BANK PERFORMANCE EVALUATION OF SUSTAINABILITY STRATEGY DIMENSIONS IN THE EMERGING MARKET USING THE MCDM APPROACH

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Abstract

Increased public awareness about the environmental and social impact of the businesses has led to the integration of sustainability into the core business activities. The banking sector, being one of the major drivers of the economy, is also focusing on social and environmental performance along with generating financial returns. The purpose of this paper is to evaluate the sustainability performance of Indian banks using grey relational analysis (GRA). This study uses three criteria to evaluate the bank's sustainability performance, which include economic, environmental, and social. Grey relational grades are obtained for ranking the banks according to their sustainability performance. The novelty of the study lies in the fact that this study is the first attempt to evaluate the sustainability performance of Indian banks using the GRA methodology. This study has practical implications for the Indian banking industry, which could encourage managers to formulate policies and strategies for adopting environmental and social parameters in their operations to improve their overall performance. The study results could also influence investors to invest in banks seeking sustainability in their operations as the country progresses towards sustainable development.

Keywords: Grey Relational Analysis, Sustainability Performance, Indian Banks, MCDM Problem, Sustainable Development, Social and Environmental Sustainability, Sustainability Reporting

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1. INTRODUCTION

These days, companies are facing immense pressure from all the stakeholders to do business responsibly and consider environmental and societal well-being along with economic performance. Businesses have also started to respond to their stakeholders by incorporating the different dimensions of sustainability and disclosing their sustainability reports. A sustainability report shows the organization's performance in terms of sustainability, highlighting both the company's advantages and disadvantages in relation to reaching its sustainability objective (Goel, 2010). Businesses

are taking a step towards greater responsibility and transparency by reporting on sustainability, and this is helping to elevate the industry (Jackson et al., 2011).

Decision-makers must implement environmental, social, and governance (ESG) principles to improve firm performance and attain continual improvement. Evaluation of the organisation's sustainability performance has become necessary due to greater awareness of sustainability and its integration into business processes (Goyal et al., 2013). However, because most businesses report on their sustainability initiatives in a way that is challenging to understand and compare directly, it can often be difficult to gauge the sustainability of the company.

Conventional statistical techniques for assessing an organization's performance, such as regression and factor analysis, frequently require a substantial volume of data, with assumptions about the normal distribution being one of their drawbacks. Grey relational analysis (GRA) overcomes these shortcomings by being a non-functional model, with calculations being natural and not requiring a large sample, and particularly not needing the data to fit into any statistical distribution (Kung et al., 2006).

The GRA methodology has proven efficient for very small samples with inadequate information or variables. While there is a wealth of research on sustainable banking in developed nations (Jeucken, 2001; Scholtens, 2009; Roca & Searcy, 2012), little is known about developing nations, and the topic is mostly unexplored in the Indian context (Khan et al., 2011).

In earlier research (Bihari, 2010; Bahl, 2012; Jha & Hui, 2012; Tara et al., 2015), the adoption of green banking was examined in relation to the banks' internal environment management and corporate social responsibility (CSR) initiatives in India (Sharma & Mani, 2013). The majority of Indian banks' green banking initiatives were restricted to the installation of solar panels, internet banking, paperless banking, and ATMs (Biswas, 2011). According to Sahoo and Nayak's (2007) analysis, the Indian banking industry has been sluggish in implementing sustainable banking practices, and banks are still unprepared to handle sustainable banking challenges.

Moreover, research on the sustainability practices of Indian banks is generally lacking. There is a gap in the literature since it is difficult to find studies on a standardised framework that thoroughly takes into account the environmental and social aspects of sustainability to evaluate how sustainable the bank's operations are.

In earlier studies, GRA has been used for the assessment of the financial performance of companies only (Suvvari et al., 2019). However, studies evaluating sustainability performance are very scarce, and no such study exists in India that has measured the sustainability performance of banks using GRA as a tool.

This study aims to address this research gap. This research uses GRA to quantify the sustainability performance of private banks in India. Since environmental and social indicators are also taken into account in this study, apart from financial indicators, GRA is an appropriate tool as companies report these indicators in various ways and there is no single way of reporting.

The originality of this study lies in the fact that it has evaluated the performance of banks in terms of economic, environmental, and social criteria using GRA, in contrast to previous studies which have analysed firm performance only according to economic or financial parameters.

The study's limitations include the small number of banks that solely provide sustainability reports and the way in which they report on social and environmental criteria. The fact that very few of them release sustainability reports within the same time frame and employ different measuring units to evaluate social and environmental performance presented a significant obstacle for the researchers in establishing the standards for evaluating the banks' performance.

