.6065, 0.6115	10.3639, 3.0916, 1.1611	4.4277, -0.1213, -4.7751	4.2005	-0.1233
G7	5.2770, 1.5493, 0.5722	5.0753, 1.5118, 0.5922	10.3523, 3.0611, 1.1644	4.6848, 0.0374, -4.5031	4.1789	0.0409
G8	5.3852, 1.6488, 0.6304	5.2005, 1.5615, 0.5958	10.5857, 3.2103, 1.2262	4.7894, 0.0872, -4.5701	4.3178	0.0736
G9	5.3060, 1.5563, 0.5804	5.4730, 1.7169, 0.6840	10.7790, 3.2732, 1.2643	4.6220, -0.1605, -4.8927	4.3905	-0.1335
G10	4.9265, 1.4346, 0.5332	4.9302, 1.4029, 0.5106	9.8568, 2.8376, 1.0437	4.4160, 0.0317, -4.3971	3.9426	0.0148

Governance criteria such as corporate governance (G1), transparency and accountability (G2), risk management (G3), ethical leadership (G4), compliance (G5), stakeholder engagement (G6), board diversity (G7), auditing and oversight (G8), environmental reporting (G9), and anti-corruption measures (G10) demonstrate significant interrelations in improving governance systems.

Key indicators like corporate governance and auditing and oversight play pivotal roles in ensuring transparency, sustainability, and accountability. Relationships among the criteria reveal that ethical leadership and stakeholder engagement strengthen organizational interactions, while risk management and compliance reduce risks and enhance organizational trust. Environmental reporting and anti-corruption measures further contribute to improving organizational transparency and accountability.

This analysis underscores the importance of integrating these criteria to enhance governance systems and align them with sustainability and accountability standards.

The analysis of integrated ESG (Environmental, Social, and Governance) criteria using the fuzzy DEMATEL method reveals complex and significant interrelations among the criteria.

For environmental criteria (E), E1 (sustainable practices) exhibits high influence within the system. The fuzzy D+R value of this indicator highlights its pivotal role in enhancing overall system sustainability. E2 (climate change initiatives) also demonstrates high influence, significantly impacting other indicators. E3 (resource efficiency), with high D and R values, emphasizes its critical importance in resource management and energy conservation. E4 (pollution control) exerts widespread effects on other environmental and social criteria, playing a key role in improving air quality and reducing pollution. E5 (biodiversity conservation)

underscores the importance of preserving various species and preventing extinction due to its high influence. E6 (green financing) significantly contributes to environmental investments and supports sustainable projects. E7 (renewable energy adoption) plays a crucial role in transitioning to clean energy and reducing reliance on fossil fuels. Lastly, E8 (supply chain responsibility) demonstrates that sustainable supply chains can enhance organizations' overall environmental performance.

Table 6. Aggregated Results of ESG Criteria Using Fuzzy DEMATEL

Criteria	Di (u, m, l)	Ri (u, m, l)	Di + Ri (u, m, l)	Di - Ri (u, m, l)	Non-Fuzzy Di + Ri	Non-Fuzzy Di - Ri
E1	8.1984, 1.4799, 0.3922	9.1793, 1.6815, 0.5452	17.3777, 3.1614, 0.9374	7.6532, -0.2016, -8.7871	5.5856	-0.3000
E2	8.8806, 1.7138, 0.6027	9.8234, 1.9180, 0.6691	18.7039, 3.6319, 1.2717	8.2115, -0.2042, -9.2207	6.1673	-0.2787
E3	10.0691, 2.0618, 0.7565	8.8714, 1.5604, 0.5008	18.9405, 3.6222, 1.2573	9.5683, 0.5014, -8.1149	6.1948	0.4793
E4	10.3783, 2.1481, 0.8006	9.4165, 1.8175, 0.6212	19.7947, 3.9655, 1.4218	9.7571, 0.3306, -8.6159	6.5853	0.3335
E5	9.4862, 1.8084, 0.6011	9.8833, 1.8607, 0.6424	19.3696, 3.6691, 1.2435	8.8438, -0.0523, -9.2823	6.2923	-0.1084

Analysis of social (S) and governance (G) indicators within the ESG framework demonstrates strong interrelations and alignment for improving organizational performance.

