THE ESG EDGE: INNOVATING THE VALUE CHAIN FOR SUSTAINABLE BANKING IN INDIA

Integrating Innovation, Economic Performance, and Sustainability for Banking 5.0 Transformation

Jayshree Roongta
Assistant Professor
The Heritage College, Kolkata
+ 91 9830390665
roongta.jayshree@gmail.com

and

Jaivardhan Roongta
Student
St. Xavier's College (Autonomous), Kolkata
jaivardhanroongta@gmail.com
https://doi.org/10.5281/zenodo.17637710

ABSTRACT

The transition from Banking 4.0 to Banking 5.0 necessitates integrating sustainability and innovation throughout the banking value chain. This study proposes and validates a framework to evaluate these integrations' impact on Economic, ESG (Environmental, Social, and Governance), and Sustainability metrics in the Indian banking sector. The study uses rigorous statistical analysis to validate the framework using data from 325 banking experts from ten major banks as well as secondary sources like sustainability reports. The framework includes Primary Activities (customer-centric solutions, risk assessment, digital transformation, stakeholder engagement, and continuous monitoring) and Support Activities (governance, human capital development, data analytics, risk management, and operations efficiency). The findings demonstrate strong validity and reliability across dimensions, as indicated by goodness-of-fit indices (RMSEA, CFI, IFI). Value chain integration innovation improves overall sustainability results and has a favorable impact on economic and ESG performances. The analysis indicates consistent positive connections between value chain integration, ESG performance, and economic outcomes, with high explanatory power (R-squared 0.616 to 0.953). This research provides guidance and ideas for banks navigating sustainable development, bridging the gap between Banking 4.0 and 5.0. It emphasizes the importance of banks embracing technology and sustainability in tandem in order to achieve long-term resilience and societal impact in Banking 5.0.

Keywords: Banking 5.0, *Indian Banking System, Innovation, Sustainability, Value Chain*

A. INTRODUCTION

The emphasis on Sustainable Development Goals (SDGs) have exerted undue pressure on the banking sector to promote sustainable banking practices. With technology growth, changing customer expectations and increasing demand for sustainability, the banking industry is at a crossroads in the global financial system (Kim et al., 2022). Banking 1.0 has given way to Banking 4.0 and now Banking 5.0 is driven by technical expertise and sustainability. A change in the banking industry, which is showcased by its path towards Banking 5.0 incorporates sustainability into everything in the ecosystem, operational processes, customer interaction and strategic decision making (Wu et al., 2023). It creates sustainable value while reducing environmental and social impact. It goes beyond compliance by promoting environmental stewardship, social equity, and economic resilience (Strakova et al., 2021; Hergert & Morris, 1989). Banking 5.0 innovates across the entire value chain, beyond new products and services to ethical investing, carbon reduction, supply chain management and financial inclusion (Tarmuji & Maelah, 2016). The most challenging aspect of value chain innovation in context of banking functionality lies in not only developing the business model but also providing a strategic approach to its implementation (Strakova et al., 2021). To align SDGs into the value chain concept requires transforming financial performance into a more comprehensive measure, inclusive of economic and ESG metrics (Velte, 2017). This builds a positive socio-environmental footprint, increases operational efficiency and profitability, and builds stakeholder trust. The emergence of cutting-edge technology such as blockchain, artificial intelligence, and decentralized finance offers prospects to reinterpret banking's function in sustainable development (Cek & Eyupoglu, 2020). The shift to Banking 5.0 represents a move toward a financially stable, socially conscious, and environmentally sustainable banking ecosystem, so scholars and stakeholders in the future of banking must examine the relationship between innovation and sustainability in the banking functionalities including focus on value chain.

B. OBJECTIVE OF THE STUDY

The scope of this study is relatively extensive in nature. The research investigates the integration of sustainability and innovation within the framework of Banking 5.0, with a specific focus on the transformative impact of emerging technologies across the banking value chain.

The presented research was undertaken given the undermentioned objectives:

1. To propose a framework that outlines the innovation across value chain for sustainability in banking.
2. To analyse the impact of innovation on Economic, ESG, and Sustainability metrices.
3. To provide strategic insights for deploying the framework for sustainable banking.

