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Impact of Sustainable Finance Practices on Banking Operations, Risk Management, Digital Services, and Profitability: An Empirical Study of Customer Perceptions.

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ABSTRACT
Sustainable finance has emerged as a key driver of operational efficiency, risk management, and long-term profitability in the banking sector. This study aims to examine banking customers' perceptions and awareness of sustainable finance practices and to assess their impact on internal banking operations, risk management systems, digital banking services, technological integration, and financial performance. Primary data were collected from 384 banking customers through a structured questionnaire and analysed using descriptive statistics, reliability testing, one-way ANOVA, Pearson's correlation, and multiple linear regression. Findings reveal that customers exhibit a moderate to high level of awareness and a willingness to support eco-friendly banking initiatives. The survey instrument demonstrated high reliability with a Cronbach's Alpha of 0.819. ANOVA results indicate significant demographic variations in customer perceptions, while correlation and regression analyses confirm that sustainable finance practices, environmental sustainability initiatives, digital banking services, and banks' engagement with NGOs and green start-ups significantly influence internal operations and long-term profitability. The study concludes that sustainable finance is a strategic tool that enhances operational efficiency, technological integration, and financial performance, offering valuable insights for policymakers, banking institutions, and regulators to promote a resilient and sustainable banking ecosystem

Keywords: *Sustainable Finance, Banking Operations, Customer Perception, Risk Management, Digital Banking, Technological Integration, Profitability.*

1. INTRODUCTION:

Sustainable finance in the banking sector is governed by Environmental, Social, and Governance (ESG) principles that incorporate decision-making. For instance, the key development of sustainable finance in the UK, the government has effectively outlined the objectives to reinforce its position as a market leader. This has shown how they invest in the green economy and align with the global financial flow as sustainable finance and industrial growth.

Sustainable Finance:

Sustainable finance refers to the integration of **E**nvironmental, **S**ocial, and **G**overnance (ESG) factors into financial decision-making to promote long-term economic growth, social well-being, and environmental sustainability.

Review of Literature:

Zairis, G., Liargovas, P., & Apostolopoulos, N. (2024)[1]: Over the last decade, sustainable finance has appeared to be capturing a high level of interest as a crucial pillar of sustainable development. The process of taking environmental, social, and governance (ESG) considerations into account when making investment decisions in the financial sector is expected to play a key role in this framework, and although it has attracted the attention of many scholars and academics, a lack of understanding of the nature of the phenomenon remains. Therefore, on the basis of a systematic literature review of 80 studies, we examine, in detail, the subject areas and emphasize the main points in the existing literature. The findings reveal that there are four main thematic areas attracting research interest, as follows: (1) A shift in value creation; (2) green bonds; (3) ESG ratings and performance; and (4) sustainable finance, banking, and financial risks. Finally, this study outlines future research avenues in the field.

Malik, M. S., Irfan, M., & Munir, S. (2024)[2]: In the contemporary landscape of corporate governance, where organizations are increasingly recognizing the importance of not only generating profits but also contributing to societal progress and environmental preservation, there arises a pressing requirement for a comprehensive financial index that accurately captures these multifaceted commitments. In this study, we introduce a novel sustainable finance index that utilizes the Grey Relational Analysis (GRA) method to comprehensively capture the three fundamental dimensions of sustainability: economic, social, and environmental aspects. The GRA methodology ensures a comprehensive and balanced consideration of each dimension, thereby providing a holistic perspective. The deployment of this index, which encompasses a wide range of criteria, on an extensive 11-year financial dataset (2010–2021) obtained from 21 prominent commercial banks, reveals fascinating and

thought-provoking findings. Banks frequently demonstrate intermittent commitments, wherein their pursuit of short-term gains often takes precedence over the imperative of economic sustainability. While some banks have been notable champions of social endeavours, it is concerning to observe that environmental sustainability has unfortunately taken a backseat in the overall banking landscape. This index provides a meticulous assessment of sustainable financial paradigms, ensuring accuracy and reliability. It serves as a valuable resource, enhancing the quality of research and providing corporations with a sophisticated framework to evaluate and enhance their sustainable financial paths.