In the social domain, indicators such as S1 (community engagement), S2 (employee welfare), and S3 (human rights) have direct and significant effects on improving social conditions, employee welfare, and human rights adherence. S4 (customer relations) and S5 (diversity and inclusion) play crucial roles in increasing customer satisfaction and promoting diversity in the workplace. Additionally, S6 (social impact investment) and S8 (corporate ethics) are key factors in improving social welfare and fostering organizational culture through supporting green projects and enhancing organizational trust.

In the governance domain, key indicators such as G1 (corporate governance), G2 (transparency and accountability), and G3 (risk management) are vital for enhancing transparency, reducing risks, and building public trust. Indicators such as G4 (ethical leadership) and G5 (compliance) aid in upholding standards and strengthening accountability, which improves social and environmental relations. Furthermore, G8 (auditing and oversight) and G10 (anti-corruption measures) play critical roles in reducing corruption, increasing transparency, and improving managerial structures.

Overall, the integration and reinforcement of these ESG indicators can improve transparency, social interactions, and resource management, paving the way for sustainability and accountability.

This section evaluates the performance of 23 corporate clients in Ilam Province based on ESG criteria (Appendix 1). These companies, representing diverse economic sectors, were purposefully selected to cover a wide range of industries and services. Data were collected confidentially from 17 banking experts and analyzed using the fuzzy ARAS method.

In the environmental dimension, criteria such as resource efficiency, pollution reduction, waste management, and renewable energy adoption were evaluated. **Resource efficiency** received the highest fuzzy weight due to the critical need for optimal utilization of natural resources in Iran.

In the social dimension, indicators such as diversity and inclusion, employee welfare, and human rights were assessed, demonstrating significant impacts on corporate social performance.

In the governance dimension, transparency, risk management, and compliance were identified as key indicators for enhancing management standards.

Results revealed varied performance across dimensions. Some companies excelled in environmental aspects but showed weaknesses in social and governance dimensions, while others required substantial improvements in environmental performance.

Table 7. Fuzzy ARAS Results for Environmental Dimension (Including ASi Scenarios)

Alternatives	ASi (Scenario 1, Scenario 2, Scenario 3, Scenario 4)	K(ASi)	Ranking

A1	(-0.746, -0.725, -0.738, -0.744)	0.224	10
A2	(-0.714, -0.693, -0.705, -0.710)	0.197	9
A3	(-0.681, -0.660, -0.672, -0.678)	0.242	7
A4	(-1.121, -1.100, -1.112, -1.118)	0.036	22
A5	(-0.735, -0.714, -0.726, -0.732)	0.312	5
A6	(-0.777, -0.756, -0.768, -0.774)	0.175	11
A7	(-0.724, -0.703, -0.715, -0.721)	0.286	8
A8	(-0.800, -0.779, -0.791, -0.797)	0.198	12
A9	(-0.376, -0.358, -0.366, -0.372)	0.565	1
A10	(-0.683, -0.662, -0.674, -0.680)	0.314	6
A11	(-0.939, -0.918, -0.930, -0.936)	0.269	15
A12	(-0.889, -0.868, -0.880, -0.886)	0.208	16
A13	(-0.441, -0.423, -0.431, -0.437)	0.446	2
A14	(-0.580, -0.562, -0.570, -0.576)	0.414	4
A15	(-0.807, -0.786, -0.798, -0.804)	0.108	13
A16	(-1.037, -1.016, -1.028, -1.034)	0.116	18
A17	(-1.223, -1.202, -1.214, -1.220)	-0.114	23
A18	(-1.025, -1.004, -1.016, -1.022)	-0.012	21
A19	(-1.029, -1.008, -1.020, -1.026)	0.015	17
A20	(-1.066, -1.045, -1.057, -1.063)	0.047	20
A21	(-0.885, -0.864, -0.876, -0.882)	0.169	14
A22	(-0.467, -0.449, -0.457, -0.463)	0.432	3
A23	(-1.075, -1.054, -1.066, -1.072)	-0.005	19

Client A9 achieved the highest score in various criteria, demonstrating exemplary environmental performance. Clients such as A13 and A22 ranked next, showing strong commitments to sustainability through green projects and renewable energy adoption. In contrast, clients like A17 and A4 scored lowest, requiring significant improvements in environmental indicators.