The rest of the paper is structured as follows. Section 2 presents the literature review and theoretical background of the study, focusing on studies related to the sustainable performance of companies and other multi-criteria decision-making (MCDM) techniques used in relation to GRA. Section 3 presents the data and methodology, including sample selection and the GRA method. Section 4 presents the results and empirical analysis. Section 5 presents the discussion, where the results of the study are compared with previous findings in the literature. Section 6 concludes with the extent to which the manuscript can advance the current body of knowledge, research implications, limitations, and future scope of the study.

2. LITERATURE REVIEW AND THEORETICAL BACKGROUND

A few studies that employed GRA for assessment purposes are as follows: Feng and Wang (2000) demonstrated how financial ratios were used to build an airline performance evaluation process. A grey-based strategy was proposed by Li et al. (2008) to address the supplier selection issue. GRA was utilised by Kuo et al. (2008) to choose the facility layout. Using GRA, Kung and Wen (2007) identified the important financial ratio variables and other financial indicators influencing the financial performance of Taiwanese venture capital firms. The authors used grey decision-making (GDM) to rank the overall performances of the sample venture capital firms.

According to Badri Ahmadi et al. (2017), GRA is also more adaptable than TOPSIS (technique for order of preference by similarity) to Ideal Solution and other decision-making instruments, where input should be included from the outset. GRA can be adapted to various decision problems, including those with qualitative and mixed qualitative-quantitative data, making it a versatile method for a wide range of applications. GRA is less data-intensive and can handle subjective data effectively when dealing with expert opinions or qualitative assessments.

Guru and Mahalik (2019) computed the efficiency of several public sector banks in India using a combination of analytic hierarchy process (AHP), TOPSIS, and GRA and compared the outcomes. They concluded that the banks deemed efficient are relatively close to the optimal solution, present a different bank rating, and both models interpret the data nearly identically.

Liu et al. (2016) provided an overview of the developments in grey system theory from 2000 to 2015 to introduce several significant new models, ideas, and techniques. Table 1 shows some featured studies in the literature based on the GRA methodology and the performance of banks.

Table 1. Featured studies in the literature

Author	*Scope*	*Model*	*Result*
Yüksel et al. (2017)	Turkish deposit banks	DEMATEL, GRA, and MOORA approaches	The findings demonstrate that coherent outcomes are produced by integrated models, and foreign banks outperform both state and private banks in terms of performance.
Martin et al. (2018)	India	TOPSIS, COPRAS, and GRA	When it comes to making predictions regarding several competing criteria, the suggested methods are practical and reasonable.
Yılmaz and Nuri İne (2018)	Turkey	Balanced scorecard approach and TOPSIS method	A mechanism for sustainability performance reports tailored to banks was developed.
Korzeb and Samaniego-Medina (2019)	Polish banking sector	TOPSIS Method	Foreign capital-rich banks showed a limited willingness to support sustainable development initiatives.
Shakil et al. (2019)	93 emerging market banks	Generalised method of moments technique	The results show a positive correlation between the financial performance of developing market banks and their social and environmental performance.
Stauropoulou and Sardianou (2019)	Greece	Analytical hierarchy process (AHP)	In the banking industry, a framework for assessing corporate sustainability was made available.
Bătae et al. (2021)	European banks	Various econometric models	The findings indicate that financial performance and emission reductions are positively correlated.
Hu and Liu (2022)	Google Scholar and Web of Science (WoS)	Literature review	The most popular approach is GRA technology, which has been the subject of more than three times as much study as all other approaches combined.
RezaHoseini et al. (2022)	Multiple	Z-AHP and Z-DEA	It illustrates how the suggested Z-AHP-DEA is a dependable method for project ranking.
Habib and Mourad (2022)	406 US firms	Robustness tests, the dynamic analysis technique, and the (GLS) regression estimator	Better performance metrics are found in companies with stronger ESG performances.
Xu et al. (2024)	Hebei Province, China	Grey correlation analysis method	In every region, the elements that facilitate and hinder sustainable development are identified. With regard to sustainable development, Shijiazhuang is the most capable.

Wu et al. (2009) used GRA to assess the financial performance of wealth management banks in the banking sector. Liu et al. (2016) addressed the problem of simultaneous consideration of multiple attributes by using grey clustering to establish a novel grey clustering group decision-making model based on the different combinations of attributes.