C. LITERATURE REVIEW

Evolution of Sustainable Banking and Theoretical Foundations

The shift in focus from Banking 4.0 to another level has gained place in the literature. Naimi-Sadigh et al. (2022) highlights the practice stating the transformative power of digital

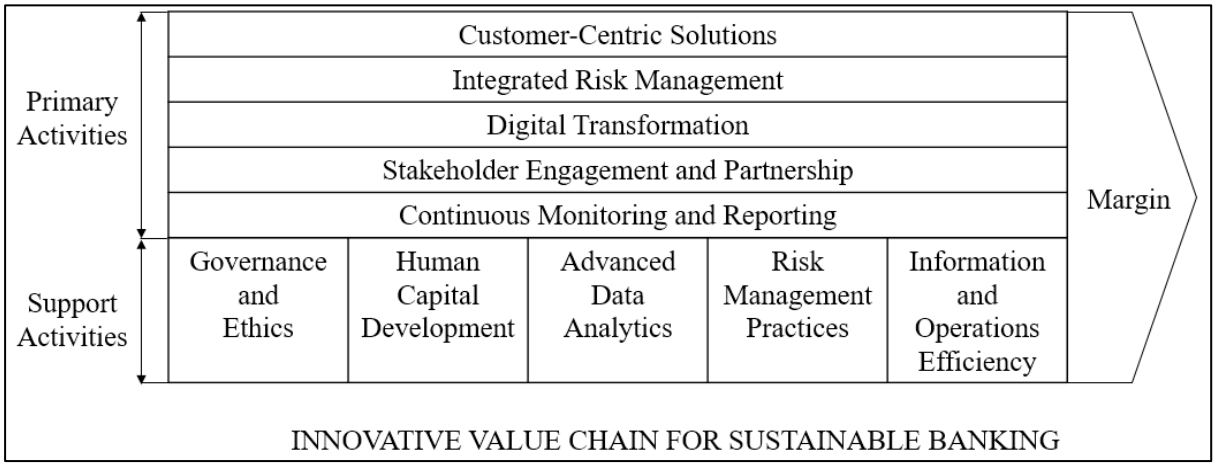
evolution in domain of banking operations and functions. Banking 5.0 is about a holistic approach to sustainability. This means incorporating social and environmental considerations into every part of banking. This is where the triple bottom line (TBL) framework (Elkington, 1994; Slaper & Hall, 2011) and stakeholder theory (Freeman, 1984) can help. According to stakeholder theory, banks must serve more people than just their shareholders. This includes customers, authorities, employees and the broader public (Rebai et al., 2022). The TBL framework measures business success beyond financial data. It looks at social and environmental issues. This is in line with the environmental, social and governance (ESG) paradigm (Bassen & Kovács, 2008). Banks can increase long term profitability while fostering honesty and trust by focusing on ESG. When making financial decisions ESG concerns such as waste management, energy efficiency, privacy and data security are becoming more important. But the link between ESG and financial success is still yielding mixed results. Gutiérrez-Ponce and Wibowo (2023) found no significant impact on Indonesian banks but Menicucci and Paolucci (2023) found a positive link in Italian banks. According to Pyka and Nocoń (2023) the regulatory framework and local context can have a big impact on ESG performance.

Role of Value Chain Innovation and Resource-Based view in Sustainable Banking

Michael Porter's Value Chain, first created for industrial sectors in 2008, has been effectively applied to banking operations. That was originally demonstrated in lending operations by scholars such as Wei-Shong and Albert (2006) and Scannella (2006). The main tasks in banking are rather simple: client engagement, credit analysis, and risk assessment. IT, HR, infrastructure, and, most importantly, risk management all help to support these tasks. Banks employ this paradigm to maximize their internal resources, both material and intangible, in order to obtain a long-term competitive edge. That is the concept underpinning the Resource-Based View of the Firm (Wernerfelt, 1984; Barney, 1991). In relation to the view, distinctive capabilities and strategic resources remain connected quite largely. The capabilities stand inclusive of digital infrastructure, qualified personnel, and difficult-to-replicate governance mechanisms (Amit & Schoemaker, 1993). The generation of economic value with environmental goals can be connected by reorganizing banking processes around the Value Chain concept. By emphasizing the cyclical link between deposits and lending as the foundation of banking operations, the financial intermediation theory supports the same (Werner, 2016; Assfaw, 2019). Further, in the concerning cycle, credit expansion and liquidity are closely related, underscoring the need of value chain efficiency.