The evaluation identifies strengths and weaknesses, providing banks and financial institutions with valuable tools to improve clients' environmental performance and achieve sustainability goals. These results offer a useful model for enhancing environmental indicators among other clients.

In the social dimension, the evaluation of 23 corporate clients revealed significant variations in their social performance. Client A1, with an ASi value of -0.413 and K(ASi) of 0.328, ranked 10th, indicating moderate performance. In contrast, Client A2, with ASi and K(ASi) values of -0.268 and 0.434, respectively, ranked 4th, showing better performance. Meanwhile, Client A3 ranked 22nd with ASi and K(ASi) values of -0.834 and 0.012, indicating a pressing need for improvement in social aspects. On the other hand, Client A4, with ASi and K(ASi) values of -0.137 and 0.483, ranked 3rd, reflecting a strong commitment to social issues.

Clients A5 and A6 ranked 15th and 21st, respectively, with weak to moderate performance. Similarly, Clients A7 and A8 require significant improvements in social matters. Client A9 demonstrated relatively good performance, ranking 12th, while Client A10, at 17th, needs more effort in this area.

Notably, Clients A11, A12, A13, and A14 ranked 7th, 11th, 8th, and 6th, respectively, with higher positive scores, demonstrating their commitment to employee welfare, diversity and inclusion, and community engagement.

These findings provide valuable insights for banks and clients to identify weaknesses and improve their social performance.

Table 8. Fuzzy ARAS Results for Social Dimension (Including ASi Scenarios)

Alternatives	ASi (Scenario 1, Scenario 2, Scenario 3, Scenario 4)	K(ASi)	Ranking
A1	(-0.413, -0.378, -0.392, -0.400)	0.328	10
A2	(-0.268, -0.243, -0.255, -0.260)	0.434	4
A3	(-0.834, -0.801, -0.816, -0.825)	0.012	22
A4	(-0.137, -0.121, -0.130, -0.135)	0.483	3
A5	(-0.587, -0.550, -0.567, -0.578)	0.178	15
A6	(-0.806, -0.785, -0.792, -0.800)	0.034	21
A7	(-0.558, -0.525, -0.540, -0.548)	0.248	14
A8	(-0.678, -0.645, -0.662, -0.670)	0.129	19

A9	(-0.485, -0.462, -0.470, -0.478)	0.207	12
A10	(-0.617, -0.592, -0.600, -0.608)	0.132	17
A11	(-0.307, -0.280, -0.295, -0.302)	0.312	7
A12	(-0.503, -0.478, -0.486, -0.495)	0.305	11
A13	(-0.302, -0.273, -0.290, -0.300)	0.333	8
A14	(-0.343, -0.314, -0.328, -0.335)	0.400	6
A15	(-0.896, -0.870, -0.884, -0.891)	-0.063	23
A16	(-0.378, -0.351, -0.362, -0.370)	0.307	9
A17	(-0.584, -0.556, -0.570, -0.578)	0.150	16
A18	(-0.701, -0.675, -0.688, -0.695)	0.020	20
A19	(-0.129, -0.110, -0.118, -0.125)	0.501	2
A20	(-0.569, -0.543, -0.555, -0.562)	0.228	13
A21	(-0.693, -0.667, -0.680, -0.688)	0.129	18
A22	(-0.001, 0.005, 0.003, 0.001)	0.626	1
A23	(-0.284, -0.250, -0.270, -0.278)	0.469	5

Client A15, with ASi and K(ASi) values of -0.896 and -0.063, ranked last (23rd), requiring substantial improvements in social aspects. Conversely, Client A22, with ASi and K(ASi) values of -0.001 and 0.626, demonstrated the best performance, ranking first. Client A16 ranked 9th (ASi = -0.378, K(ASi) = 0.307), and Client A19 ranked 2nd (ASi = -0.129, K(ASi) = 0.501), showing good performance in social dimensions.

In contrast, Clients A18 (ranked 20th) and A21 (ranked 18th) highlighted areas requiring improvement in social matters. These results suggest that some clients lack in areas such as social welfare, employee rights, and diversity, requiring strategies for enhancement.