Özçelik and Avci Öztürk (2014) used the GRA method to assess the sustainability performance of Turkish banks that disclose sustainability reports.

In order to ensure sustainable growth in any nation, it is now essential to integrate sustainability into banking (Achua, 2008). Development that is sustainable is one that satisfies current needs without jeopardising the capacity of future generations to satisfy their own. The banking industry must take responsibility for its actions that impact the social, economic, and environmental spheres and ensure that these practices are reflected in all of the endeavours undertaken.

The banking institution's main role is to bring about macroeconomic stability and to supply funds to other sectors to grow; therefore, they are likely to affect society and could have an impact on social justice, the environment, and humanity in a favourable or an unfavourable way (Widiyanto et al., 2023; Pasha & Elbages, 2022; Pula, 2022; Kostyuk et al., 2013).

Defensive, preventative, aggressive, and sustainable banking are the four stages of banking that Jeucken (2001) identified in order to attain sustainability. It is in the sustainable banking phase when all the operations of banks become sustainable and social and environmental sustainability is prioritized instead of the maximization of financial returns.

Sustainable banking encompasses the ideas of green banking, ethical banking, social banking, and corporate social responsibility. According to Dewi and Dewi (2017), green banking focuses primarily on addressing the environmental aspects of sustainability.

Beginning with social banking, which involves philanthropy; ethical banking, which integrates business values and ethical practices into banking operations; green banking, which includes an environment management system; and sustainable banking, which addresses ESG issues, the concept of sustainability in banking has been continuously evolving (Weber & Feltmate, 2016).

3. DATA AND RESEARCH METHODOLOGY

3.1. Data

The sustainability performance of 10 Indian banks was evaluated for the year 2018–2023 using economic (EBIT and PAT), environmental (electricity consumption and CO2 emission), and social (employee turnover rate and education hour per employee) criteria.

Different criteria used for assessing sustainable performance, different indicators for the respective criteria, their formulas and supporting literature are shown in Table 2.

Table 2. Sustainability performance criteria

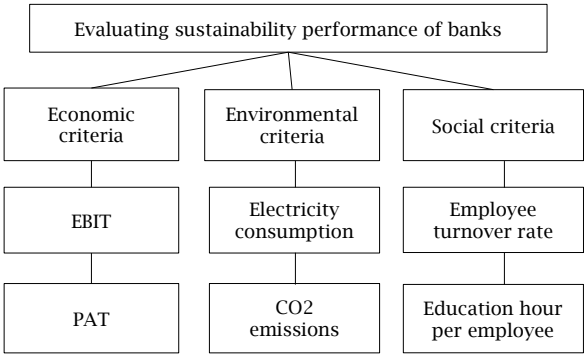
Criteria	*Indicators*	*Formulas*	*Supporting literature*	*Target*
Economic criteria				
C1	Earnings before interest and tax (EBIT)	Net Income + Interest + Taxes	Jankalová and Kurotová, (2020), Iotti and Bonazzi (2023)	Larger-is-better
C2	Profit after tax (PAT)	Profit Before Tax - Tax rate	Korzeb and Samaniego-Medina (2019), Oyewo (2022)	Larger-is-better
Environmental criteria				
C3	Electricity consumption	kWh	Olsthoorn et al. (2001), GRI (2016)	Smaller-is-better
C4	CO2 emissions	CO2 Emissions (kg)	(Tyteca et al., 2001; Bae & Smardon, 2011; GRI, 2016)	Smaller-is-better
Social criteria				
C5	Employee turnover rate	Number of separations during the year/Average number of employees during the year	Spangenberg and Bonniot (1998), GRI (2016)	Smaller-is-better
C6	Education hour per employee	Education hour/employee	GRI (2016)	Larger-is-better

The banks chosen for the study included Kotak Mahindra Bank, Axis Bank, YES Bank, ICICI Bank, IndusInd Bank, HDFC Bank, SBI Bank, IDFC Bank, RBL Bank and Federal Bank. These banks were selected based on the reports issued by them. Since not all banks issue sustainability reports (SR) or business responsibility reports (BRR). According to Kumar and Prakash (2019), SBI is the only Public Sector Bank (PSB) that releases sustainability reports and complies with international standards like Global Reporting Initiatives (GRI). It is imperative that banks assume a leading role in upholding global norms and recommendations such as the Equator Principle, UNEP FI, and UNGC principles.

Another reason for choosing the above banks stems from the fact that some banks assess measures qualitatively, while others provide numerical values. Problems related to their reporting cycles and terms have resulted in a lack of standardized form. Therefore, the sample size was limited to these five banks issuing sustainability report (SR) or business responsibility report (BRR) for the respective financial year.