Proposed framework for innovation across value chain for sustainable banking (in context of Value Chain Innovation and Resource-Based view in Sustainable Banking)

Figure 1: Framework For Innovation Across Value Chain for Sustainable Banking



Source: Authors own framework proposition by adapting variable context from Scannella, 2015; Lamarque, 2004; Lammers et al., 2004; Porter, 2008; Colquitt, 2007; Wei-Shong & Albert, 2006; Van Greuning & Brajovic Bratanovic, 2020; Hubbard et al., 2014; Naimi-Sadigh et al., 2022; Werner, 2016; Assfaw, 2019; Yang & Liping, 2014.

Primary activities in a value chain encompass core functions that directly contribute to the creation, delivery, and support of products or services. Customer-Centric Solutions - Focus on creating banking experiences, services, and products that value and improve client loyalty and happiness. Facilitate use of consumer feedback and insights to customize services and enhance the entire customer experience. Integrated Risk Assessment - Involve a comprehensive approach to identifying, assessing, and managing various risks (financial, operational, regulatory, etc.) across all aspects of banking operations. Improve resilience and sustainability by incorporating risk management into strategic decision-making processes. Digital Transformation - Utilize digital technology to transform conventional banking procedures, frameworks, and client communications. Include projects like blockchain for security and transparency, AI-driven customer support, mobile banking, etc. Stakeholder Engagement and Partnership - Develop and maintain relationships with all relevant stakeholders, including as customers, employees, regulators, and communities. Build collaborations and alliances that might lead to the creation of shared value, trust, and innovation. Continuous Monitoring and Reporting - Incorporate ongoing assessment and monitoring of key performance indicators (KPIs) pertaining to customer satisfaction, sustainability, and risk management, among other areas. Achieve transparency via reporting to stakeholders on progress, obstacles, and outcomes.

Support activities in a value chain provide essential infrastructure and resources that facilitate and enhance the effectiveness of primary activities. Governance and Ethics - Ensure compliance, integrity, and responsibility in all banking activities by establishing strong governance structures and ethical standards. Encourage ethical conduct across the whole business. Human Capital Development - Prioritize innovation and performance, capabilities of developing talent, skills, and employee well-being. Include diversity initiatives, training programs, leadership development, and creating a positive work environment. Advanced Data Analytics - Generate useful insights for risk management, decision-making, customer customization, and operational efficiency by utilizing big data and analytics technologies. Permit fraud detection, consumer segmentation, predictive modeling, and banking process

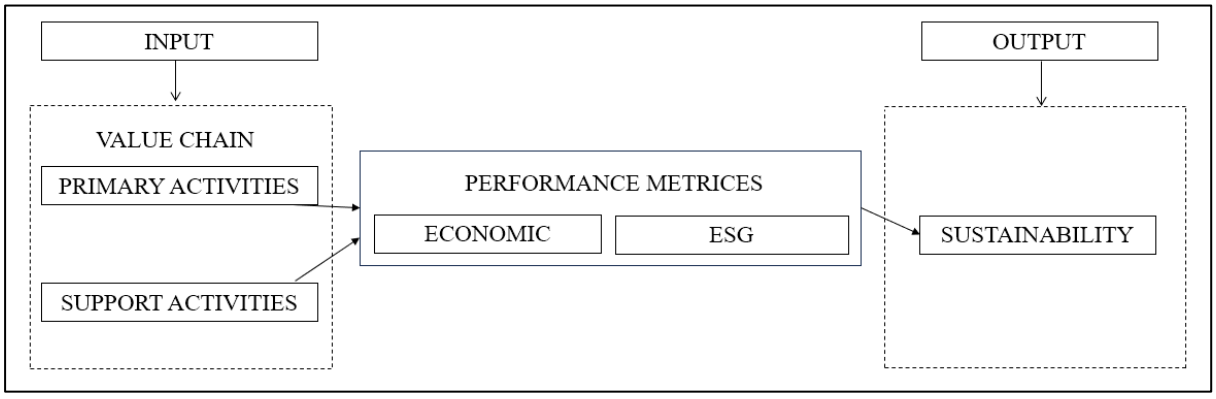
optimization. Risk Management Practices - Incorporate proactive tactics and methods to recognize, evaluate, reduce, and keep an eye on hazards throughout the company. Comprise risk management for compliance, market, operational, and credit risks. Information and Operations Efficiency - Focus on streamlining operational procedures and information management systems to increase productivity, cut expenses, and improve service delivery. Utilize of technology to improve data security, automate tasks, and streamline procedures.