In the governance dimension, the results also revealed notable differences among clients. Client A1, with ASi = 0.801 and K(ASi) = 1.214, ranked first, reflecting excellent performance in governance aspects such as transparency, risk management, and ethical leadership. This top ranking highlights strong adherence to corporate governance principles and effective risk management capabilities.

Conversely, Client A2, with ASi = 0.501 and K(ASi) = 0.855, ranked last (23rd), indicating a need for improvement in areas such as transparency and regulatory compliance.

Table 9. Fuzzy ARAS Results for Governance Dimension (Including ASi Scenarios)

Alternatives	ASi (Scenario 1, Scenario 2, Scenario 3, Scenario 4)	K(ASi)	Ranking
A1	(0.801, 0.825, 0.810, 0.802)	1.214	1
A2	(0.501, 0.530, 0.515, 0.503)	0.855	23
A3	(0.691, 0.710, 0.698, 0.693)	1.083	4
A4	(0.658, 0.675, 0.662, 0.660)	1.064	10
A5	(0.670, 0.688, 0.673, 0.671)	1.059	7
A6	(0.672, 0.690, 0.676, 0.673)	1.059	6
A7	(0.660, 0.678, 0.664, 0.662)	1.051	9
A8	(0.688, 0.706, 0.692, 0.689)	1.088	5
A9	(0.592, 0.612, 0.598, 0.593)	0.944	18
A10	(0.582, 0.600, 0.587, 0.583)	0.953	20
A23	(0.753, 0.773, 0.760, 0.754)	1.157	3

Clients A17 (ASi = 0.776) and A23 (ASi = 0.753) ranked 2nd and 3rd, respectively, with excellent governance performance. Their high K(ASi) values (1.203 and 1.157) confirm their strong performance in transparency, accountability, and compliance.

Clients like A3 (ASi = 0.691), A8 (ASi = 0.688), and A6 (ASi = 0.672), ranked 4th to 6th, demonstrating adherence to corporate governance principles. In contrast, Clients A9, A10, A12, and A18, with lower scores (e.g., ASi = 0.592, 0.582, 0.577, and 0.545), highlighted weaknesses in risk management, transparency, and accountability.

These findings can assist banks and financial institutions in identifying clients' strengths and weaknesses, offering strategies to enhance client performance. Improvements in these areas can increase public trust, reduce risks, and ultimately lead to better overall financial and credit performance. Using the fuzzy ARAS method enhanced result accuracy, providing researchers and banking managers with a robust foundation for strategic decision-

making to improve sustainability and financial stability for corporate clients.

Iran's economic future is analyzed under four scenarios, examining the effects of sanctions and the government's role in domestic and international policies.

Scenario 1: Sustainable Growth

In this scenario, sanctions are lifted, and Iran actively participates in the international system, enabling sustained economic growth of 5–8%. Focus on governance criteria (G) such as transparency, accountability, risk management, and compliance, along with environmental criteria (E) like resource efficiency and pollution reduction, is critical for attracting foreign investment.

Scenario 2: Relative Prosperity

Here, sanctions are lifted, but economic growth is moderate at 3%, driven by a rent-seeking economy. Social criteria (S), such as employee welfare, human rights, and diversity and inclusion, gain prominence, while governance criteria remain essential.

Scenario 3: Active Engagement Under Sanctions

In this scenario, sanctions persist, but the government adopts global financial rules and regional diplomacy. Reducing corruption and improving transparency are priorities. Governance criteria such as risk management and accountability, coupled with social criteria like customer relations and social impact investment, are emphasized.

Scenario 4: Inaction and Turmoil

With continued sanctions and weak government involvement, economic instability and poor governance escalate. Special attention to governance criteria such as risk management and transparency, and social criteria like human rights and employee welfare, is crucial.

Table 10. Weighting of Scenarios

Scenario	Governance (G)	Social (S)	Environmental (E)	Inconsistency Index (KSI)
Sustainable Growth	0.594	0.063	0.344	0.094
Relative Prosperity	0.25	0.667	0.083	0.083
Active Engagement	0.719	0.219	0.063	0.156
Inaction and Turmoil	0.597	0.347	0.056	0.097

Focusing on specific ESG criteria in each scenario can enhance economic performance and sustainability. Governance criteria are pivotal across all scenarios, reflecting their critical role in improving economic conditions and attracting investments. Social criteria are essential in scenarios like relative prosperity and inaction and turmoil to prevent social dissatisfaction and maintain stability. Environmental criteria, particularly in the sustainable growth scenario, are crucial for achieving a resilient and sustainable economy.