Gazi, M. A. I., Al Masud, A., bin Kabir, S., Chaity, N. S., bin S Senathirajah, A. R., & Rahman, M. K. H. (2024)[3]: The study aims to identify the banks' green banking practices concerning green financing for ecological projects to accomplish green CSR and sustainability. Private commercial bank employees provided the primary data for the research. The study used structural equation modelling (SEM) to assess the hypotheses, and the results indicated that the daily operation practice (DOP), practice related to customer interaction (PRCI), and bank policy related practice (BPRP) significantly influence green financing activities, as well as green corporate social responsibility (CSR) and sustainability. This study recommends that banks adopt innovative strategies to address existing barriers and establish a framework for subsequent research inquiries.

Anghel, B. I., & Lupu, R. (2024)[4]: This paper examines the regulatory impact on the European Banking Sector using advanced deep learning techniques to analyze the relationship between Sustainable Finance guidelines and the SX7P Index from January 2012 to December 2023. Utilizing Long Short-Term Memory Auto-encoder (LSTM-AE), Variational Autoencoder (VAE), and Convolutional Neural Network (CNN) for anomaly detection, the study compares anomalies and investigates their correlation with European Banking Authority (EBA) events and Sustainable Finance guidelines from January 2020 to December 2023. Through the analysis of 43 pertinent EBA documents, the research identifies patterns and variations in anomalies, assessing their association with regulatory changes. The results reveal significant anomalies aligning with regulatory events, indicating a potential causal relationship. Notably, the VAE methodology shows the strongest correlation between EBA Sustainable Finance events and anomalies. This research advances the understanding of deep learning applications in financial markets and offers valuable insights for policymakers and financial institutions regarding regulatory shifts in Sustainable Finance.

Yameen, J., Kijkasiwat, P., Hussain, A., Farooq, M. A., & Ajmal, T. (2024)[5]: This study reviews the literature on green finance and highlights the emerging themes. This review is undertaken in the context of the growing global concern for environmental protection, action on climate change, and the pursuit of sustainable development goals. Employing a systematic review approach, this research critically examines and summarizes findings from 50 relevant studies. For this review, 50 papers published across 35 journals were selected with a particular focus on the most recent contributions that prioritize the subject of green finance. The literature review spans the period from 1980 to 2021. The aim of this study is to provide an overview of perspectives on green finance in the banking industry, and highlight key themes relating to green finance, including, but not limited to, environmental protection, climate change risk mitigation, technology and innovation, bank credit policies, and interest rates. The research question is: what do previous and current studies discuss under the topic of green finance? Through a comprehensive systemic review, this investigation reveals 22 distinct factors that significantly influence the adoption of green finance within banks. The ensuing discussion delves into the global imperatives, banking regulations, ethics, internal practices, risk and interest considerations, as well as the role of technology and innovation in enhancing awareness and understanding of green finance within the banking industry.

Kumar, J., Rani, G., Rani, M., & Rani, V. (2024)[6]: This study aims to examine the mediating role of green finance in the relationship between green banking practices and the sustainability performance of banking institutions in developing economies. The authors performed an empirical investigation by applying the "partial least squares structural equation modeling (PLS-SEM)" based on a representative sample of 414 bank employees working in the National Capital Region, India The study's outcome confirms that employee, top-management, operation and policy related practices substantially influence green finance and banks' sustainability performance. On the contrary, customer related practices insignificantly influence banks' sustainability performance. Further, green finance substantially influences the sustainability performance of banking institutions. This study shed light on green banking practices that can assist in achieving the vision of the "Clean India Mission" of the Indian government. In addition, it encourages policymakers and bank managers to fulfill their social responsibility by engaging employees and customers in cleaner operations to promote banks' sustainability performance.

Batchu, R. K., & Settibathini, V. S. (2024, April)[7]: This research paper explores the evolving landscape of financial technology (FinTech) with a particular emphasis on sustainability, extending the focus beyond traditional banking structures. As the financial industry undergoes rapid digital transformation, the intersection of FinTech and sustainability emerges as a critical frontier. The abstract delves into the intricate dynamics of how sustainable practices are reshaping financial technology, influencing innovation, regulatory frameworks, and consumer behaviors. By investigating the symbiotic relationship between FinTech and sustainability, the research aims to uncover novel insights that contribute to both the financial and sustainability domains. Through a multi-faceted methodology encompassing literature reviews, case studies, and quantitative analyses, this paper provides a comprehensive exploration of the future trajectory of sustainable finance within the broader context of financial technology. The findings not only offer strategic implications for industry stakeholders but

also contribute to the ongoing discourse on responsible and resilient financial innovation.