Sustainable Banking and ESG Integration in Banking Decisions

Sustainable lending does not have a widely accepted definition but generally means credit decisions that follow ESG principles and long-term economic viability. Calderon and Chong (2014) define it as selecting borrowers based on their ESG compliant practices. It further comprises of methodical frameworks that contribute in assessing the social and environmental impacts of loan activities (Helaba, 2023). Lending, inclusive of focus on economic sustainability, counts essential for achieving sucess in the long run. This helps to cater also to social and environmental systems. According to Jiang et al. (2023), banks are shifting their portfolios to incorporate sustainable financing initiatives for environmental preservation and equitable development. However, the multifaceted aspect of sustainability is sometimes overlooked by conventional value chain models. According to Wu et al. (2012), requirement for Sustainable Value Chain (SVC) holds immense prominence. This tends to integrate TBL and ESG concepts into main and supporting operations. In the banking domain, they help the institutions handle complicated stakeholder requirements and match operational efficiency with ESG outcomes (Fearne et al., 2012; Sultan, 2013).

Input-output model for impact of innovation across value chain on economic, esg, and sustainability metrices

Figure 2: Input-Output Model for impact of innovation across value chain on various metrices



Source: Authors own proposition by adapting variable context from Freeman, 1984; Elkington, 1994; Financial Sector Initiative-The Global Compact, 2004; Porter, 2008.

Economic Performance Metrices: Return on Sustainable Investments, Net Interest Margin on Green Loans, Cost-to-income Ratio for Sustainable Operations, Sustainable Revenue Growth Rate, Carbon Productivity Index, Impact Investment – Return on Investment, Economic Value Distributed.

ESG Performance Metrices: Carbon Footprint Intensity, Social Impact Score, Governance Effectiveness Index, Water Usage Efficiency, Diversity and Inclusion Index, Ethics and Compliance Rating, Supply Chain Sustainability Index.
Sustainability Metrices: Renewable Energy Usage Percentage, Sustainability Procurement Spend, Waste Reduction Rate, Community Investment Ratio, Environment Certification Compliance Rate, Eco-efficiency of Operations, Sustainability Reporting Transparency Index.

Need for Standardization and Measurement

Existing literature also places importance of standardization, and on defining and developing a ESG measurement which would nullify the possibility of greenwashing which is a highly common practice undertaken by banks. Banks tend to misrepresent their operation accounting them as sustainable despite an increased use of ESG (Devalle et al., 2017). Further, studies have highlighted the requirement of improved regulatory monitoring mechanisms and uniform frameworks in result of growing stakeholder demands for transparency and verifiable sustainable performance (Manurung et al., 2024).

D. RESEARCH GAP

Movement towards Banking 5.0 is a transformation in the big field of banking. Contrastingly, the research in this field is limited (Naimi-Sadigh et al., 2022). Studies have placed great importance on digital transformation but have ignored the effect it places on banking value chains and economic and ESG performance (Wu et al., 2012). Although the Triple Bottom Line (TBL) concept and ESG indicators are popular, there is a lack of integrated frameworks that assess their combined impact on core banking activities like lending. Value chain analysis is widely used for financial performance evaluation (Porter, 2008) but underutilized in sustainable banking, especially in lending. Further, there has been extensive exploration of the three components of ESG separately (Menicucci & Paolucci, 2023; Gutiérrez-Ponce & Wibowo, 2023), without providing a holistic view of the same. This extends to the banking value chain perspective too, especially in terms of innovation. Disparities induced under regulatory, cultural, and governance contexts, in regionality terms, further influence how banks implement sustainable practices (Miralles-Quirós et al., 2019; Pyka & Nocoń, 2023). No doubt can be placed on the importance of sustainability metrics, BUT the lack of standardized indicators raises questionability on the comparison of banks' sustainability performance (Devalle et al., 2017; Manurung et al., 2024). Although the resource-based view (RBV) highlights unique resources for competitive advantage (Barney, 1991; Teece, 2018) there is limited research on how banks' technological infrastructure, governance systems and human capital contribute to sustainability goals. Future research should look at how these capabilities support ESG integration and long-term value creation in banking value chains.