Sustainability performance for the chosen sample was based on two economic, two environmental, and two social indicators for the year 2018–2023. The study's data has been extracted from the annual reports, business responsibility reports, and sustainability reports of the individual banks. The theoretical framework of the given MCDM problem is shown in Figure 1. To compare the reports, the units of measurement were standardized, and a value per employee was calculated.

Figure 1. Theoretical framework of the MCDM problem



The criteria used in the sustainability performance evaluation of banks are detailed in Table 2, and the explanation of the different criteria names is discussed next.

Economic criteria — The economic dimension of sustainable finance monitors the impact of organizational practices on the financial stability of stakeholders and overall economic conditions, measured using EBIT and PAT for different years.

EBIT — Earnings before interest and Taxes (EBIT) measures a company's net income before deducting income tax and interest expenses.

PAT — Profit after tax (PAT) refers to the amount remaining after a company has paid all operating and non-operating expenses, other liabilities, and taxes.

Environmental criteria — According to Olsthoorn et al. (2001), MEPI defined three primary categories of environmental performance indicators: physical, business/management, and impact indicators. Physical indicators focus on inputs and outputs of energy and materials during the production process.

The goal of business/management indicators (management indicators) is to describe an organization's environmental management initiatives. Impact indicators, such as those on emissions, link possible environmental effects to physical production statistics (Tyteca et al., 2001).

The environmental component of sustainability, as defined by the GRI Standards (GRI, 2016), is concerned with how an organisation affects both living and non-living natural systems. The reporting standards for energy (energy consumption both within and outside the company, energy intensity, reduction of energy consumption, and reduction of energy requirements of goods and services) are outlined in GRI 302: Energy 2016. GRI 305: Emissions 2016 addresses air emissions, both direct and indirect (greenhouse gas (GHG), compounds that deplete the ozone layer, etc.). According to a study by Bae and Smardon (2011), the five most commonly used absolute environmental performance indicators among NYSE-listed companies are total water used, total energy used, total greenhouse gas generated, total solid waste generated, and total hazardous waste generated.

The impact of the business on the social structures in which its functions is the subject of the social dimension of sustainability. Enhancing social capital (interaction between persons at all organisational levels) and human capital (individuals'

knowledge and experience) simultaneously is necessary for progress in social sustainability at the business level (Spangenberg & Bonniot, 1998). Among the 19 indicators for social performance, the GRI (2016) identifies the employee turnover rate and the number of hours of education per employee as the two social indicators.

Different criteria indicators exhibit different target notions such as whether preferred values should be large or small. Table 2 also contains the target conceptions for each indicator. The target assumptions stem from the fact that certain indicators require a larger value to reflect the high performance of certain companies, while others show superior performance when a lower value is achieved.

3.2. Research methodology: Grey relational analysis

As science, technology, and humans have advanced, our understanding of the uncertainties inherent in systems has also progressed. Consequently, research on uncertain systems has expanded significantly (Liu et al., 2012).

Ju-Long (1982) introduced grey system theory, and the advent of fuzzy mathematics in the 1960s marked its beginning. Researchers often use colours to express the degree of clarity of available information when discussing uncertainty. Scholars typically refer to items with unknown interior information as “black boxes”, denoting the absence of any available information. On the other end of the spectrum, “white” indicates that all the data is accessible for the study. Consequently, white denotes “full information”, whereas black denotes “no information”. In uncertain theory, incomplete information falls within the “grey” area in between, which represents information that is partially known and partially unknown (Suvvari et al., 2019). As a result, it is crucial that decision-makers consider a variety of factors and carefully consider every option. These issues are referred to as multi-criteria decision-making (MCDM).

Much research has been conducted in the past relating to the evaluation of financial performance of banks. These studies have used financial ratios as an indicator in their analysis. However, there is an issue of weight assignment to each indicator. Chen (2002) used the data envelopment analysis (DEA) method to resolve the weight assignment problem. This method creates a set of weights for each indicator using a mathematical programming technique. The ability of a set of comparable units, such as banks, bank branches, schools, hospitals, and similar institutions, to have their activities described as the conversion of specific inputs into various forms of output makes DEA a useful tool for comparing the relative efficiencies of these units (Habib, 2023; RezaHoseini et al., 2022). Businesses with effective working capital management have higher net income and sales returns (Habib & Mourad, 2022).