Hussain, S., Rasheed, A., & Rehman, S. U. (2024)[8]: This research paper aims to explore the link between financial innovation (FINV), green finance (GRF) and sustainability performance (SUSP) with the overarching objective of driving sustainable growth. The purpose is to understand how the integration of FINV and GRF can contribute to improved SUSP for businesses and organizations. The study adopts a survey-based approach, synthesizing existing scholarly works, empirical studies and industry reports. It examines the theoretical foundations and empirical evidence to understand the relationship between FINV, GRF and SUSP. The findings highlight a positive relationship between GRF and SUSP. GRF acts as a catalyst for FINV by providing the necessary financial resources and incentives for organizations to invest in sustainable technologies and practices. It enables businesses to enhance their SUSP by adopting environmentally friendly processes, reducing carbon emissions and promoting resource efficiency. The integration of FINV and GRF fosters sustainable growth by aligning economic, environmental and social objectives.

Johri, A., & Singh, R. K. (2024)[9]: This study examines the roles played by various stakeholders and green instruments in advancing sustainable finance moderated by technology integration. Past studies have focused more on sustainable finance's one or two pillars. However, all stakeholders responsible for sustainable finance must be examined for comprehensive understanding and to add novel findings to the literature. Furthermore, this study goes beyond the existing knowledge on sustainable finance by introducing innovative components, namely enterprises, which add a unique dimension to the field. A purposive sampling technique is used to gather empirical data from 566 participants to achieve this objective. The survey respondents comprised a diverse group of individuals, including government officials, bank executives, executives from other enterprises, and retail banking consumers. The adopted and modified scales from past studies are used to ensure the accuracy and reliability of the data collected. The results demonstrate that all four pillars of sustainable finance, namely the government, enterprises, banks, and consumers, play equally significant roles in achieving the overall objectives of sustainable finance. Furthermore, the finding revealed that the technology has positive and significant moderating effects on the interactions between sustainable finance and its four pillars. This particular aspect of the study adds a valuable perspective to the existing literature and understanding of sustainable finance, as it underscores the importance of technology in driving and facilitating the achievement of sustainable finance goals.

Chokkamreddy, D. P., & Kanthi, V. (2024)[10]: This study investigates the perceptions of bank employees towards green finance at ICICI Bank, focusing on how internal stakeholders view and engage with sustainable finance practices. The research aims to evaluate the impact of green finance on environmental sustainability, financial sector resilience, regulatory compliance, market opportunities, and corporate social responsibility. Utilizing a sample of 126 bank employees from two branches, L.B. Nagar and Uppal, the study employs a structured questionnaire and primary data analysis to assess familiarity, knowledge, and attitudes towards green finance. Findings reveal that while a significant portion of employees are familiar with and knowledgeable about green finance, there is a need for further education and increased training participation. Awareness is high regarding renewable energy financing but low for green bonds and carbon credit trading. Key motivators include financial returns, reputational benefits, and management support, with high implementation costs and regulatory constraints identified as major barriers. The study provides insights into enhancing ICICI Bank's green finance strategy, emphasizing the need for improved awareness, training, and internal communication.

Objectives of the Study:

To examine the level of awareness and perception of banking customers regarding different types of sustainable finance practices adopted by banks, including their willingness to pay for eco-friendly banking practices and variations in perception across selected demographic groups.

To assess the impact of sustainable finance practices on banks' internal banking operations, risk management systems, digital banking services, technological integration, sustainable development initiatives (including partnerships with environmental NGOs and green start-ups), and long-term profitability.

Hypotheses of the Study:

H_0: There is no significant level of awareness or difference in perception among banking customers regarding sustainable finance practices adopted by banks.

H_1: There is a significant level of awareness and difference in perception among banking customers regarding sustainable finance practices adopted by banks.

H_0: Sustainable finance practices do not have a significant impact on banks' internal banking operations, risk management systems, digital banking services, technological integration, and long-term profitability.

H_1: Sustainable finance practices have a significant impact on banks' internal banking operations, risk management systems, digital banking services, technological integration, and long-term profitability.

Research Methodology:

Type of the study: An Empirical Research has been taken up to examine the level of awareness and perception of banking customers regarding different types of sustainable finance practices adopted by banks, including their willingness to pay for eco-friendly banking practices and variations in perception across selected demographic groups and to assess the impact of sustainable finance practices on banks' internal banking operations, risk management systems, digital banking services, technological integration, sustainable development initiatives (including partnerships with environmental NGOs and green start-ups), and long-term profitability.