E. RESEARCH METHODOLOGY

This study presents an analysis obtained by both primary data and secondary data. The data needed for this study was obtained through a well-structured questionnaire. The questionnaire is comprised of two major sections, demographic profile of the respondents, and perceptions and practices which impact Economic, ESG, and Sustainability metrices via Value Chain in Banking domain. Secondary data were obtained from sustainability reports and annual reports of the banks. A convenience sampling method was used to select ten major Indian banks by market capitalization in 2023, followed by purposive sampling to select respondents within those banks. Public Sector Banks include – State Bank of India, Punjab National Bank, Union Bank of India, Canara Bank, Bank of Baroda. Private Sector Banks include – ICICI Bank, HDFC Bank, YES Bank, IDBI Bank, IndusInd Bank. The respondents comprise of banking professionals from ten commercial banks in India. A total number of 325 respondents formed the study sample. The study is cross-sectional in nature. Conducted at one-point time frame in 2024. The presented study deals extensively with qualitative primary data obtained via a well-structured questionnaire; the analysis techniques involve evaluation of measurement model to test the validity and reliability of metrices, Goodness-of-fit test, Inferential Statistics (t-value and p-value) – measuring the influence between variables.

ANALYSIS OF DATA

Table 1: Demographic Profile of Respondents

Variable	Description	Percentage (%)
Gender	Male	52.32
	Female	45.92
	Others	1.76
Age	20-29	16.96
	30-39	30.88
	40-49	43.36
	50 and above	8.80
Educational Qualification	Graduate	26.64
	Post-Graduate	34.08
	Doctorate	8.48
	Diploma Holder	28.64
	Others	2.56
Work Unit	Customer Service	14.24
	Risk Management	16.48
	Operations	15.52
	Marketing	16.16
	Finance	18.08
	IT/Technology	15.20
	Others	4.32
Employment Designation	Managerial/Executive	25.12
	Specialist/Analyst	22.88
	Relationship Manager	15.84

	Team Leader	17.28
	Department Head	13.60
	Group /Division Head	5.28
Work Experience	Less than 1 year	10.40
	1-5 years	15.68
	6-10 years	37.28
	11-15 years	30.08
	More than 15 years	6.56
Are you aware of your bank's sustainability practices and reports	Yes	77.92
	No	22.08

Source: Author's own computation based on primary data

Table 2: Respondents Segregation based on Bank

Bank	Percentage (%)
State Bank of India	11.36
Punjab National Bank	9.92
Union Bank of India	9.12
Canara Bank	9.12
Bank of Baroda	9.92
ICICI Bank	9.76
HDFC Bank	11.84
YES Bank	10.08
IDBI Bank	9.76
IndusInd Bank	9.12

Source: Primary Data

The demographic profile indicates a diverse representation within the banking sector, with significant proportions across various age groups, educational backgrounds, and work units. There is notable awareness (77.92%) among respondents regarding their bank's sustainability practices and reports, suggesting a proactive engagement with sustainability initiatives. Most respondents hold managerial/executive roles or specialize in areas such as finance, operations, and IT/technology, indicating a blend of leadership and specialized expertise in sustainability practices. The distribution across different banks shows a balanced representation among major institutions, reflecting a comprehensive sample from the banking sector. State Bank of India, HDFC Bank, and YES Bank are among the top banks represented, each contributing approximately 10-12% of respondents. This distribution allows for a thorough analysis of sustainability practices and awareness across diverse organizational contexts within the banking industry.