Yılmaz and Nuri İne (2018) used the TOPSIS method, one of the MCDM techniques, to assess the sustainability performances of the banks.

TOPSIS is more suitable when dealing with well-defined and deterministic data. It is widely used in situations where the criteria are quantitative and can be precisely measured. GRA is particularly useful when dealing with data that is uncertain, incomplete, or qualitative. It can handle situations where the relationships between criteria are not well-defined (Stanujkić et al., 2013; Mohammadshahi, 2013; Martin et al., 2018).

Nannapaneni et al. (2016) employed a different strategy called Bayesian networks to suggest a methodical framework to aggregate the uncertainty from many sources with the goal of uncertainty quantification (UQ) in the prediction of manufacturing process performance.

Hunjak and Jakovčević (2001) used the AHP method for bank performance evaluation. This method made it possible to combine the qualitative and quantitative data that make up the bank’s features. The Data Envelopment Analysis approach was utilised to measure the financial ratios utilised in the model.

Using the order preference by similarity to the ideal solution (TOPSIS) method with various weight vectors, Korzeb and Samaniego-Medina (2019) examined the Polish banking industry’s involvement with sustainable development. The findings of the study highlighted several issues related to the sustainability of commercial banking operations.

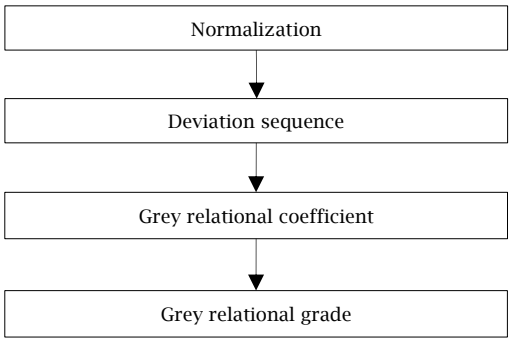
In this research, we can consider the problem of evaluating sustainability performance as an MCDM problem by having many criteria and alternatives. GRA can be used to evaluate such an MCDM problem by identifying the qualitative and quantitative aspects of the different criteria (economic, environmental, and social) used in the study.

Based on the goal of the MCDM problem, GRA can set the target series as the reference series to ascertain the correlation between the series. Next, it determines the parallels and divergences between the alternative series and the reference series (Kung & Wen, 2007). The ambiguous relationship between the alternative series and the reference series is modelled using GRA. The series that most closely resembles the reference series is selected.

GRA can help to overcome the limitation of traditional methods, as all the values (whether large or small, ideal or non-ideal) can be evaluated during the decision-making process (Wu, 2002). This study uses the GRA method and closely follows the methods described by Wu (2002) and calculates Grey relational grades.

The procedure of GRA is shown in Figure 2.

Figure 2. Procedure for grey relational steps



GRA includes the following steps (Wu, 2002; Zhai et al., 2009):

Step 1: Construction of the decision matrix. $X = x_i(j)$. Assume there are n data sequences characterized by m criteria. The compared sequences can be shown in a matrix form:

$$X = \begin{matrix} x_1(1) & x_1(2) & \dots & x_1(m) \\ x_2(1) & x_2(2) & \dots & x_2(m) \\ \dots & \dots & \dots & \dots \\ x_n(1) & x_n(2) & \dots & x_n(m) \end{matrix} \quad (1)$$

where, $x_i(j)$ is the value of the i-th bank corresponding to the j-th criteria ($i = 1, \dots, n; j = 1, \dots, m$).

Step 2: Normalization of the data set. The normalisation procedure is performed to make the values unit-free. This process is referred to as grey relational generation. The data can be normalised using any of the three regimes: Larger the Better, Smaller the Better, and Nominal the Best.

If the expected data sequence is of the form "Larger the Better", then the original sequence can be normalized as:

$$X_i^*(K) = \frac{X_i^o(K) - min\ X_i^o(K)}{max\ X_i^o(K) - min\ X_i^o(K)} \quad (2)$$

If the expected data sequence is of the form "Smaller the Better", then the original sequence can be normalized as:

$$X_i^*(K) = \frac{max\ X_i^o(K) - X_i^o\ (K)}{max\ X_i^o(K) - min\ X_i^o\ (K)} \quad (3)$$