Comparing the four scenarios reveals that the performance of corporate clients varies significantly depending on the prioritization of environmental, social, and governance criteria.

Scenario 1: Sustainable Growth: Clients such as **A13**, **A1**, and **A14**, excelling in governance and environmental criteria, rank highest, while those with weaknesses in transparency, risk management, and resource efficiency, such as **A18** and **A20**, rank lower. This scenario underscores the importance of governance principles and environmental management for investment attraction and sustained growth.

Scenario 2: Relative Prosperity: In this socially focused scenario, clients like **A22** and **A19** lead due to strong performance in employee welfare, human rights, and diversity and inclusion. This highlights the necessity of emphasizing social criteria in a moderately growing economy to ensure social stability.

Scenario 3: Active Engagement: Clients such as **A1** and **A23**, with strong performance in transparency, corruption reduction, and risk management, top the rankings. This scenario stresses the importance of governance improvements to mitigate sanctions' adverse effects and create better economic conditions.

Scenario 4: Inaction and Turmoil: Despite continued sanctions and weak governance, clients like **A22** and **A23** maintain high rankings due to solid performance in governance and social criteria. This scenario highlights the importance of governance reforms and attention to social criteria to prevent further instability.

Table 11. Rankings Based on Each Scenario

Client	K(ASi) Environmental	K(ASi) Social	K(ASi) Governance	K(ASi) Scenario 1	Rank Scenario 1	K(ASi) Scenario 2	Rank Scenario 2	K(ASi) Scenario 3	Rank Scenario 3	K(ASi) Scenario 4	Rank Scenario 4

A1	0.545	0.544	0.801	0.696938	2	0.608333	8	0.728781	1	0.697542	3
A2	0.554	0.695	0.501	0.531344	18	0.634750	6	0.546750	19	0.571306	12
A3	0.580	0.223	0.691	0.623594	7	0.369750	20	0.581688	14	0.522333	18
A4	0.255	0.787	0.658	0.527531	19	0.710417	3	0.661031	4	0.680403	5
A5	0.630	0.403	0.670	0.639563	6	0.488667	13	0.609094	10	0.575069	11
A6	0.520	0.225	0.672	0.591813	11	0.361333	21	0.564719	17	0.508347	20
A7	0.580	0.408	0.660	0.616750	8	0.485333	14	0.599875	12	0.568056	13
A8	0.504	0.305	0.688	0.600813	9	0.417333	18	0.592719	13	0.544792	15
A9	0.864	0.456	0.592	0.677000	5	0.524000	11	0.579250	15	0.559889	14
A10	0.580	0.375	0.582	0.568375	13	0.443833	17	0.536594	21	0.510014	19
A11	0.433	0.594	0.650	0.571906	12	0.594583	9	0.624188	9	0.618500	8
A12	0.422	0.490	0.577	0.518281	21	0.506083	12	0.548281	18	0.538181	17
A13	0.847	0.578	0.664	0.721531	1	0.621917	7	0.656625	6	0.644306	7
A14	0.778	0.645	0.648	0.692500	3	0.656833	5	0.655469	7	0.654181	6
A15	0.471	0.121	0.637	0.547688	14	0.279167	23	0.513750	22	0.448611	22
A16	0.304	0.554	0.649	0.524469	20	0.556917	10	0.606656	11	0.596847	10
A17	0.137	0.389	0.776	0.532156	17	0.464750	15	0.651406	8	0.606125	9
A18	0.271	0.244	0.545	0.432000	23	0.321500	22	0.462031	23	0.425264	23
A19	0.308	0.803	0.646	0.539625	16	0.722500	2	0.659219	5	0.681736	4
A20	0.287	0.417	0.635	0.501750	22	0.460667	16	0.565563	16	0.539972	16
A21	0.463	0.326	0.614	0.544094	15	0.409417	19	0.541563	20	0.505611	21
A22	0.808	0.917	0.589	0.684781	4	0.825917	1	0.674438	3	0.715056	1
A23	0.300	0.692	0.753	0.593469	10	0.674583	4	0.711344	2	0.706653	2

This analysis provides a detailed assessment of how client performance aligns with the priorities of each economic scenario, offering strategic insights for stakeholders to navigate varying economic conditions effectively.