Table 3: Evaluation of Framework and Model for validity and reliability of indicators

Dimension	Avera	Decisi	Cronbach	Decisi	Composi	Decisi	Averag	Decisi

	ge Loading Factor	on	's Alpha	on	te Reliability	on	e Variance Extracted	on
Primary Activities	0.811	Valid and Reliable	0.899	Valid and Reliable	0.899	Valid and Reliable	0.645	Valid and Reliable
Support Activities	0.794	Valid and Reliable	0.868	Valid and Reliable	0.868	Valid and Reliable	0.622	Valid and Reliable
Economic Performance	0.824	Valid and Reliable	0.919	Valid and Reliable	0.839	Valid and Reliable	0.672	Valid and Reliable
ESG Performance	0.921	Valid and Reliable	0.957	Valid and Reliable	0.957	Valid and Reliable	0.848	Valid and Reliable
Sustainability Functioning	0.861	Valid and Reliable	0.934	Valid and Reliable	0.919	Valid and Reliable	0.734	Valid and Reliable

Decision Criteria: Average Loading Factor >0.5; Cronbach's Alpha >0.6; Composite Reliability >0.6; Average Variance Extracted > 0.5 $\Rightarrow$ good construct validity and reliability
Source: Authors own computation

All dimensions have average loading factors above 0.5, implying the items to be highly valid and reliable. In every case, values of Cronbach's Alpha exceed 0.6 indicating good levels of internal consistency in each dimension. Composite reliability scores are all above 0.6 making it possible to conclude that the measurement model is both stability and accuracy. Furthermore, all dimensions' average variance extracted values exceed 0.5 which hints at adequate convergent validity. The ESG performance dimension has high reliability and validity according to all evaluated metrics with scores higher than 0.8. These findings strengthen the credibility and robustness of the suggested framework and model as a result supporting its applicability for evaluating sustainability through innovation in the banking value chain context for banking sector particularly.

Table 4: Evaluation of goodness-of-fit of the Framework and Model

Criteria	Loading Factor	Threshold	Decision
Root Mean	0.062	< 0.08	Good Fit

Square Error of Approximation (RMSEA)			
Comparative Fit Index (CFI)	0.941	> 0.90	Good Fit
Incremental Fit Index (IFI)	0.926	> 0.90	Good Fit

Source: Authors own computation

The model's fit was evaluated using the following criteria: RMSEA, CFI, and IFI. A decent fit between the model and the data is shown by the RMSEA value of 0.062, which is less than the generally recognized cutoff of 0.08. This implies that the observed covariance matrix is sufficiently approximated by the suggested framework. The stated values for the CFI and IFI are 0.941 and 0.926, respectively. These numbers show that the model matches the data better than the suggested cutoff point of 0.90. Values above 0.90 indicate a satisfactory fit. Overall, the suggested framework and model show a strong goodness-of-fit across all assessed criteria. This indicates that the model does a good job of capturing the structure and linkages that the Banking 5.0 theoretical framework and its emphasis on sustainability via innovation throughout the value chain imply. These findings validate the applicability and dependability of the suggested approach for investigating and promoting sustainable banking practices.

Table 5: Analysis of influence of innovation across value chain on economic, esg, and sustainability metrices

Influence Relation	Estimate	Standard Error	t-value	p-value	Acceptance Decision
Innovation in Value Chain → Increased Economic Performance	0.476	0.043	3.858	0.001	✓
Innovation in Value Chain → Increased ESG Performance	0.882	0.079	9.360	0.000	✓
Innovation in Value Chain → Enhanced Sustainability	0.179	0.041	0.375	0.001	✓
Increased ESG Performance → Increased Economic Performance	0.523	0.054	9.781	0.003	✓
Increased ESG Performance → Enhanced Sustainability	0.681	0.076	8.324	0.002	✓
Increased Economic Performance → Enhanced Sustainability	0.145	0.071	0.146	0.006	✓
Innovation in Value Chain → Increased Economic Performance → Enhanced Sustainability	0.047	0.013	0.432	0.021	✓
Innovation in Value Chain → Increased ESG Performance → Enhanced Sustainability	0.539	0.064	7.761	0.000	✓

Decision at 5% level of significance
Source: Authors own computation

In the context of Banking 5.0, the analysis shown in Table 5 offers a thorough understanding of the connections between innovation throughout the value chain and important performance indicators. The results show that innovation is essential to improving economic performance, ESG performance, and overall sustainability in banking operations. Empirical evidence indicates that augmenting innovation throughout the value chain yields noteworthy enhancements in economic outcomes and fortifies compliance with environmentally-sound governance norms. The significant impact that ESG performance has on sustainability and economic performance is especially remarkable, as it emphasizes the connections and mutual support between sustainability and financial objectives. The ripple impacts of innovation are further highlighted by indirect effects, which show how changes in pathways for economic and ESG performance led to better sustainable outcomes. These associations are statistically significant, supporting the findings and implying that strategic innovation efforts may successfully promote comprehensive and long-term growth plans in Banking 5.0 frameworks. Overall, the research emphasizes the significance of combining innovation and sustainability strategies in the banking industry to promote resilience and long-term value generation in the face of changing social and environmental demands.