Step 3: Determining the deviation sequence of the reference series. The deviation sequence is calculated using the following formula:

$$X_i^*(K) = 1 - \frac{|X_i^o(K) - X_i^o|}{max\ X_i^o(K) - X_i^o} \quad (4)$$

Step 4: Estimating the grey relational coefficient (GRC). GRC is calculated to express the relationship between the ideal and the actual normalized experimental results. The GRC is estimated using the formula:

$$\xi i\ (k) = \frac{\Delta_{min} + \xi.\Delta_{max}}{\Delta_{oi}(K) + \xi.\Delta_{max}} \quad (5)$$

Here, ξ is the distinguishing coefficient. The coefficient of determination or the distinguishing coefficient value lies between 0 and 1. Most studies consider the value of the distinguishing coefficient for GRA to be 0.5 in order to weaken the influence if the deviation sequence Δ_{max} gets too big.

$$\Delta_{oi}(K) = |X_o^*(K) - X_i^*(K)| \quad (6)$$

where, $\Delta_{max} = 1.0000$ and $\Delta_{min} = 0.0000$

Step 5: Calculating the grey relational grade. The final step is to calculate the grey relational grade, which combines the grey relational coefficients of each criterion into a single measure of performance. This is done using the following formula:

$$\gamma_i = \frac{1}{n} \sum_{K=1}^{n} W_K \xi_i\ (K) \quad (7)$$

Some studies estimate weights using subjective methods like the AHP method (Saisana et al., 2005) or objective weight methods like criteria importance through intercriteria correlation (CRITIC) method. The significance of each indicator in the performance evaluation is dependent on the weight effect in the analysis, which determines the weights allocated to each indicator. To eliminate bias, equal weights are applied to each indicator in this case.

4. EMPIRICAL ANALYSIS AND RESULTS

This section presents the value of all indicators belonging to the respective three criteria (economic, environmental, and social). Table 3 shows that the Economic performance is led by SBI and HDFC banks. It also shows the electricity consumption (kWh) and CO2 emission (kg) by respective banks. This analysis involves a total of six indicators, three of which indicators depict the "larger is better" value, while the other three depict the "smaller is better" value.

Table 4 shows the normalized decision matrix and the reference series. To make the values unit-free, the values in the decision matrix are normalized. The study relies heavily on the normalisation procedure since it explains the correlation between the intended and experimental data. After that, the deviation sequence is shown in Table 5.

Grey relational coefficients are calculated in Table 4 by taking $\xi = 0.5$ to provide a moderate distinguishing effect. In the final step, grey relational grades are calculated for all banks based on equal weights assigned.

Step 1: Decision matrix construction. Creating a decision matrix that displays the values of each alternative in relation to each analytical criterion is the first stage in the GRA approach. Table 3 displays the decision matrix of our analysis.

Table 3. Decision matrix

Banks	*Economic criteria*		*Environmental criteria*		*Social criteria*	
	C1	*C2*	*C3*	*C4*	*C5*	*C6*
Kotak Mahindra Bank	26935.792	7385.868	46667.000	37409.000	0.331	41.723
Axis Bank	65171.690	5962.195	501646.582	3303.632	0.247	48.677
YES Bank	24728.978	-2774.420	47304.853	39897.198	0.360	39.520
ICICI Bank	82317.408	17227.380	57028.060	14413.000	0.228	46.000
Indusind Bank	28285.668	3754.502	73458.940	68046.717	0.271	43.185
HDFC Bank	119887.398	27955.485	477977.560	20490.420	0.178	44.145
SBI Bank	271836.128	32360.280	5125750.167	1159988.333	0.025	58.603
IDFC Bank	13435.530	-152.365	97736.750	77750.720	0.371	47.465
RBL Bank	7451.855	216.520	102958.580	10360.167	0.320	40.602
Federal Bank	13290.405	1855.476	130969.470	2363.167	0.032	38.045

Step 2: Normalization of data set, construction of normalized matrix and generation of reference series. Formulas 2 and 3 are used to normalise the values in the decision matrix. For indicators with "larger-is-better situations" (*C1, C2, C6*), Formula 2 is used, whereas for indicators with "smaller-is-better situations" (*C3, C4, C5*), Formula 3 is used. The maximum values for each criterion are then used to construct a reference series. Table 4 displays the reference series and normalised decision matrix.