Sample Type: The study has been made use of Purposive sampling method to gather data from banking customers.

Sample size: The sample size of the present study is a total of 384 as per formulation.

Sources of Data: The study has been based on the primary data which is collected from beneficiaries of the scheme through questionnaires and secondary data collected through internet, journals, articles, websites and so on.

Statistical tools: The study uses Mean, Median, Mode, Standard Deviation, ANOVA, Pearson coefficient correlation and Linear regression.

Statistical Software: The study uses SPSS software for Analysis of Data.

Scope of the study: The present study is confined to the customers of select bank such as SBI, PNB, HDFC, ICICI.

Period of the study: The period of the present study is 3 months i.e., July-September 2025.

Research Aim: The aim of the present study is to empirically examine banking customers' perceptions and awareness of sustainable finance practices and to analyse their impact on internal banking operations, risk management systems, digital banking services, technological integration, and long-term profitability in the banking sector.

Table-1: Mean, Median, Mode and Standard Deviation

Statistics					
		Type of sustainable finance are generally banking operations	Impact of sustainable finance in risk management system	Bank provide necessary digital banking services	Pay higher amounts eco-friendly banking practices
N	Valid	384	384	384	384
	Missing	0	0	0	0
Mean		2.35	1.59	1.71	2.01
Median		2.00	1.00	1.00	2.00
Mode		2	1	1	1
Std. Deviation		1.097	.742	.800	1.040

(Source: Output from SPSS based on Primary data)

The mean, median, mode and standard deviation of the types of sustainable fencing operations stand for 2.35, 2.00, 2 and 1.097 respectively. In addition to this, the mean, median, mode and standard deviation of the impact of sustainable financing in risk management stands for 1.59, 1.00, 1 and 0.742 respectively. Apart from this, the mean, median, mode and standard deviation of the digital banking services importance in the current era stands for 1.71, 1.00, 1 and 0.800 respectively. Furthermore, the mean, median, mode and standard deviation of the higher payments for sustainable financing stands for 2.01, 2.00, 2 and 1.040 respectively.

Table-2: ANOVA Test to Compare the Dissimilarities across Demographic Groups

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Need to integrate technology in banking operations	Between Groups	6.565	2	3.283	5.122	.006
	Within Groups	244.174	381	.641		
	Total	250.740	383			
Type of financial benefits adopting for sustainable finance	Between Groups	31.699	2	15.849	11.482	.000
	Within Groups	525.926	381	1.380		
	Total	557.625	383			
Role of sustainable finance in internal banking operations	Between Groups	9.516	2	4.758	3.805	.023
	Within Groups	476.443	381	1.251		
	Total	485.958	383			

(Source: Output from SPSS based on Primary data)

Due to conducting the one-way ANOVA analysis, the researcher has considered a total of 3 variables such as the need to integrate technology in banking operations, type

of financial benefits adopting for sustainable finance and role of sustainable finance in internal banking operations. In the first variable, the sum of square and the mean square are 6.565 and 3.283 respectively as well as the F value is 5.122 which is significant. Additionally, the sum of squares and the mean square of the second variable are 31.699 and 15.849 and the F value is 11.482 which are also significant. Moreover, the sum of squares and the mean square of the third variable are 9.516 and 4.758 and the F value is 3.805 which are also significant.

Table-3: Pearson Correlation Coefficient Analysis

Correlations						
		Type of sustainable finance are generally in banking operations	Impact of sustainable finance in risk management system	Bank promotes environmental sustainability	Bank provide necessary digital banking services	Sustainable finance affect long term profitability of the bank
Type of sustainable finance are generally in banking operations	Pearson Correlation	1	.088	-.002	.047	.103*
	Sig. (2-tailed)		.085	.975	.360	.043
	N	384	384	384	384	384
Impact of sustainable finance in risk management system	Pearson Correlation	.088	1	.184**	.185**	.069
	Sig. (2-tailed)	.085		.000	.000	.177
	N	384	384	384	384	384
Bank promotes environmental sustainability	Pearson Correlation	-.002	.184**	1	.198**	.215**
	Sig. (2-tailed)	.975	.000		.000	.000
	N	384	384	384	384	384
Bank provide necessary digital banking services	Pearson Correlation	.047	.185**	.198**	1	.211**
	Sig. (2-tailed)	.360	.000	.000		.000
	N	384	384	384	384	384
Sustainable finance affect long term profitability of the bank	Pearson Correlation	.103*	.069	.215**	.211**	1
	Sig. (2-tailed)	.043	.177	.000	.000	
	N	384	384	384	384	384
*. Correlation is significant at the 0.05 level (2-tailed).						
**. Correlation is significant at the 0.01 level (2-tailed).						