4. Discussion and Conclusion

This study aimed to design a credit evaluation model for bank loan applicants based on Environmental (E), Social (S), and Governance (G) criteria. Given the need to improve traditional credit evaluation systems and enhance economic sustainability, incorporating ESG dimensions into banking decision-making processes was essential. This approach can reduce credit risk, improve resource allocation, and enhance social and environmental accountability within the banking system.

The research was conducted in several stages. First, ESG indicators were identified and categorized through thematic analysis. Then, the fuzzy DEMATEL method was employed to analyze the interrelationships among the indicators, determining the intensity of influence and susceptibility for each. Next, corporate clients were ranked based on ESG criteria using the fuzzy ARAS method. Data were collected through the participation of 17 banking experts, and the criteria were weighted using the Best-Worst Method (BWM). Various economic scenarios were analyzed to assess the impact of Iran's economic conditions on the importance of ESG criteria.

The results revealed that each ESG criterion holds varying significance across different economic scenarios.

- **Scenario 1 (Sustainable Growth):** Governance and environmental criteria were prioritized. Clients such as A13 and A1, who performed well in transparency, accountability, and resource efficiency, ranked highest.
- **Scenario 2 (Relative Prosperity):** Social criteria such as employee welfare and diversity were emphasized, with clients like A22 and A19 showing superior performance.
- **Scenario 3 (Active Engagement):** Governance criteria like risk management and corruption reduction gained prominence, with clients A1 and A23 securing top ranks.
- **Scenario 4 (Inaction and Turmoil):** Governance and social criteria were emphasized, and clients with strong performance in these domains achieved higher rankings.

Overall, this study highlights the unique importance of environmental, social, and governance criteria across varying economic scenarios. Enhancing these criteria can support organizational sustainability and accountability.

In **Scenario 1 (Sustainable Growth)**, assuming sanctions are lifted and Iran achieves sustainable economic growth, greater weight is allocated to governance and environmental criteria. Clients such as A13, A1, and A14 ranked highest due to their strong performance in transparency, accountability, and resource efficiency,

indicating their high commitment to these principles. This scenario emphasizes the importance of governance reform and risk management for attracting foreign investment and achieving sustainable growth. Conversely, clients like A18 and A20, who performed poorly in governance principles, ranked lower and require significant improvement.

In **Scenario 2 (Relative Prosperity)**, with moderate economic growth, social criteria became more critical. Clients such as A22, A19, and A4, who excelled in employee welfare, human rights, and diversity, ranked highest. This scenario underscores the necessity of focusing on social criteria to ensure social stability and foster economic prosperity. In contrast, clients like A15 and A18, with weaker performance in these areas, ranked lower.

Scenario 3 (Active Engagement) focuses on continued sanctions and the government's active engagement by adhering to global financial rules. Governance criteria such as risk management, transparency, and corruption reduction are emphasized. Clients like A1, A23, and A17 ranked highest due to their strong performance in these areas. Conversely, clients like A18 and A10, who showed weaknesses in governance, ranked lower.

In **Scenario 4 (Inaction and Turmoil)**, where sanctions persist and the government struggles with economic diplomacy, governance and social criteria are most important. Clients like A22, A23, and A1, with strong performance in these areas, ranked highest, while clients like A18 and A15 ranked lowest and require improvement.

These analyses assist banks in devising more effective strategies to enhance client performance and achieve economic sustainability under various scenarios.

For future research, it is recommended to develop advanced models incorporating data mining and artificial intelligence technologies to increase accuracy in credit evaluation processes. Comparative studies across different countries can provide deeper insights into the impacts of ESG criteria on banking performance. Moreover, investigating the application of ESG indicators in other financial domains such as insurance and stock markets could uncover new opportunities for their integration. Developing standardized frameworks for incorporating ESG criteria into credit evaluation systems, especially in developing countries, can mitigate implementation challenges. Additionally, creating appropriate policy tools to facilitate ESG adoption and promote economic and social sustainability is essential.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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