Table 4. Normalized decision matrix and reference series

Banks	Economic criteria		Environmental criteria		Social criteria	
	C1	C2	C3	C4	C5	C6
Kotak Mahindra Bank	0.074	0.289	1.000	0.970	0.115	0.179
Axis Bank	0.218	0.249	0.910	0.999	0.359	0.517
YES Bank	0.065	0.000	1.000	0.968	0.031	0.072
ICICI Bank	0.283	0.569	0.998	0.990	0.412	0.387
Indusind Bank	0.079	0.186	0.995	0.943	0.289	0.250
HDFC Bank	0.425	0.875	0.915	0.984	0.559	0.297
SBI Bank	1.000	1.000	0.000	0.000	1.000	1.000
IDFC Bank	0.023	0.075	0.990	0.935	0.000	0.458
RBL Bank	0.000	0.085	0.989	0.993	0.147	0.124
Federal Bank	0.022	0.132	0.983	1.000	0.980	0.000

Step 3: Determining the deviation sequence of the reference series. This stage calculates distances between the reference series (the greatest values for each criterion) and the normalised values corresponding to the respective criteria, thereby generating the deviation sequence. The Deviation Sequence is displayed in Table 5 and is computed using Formula 4.

Table 5. Deviation sequence

Banks	Economic Criteria		Environmental Criteria		Social Criteria	
	C1	C2	C3	C4	C5	C6
Kotak Mahindra Bank	0.926	0.711	0.000	0.030	0.885	0.821
Axis Bank	0.782	0.751	0.090	0.001	0.641	0.483
Yes Bank	0.935	1.000	0.000	0.032	0.969	0.928
ICICI Bank	0.717	0.431	0.002	0.010	0.588	0.613
Indusind Bank	0.921	0.814	0.005	0.057	0.711	0.750
HDFC Bank	0.575	0.125	0.085	0.016	0.441	0.703
SBI Bank	0.000	0.000	1.000	1.000	0.000	0.000
IDFC Bank	0.977	0.925	0.010	0.065	1.000	0.542
RBL Bank	1.000	0.915	0.011	0.007	0.853	0.876
Federal Bank	0.978	0.868	0.017	0.000	0.020	1.000

Step 4: Calculation of grey relational coefficients. Grey relationship coefficients, which show the similarity between the reference series and the alternatives, are calculated using Formulas 5 and 6, with a moderate distinguishing effect of $\xi = 0.5$. The grey relational coefficients of alternatives are shown in Table 6.

Table 6. Grey relational coefficient of the banks with respect to each criterion

Banks	Economic criteria		Environmental criteria		Social criteria	
	C1	C2	C3	C4	C5	C6
Kotak Mahindra Bank	0.351	0.413	1.000	0.943	0.361	0.378
Axis Bank	0.390	0.400	0.848	0.998	0.438	0.509
YES Bank	0.349	0.333	1.000	0.939	0.340	0.350
ICICI Bank	0.411	0.537	0.996	0.980	0.460	0.449
Indusind Bank	0.352	0.380	0.990	0.898	0.413	0.400
HDFC Bank	0.465	0.800	0.855	0.970	0.531	0.416
SBI Bank	1.000	1.000	0.333	0.333	1.000	1.000
IDFC Bank	0.338	0.351	0.980	0.885	0.333	0.480
RBL Bank	0.333	0.353	0.978	0.986	0.370	0.363
Federal Bank	0.338	0.365	0.968	1.000	0.962	0.333

Step 5: Calculation of grey relational grades. Assuming equal importance of each decision criterion, the grey relational grades (γ_i) are computed using Formula 7. Banks are ranked based on their γ_i values. Table 7 shows the γ_i values and the ranking order of banks according to their sustainability performance.

Table 7. Grey relational grades and ranking showing sustainability performance of the banks

Banks	Grey relational grade	Rank
Kotak Mahindra Bank	0.574	6
Axis Bank	0.597	5
YES Bank	0.552	10
ICICI Bank	0.639	4
Indusind Bank	0.572	7
HDFC Bank	0.673	2
SBI Bank	0.778	1
IDFC Bank	0.661	3
RBL Bank	0.564	8
Federal Bank	0.561	9

Based on Grey Relationship Grades, SBI Bank is ranked first with a grade of 0.778. HDFC Bank follows with a score of 0.673, and IDFC Bank ranks third with a grade of 0.661. ICICI Bank, Axis Bank, Kotak Mahindra Bank, IndusInd Bank, RBL Bank, Federal Bank, and YES Bank have ratings of 0.639, 0.597, 0.574, 0.572, 0.564, 0.561, and 0.552 respectively. Among the 10 banks evaluated, SBI Bank demonstrated the best overall sustainability performance, followed by HDFC Bank and IDFC Bank. The overall sustainability score could be lower due to underperformance in any of the mentioned criteria.