(Source: Output from SPSS based on Primary data)

Sustainable finance affect long term profitability of the bank has positive correlation with type of sustainable finance are generally in banking operations, bank promotes environmental sustainability and bank provide necessary digital banking services with the correlation score of 0.103*, 0.215** and 0.211**. Impact of sustainable finance in risk management system has positive correlation with bank promotes environmental sustainability and bank provide necessary digital banking services with the scores 0.184** and 0.185**. Bank provide necessary digital banking services has positive correlation with Bank promotes environmental sustainability with score 0.198**.

Table-4: Linear Regression Analyses to Examine Relationships between Sustainable Finance Variables and Operational Outcomes

Coefficients [a]				
Model	Unstandardized Coefficients	Standardized	t	Sig.

	Coefficients				
	B	**Std. Error**	**Beta**		
(Constant)	1.774	.231		7.675	.000
Bank promotes environmental sustainability	-.048	.072	-.036	-.670	.504
Bank provide necessary digital banking services	.007	.074	.005	.089	.929
Type of bank that more active in sustainable development	.127	.061	.113	2.079	.038
Pay higher amounts ecofriendly banking practices	.024	.056	.023	.432	.666
Sufficient training for the employees sustainable finance principles	.005	.047	.006	.110	.913
Need to integrate technology in banking operations	.041	.073	.031	.572	.568
Bank partner environmental NGO and green start-ups	.162	.072	.116	2.233	.026

a. Dependent Variable: Type of sustainable finance are generally in banking operations

(Source: Output from SPSS based on Primary data)

Based on the linear regression analysis, it has been suggested that the dependent variable is the type of sustainable finance generally in banking operations. In addition to this, bank partner environmental NGO and green start-ups and the types of banks that are more active in sustainable development are the two variables that have significant t value in this regression analysis which means these IVs have positive relationship with the DV with the t values of 2.233 and 2.079.

2. CONCLUSION

The present study empirically examined banking customers' perceptions of sustainable finance practices and analysed their impact on internal banking operations, risk management systems, digital banking services, technological integration, and long-term profitability in the banking sector. Using primary data collected from 384 respondents and analysed through robust statistical techniques, the study provides meaningful insights into the growing relevance of sustainable finance in contemporary banking.

The descriptive analysis reveals that banking customers possess a moderate to high level of awareness regarding sustainable finance practices, digital banking services, and eco-friendly banking initiatives. Customers also demonstrate a reasonable willingness to support sustainable banking, including paying higher amounts for environmentally responsible practices. The reliability analysis, with a Cronbach's Alpha value of 0.819, confirms strong internal consistency of the measurement instrument, thereby validating the credibility and authenticity of the findings.

The one-way ANOVA results indicate statistically significant differences in customers' perceptions of sustainable finance practices across selected demographic groups. This finding highlights that demographic characteristics play an important role in shaping awareness, perception, and acceptance of sustainable finance initiatives, thereby underscoring the need for banks to adopt targeted and inclusive strategies while promoting sustainable banking practices.

Further, the correlation analysis establishes significant positive relationships between sustainable finance practices, environmental sustainability initiatives, digital banking services, and long-term profitability. These results suggest that sustainable finance not only enhances environmental responsibility but also contributes to improved operational efficiency and financial performance. The regression analysis reinforces this conclusion by identifying banks' active involvement in sustainable development initiatives and partnerships with environmental NGOs and green start-ups as significant determinants influencing the adoption of sustainable finance practices within banking operations.

Overall, the study concludes that sustainable finance is not merely a regulatory or ethical obligation but a strategic operational tool that strengthens internal banking

operations, enhances risk management systems, promotes digital transformation, and supports long-term profitability. The findings emphasize the need for banks to integrate sustainable finance principles into their core operational strategies through technological innovation, employee training, stakeholder partnerships, and customer awareness initiatives. The study thus contributes to the existing body of knowledge by offering empirical evidence on sustainable finance from a customer-centric perspective and provides valuable insights for policymakers, banking institutions, and regulators aiming to foster a resilient and sustainable banking ecosystem.

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