5. DISCUSSION

In the previous section, we discussed the sustainability performance of banks using three different criteria: economic, environmental, and social. The sustainability performance was evaluated on different indicators for the respective criteria using GRA, which is widely accepted for evaluating performance when there are multiple criteria and alternatives (Kung & Wen, 2007).

As a result, banks have the opportunity to focus on implementing and strengthening sustainable practices to enhance their overall performance and adhere to global standards as benchmarks for sustainability performance. Additionally, the results suggest that very few banks reported on all indicators relating to sustainability; therefore, a more robust regulatory framework is needed to enhance the reporting measures of Indian banks. Policymakers and the regulatory framework should incorporate sustainability practices into the core business operations of Indian banks so that they can move beyond mere compliance with CSR.

We find that different banks have reported the initiatives in different ways, which is seemingly a difficult task to gauge and make comparisons. Therefore, there is a need to establish a clear methodology that can measure the sustainability performance of such companies.

Companies' environmental performance is mostly evaluated by calculating their "environmental footprint" or the externalities they have on society and on the environment. However, compared to the evaluation of an organization's economic and environmental performance, assessing a company's social impact appears to be a more challenging and underdeveloped process (Ranganathan, 1998).

National voluntary guidelines (NVGs), which serve as guidelines for environmental and social performance, have been embraced by the majority of banks in India. However, it was discovered that the execution of these recommendations has been restricted to policy disclosure or the reporting of qualitative data for each indicator included in the NVGs. Most of the time, quantitative data on sustainable banking activities was not disclosed, which supports the fact that the pace of adopting sustainable banking practices is slow in the Indian banking industry (Kumar & Prakash, 2019).

Yüksel et al. (2017) concluded that GRA is a significant method in measuring the financial performances of banks, supporting the study conducted by Ho and Wu (2006) on measuring company performances through the GRA method and concluding it to be effective. Future research could compare the results of this study with the use of other multi-criteria decision-making models, like AHP, TOPSIS, and ANP, on the sustainability performance of banks. Analysing the impact of ESG performance on financial success can be a future research area, with a particular focus on the attainment of Sustainable Development Goals.

6. CONCLUSION

Among businesses, financial institutions, and other corporations, there has been an increase in the awareness level regarding environmental issues, sustainable economy development, and the penalties associated with environmental damage. The banking industry plays a major role in the sustainable development of any economy, with banks serving as significant facilitators.

As more firms continue to increase their sustainability initiatives, the need to measure sustainability performance arises. However, measuring social and environmental parameters and comparing them across firms remains a difficult task. A methodology that can standardize the measurement of environmental and social performance is needed (Adams, 2004). This study aimed to assess the sustainability performance of banks using publicly accessible data from sustainability reports, business responsibility reports, annual reports, and information from bank websites. The GRA methodology was employed to evaluate the banks on different parameters of sustainability.

The results showed that among the 10 banks evaluated, State Bank of India (SBI) had the best overall sustainability performance followed by HDFC Bank, IDFC Bank, and ICICI Bank. Banks may also score low in the overall sustainability performance by not performing well in one or more dimensions of sustainability.

The research findings demonstrate that the Indian banking sector has not been fully equipped to tackle this challenge, as the country is still in the early stages of adopting sustainable banking practices. Banks should embrace international codes of conduct on sustainability, such as UNEP FI, GRI, UNGC principles, and Equator principles, to enhance their performance in sustainable banking. These frameworks could serve as a guideline for implementing sustainable banking practices. Other banks should learn from India's best-performing banks and develop sustainable products and services, as well as further standardise non-financial performance further.

The finding has important implications for India and other developing nations' sustainable banking systems. This research will offer opportunities for enhancing sustainable banking performance and assist banks and other stakeholders in better understanding the challenges associated with implementing sustainable banking practices. The study has taken financial performance also into consideration, emphasizing that high sustainability performance does not necessarily mean foregoing financial gain.

This study has some limitations despite offering valuable insight into the nature, scope, and performance of sustainable banking in India. The research is based on publicly available data volume, but it has not considered the extent and

significance of banks' sustainable performance. Foreign banks operating in India and regional rural banks are not included in the study sample. Only a few metrics have been considered in this study to gauge sustainable banking performance. Future research can use other sustainable banking metrics. This paradigm can be applied in other developing nations with similar conditions. Further studies can focus on the banking industry by linking sustainability performance with banks' financial performance.

In the future, longitudinal studies comparing sustainable banking performance over different time periods may attempted to assess the institutions' advancements in sustainable banking performance. Future research can be expanded by measuring sustainability performance over years, including other financial institutions, and using various standardisation metrics.

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