Table 6: Analysis of Bank Standings

Bank	Influence Relation	Estimate	Standard Error	t-value	p-value	Acceptance Decision	R^2
State Bank of India	Innovation in Value Chain → Increased Economic Performance	0.662	0.281	4.439	0.000	✓	0.953
	Innovation in Value Chain → Increased ESG Performance	0.619	0.207	3.819	0.000	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.057	0.116	0.566	0.000	✓	
	Increased ESG Performance → Increased Economic Performance	0.618	0.129	4.893	0.000	✓	
	Increased ESG Performance → Enhanced	0.429	0.144	3.312	0.000	✓	

	Sustainability						
	Increased Economic Performance → Enhanced Sustainability	0.416	0.292	2.666	0.002	✓	
Punjab National Bank	Innovation in Value Chain → Increased Economic Performance	0.514	0.192	4.583	0.000	✓	0.874
	Innovation in Value Chain → Increased ESG Performance	0.707	0.145	5.701	0.000	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.454	0.188	3.481	0.001	✓	
	Increased ESG Performance → Increased Economic Performance	0.401	0.041	0.844	0.000	✓	
	Increased ESG Performance → Enhanced Sustainability	0.663	0.107	4.972	0.000	✓	
	Increased Economic Performance → Enhanced Sustainability	0.058	0.120	0.434	0.567	✗	
Union Bank of India	Innovation in Value Chain → Increased Economic Performance	0.611	0.141	6.591	0.002	✓	0.813
	Innovation in Value Chain → Increased ESG Performance	0.515	0.192	0.418	0.000	✓	
	Innovation in	0.027	0.051	0.589	0.522	✗	

	Value Chain → Enhanced Sustainability						
	Increased ESG Performance → Increased Economic Performance	0.784	0.088	8.319	0.000	✓	
	Increased ESG Performance → Enhanced Sustainability	0.810	0.113	6.476	0.001	✓	
	Increased Economic Performance → Enhanced Sustainability	0.412	0.161	1.293	0.000	✓	
Canara Bank	Innovation in Value Chain → Increased Economic Performance	0.725	0.275	4.128	0.000	✓	0.910
	Innovation in Value Chain → Increased ESG Performance	0.647	0.266	3.114	0.001	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.028	0.189	0.527	0.000	✓	
	Increased ESG Performance → Increased Economic Performance	0.659	0.147	4.873	0.000	✓	
	Increased ESG Performance → Enhanced Sustainability	0.416	0.132	3.267	0.000	✓	
	Increased Economic Performance → Enhanced	0.499	0.216	2.714	0.002	✓	

	Sustainability						
Bank of Baroda	Innovation in Value Chain → Increased Economic Performance	0.371	0.156	3.868	0.002	✓	0.724
	Innovation in Value Chain → Increased ESG Performance	0.562	0.254	0.489	0.000	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.036	0.072	0.614	0.511	✗	
	Increased ESG Performance → Increased Economic Performance	0.613	0.211	4.419	0.000	✓	
	Increased ESG Performance → Enhanced Sustainability	0.428	0.123	3.987	0.000	✓	
	Increased Economic Performance → Enhanced Sustainability	0.119	0.186	1.238	0.169	✗	
ICICI Bank	Innovation in Value Chain → Increased Economic Performance	0.598	0.245	3.361	0.000	✓	0.753
	Innovation in Value Chain → Increased ESG Performance	0.650	0.359	4.257	0.001	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.061	0.147	3.117	0.000	✓	
	Increased ESG Performance →	0.627	0.248	3.484	0.000	✓	

	Increased Economic Performance						
	Increased ESG Performance → Enhanced Sustainability	0.413	0.159	4.713	0.002	✓	
	Increased Economic Performance → Enhanced Sustainability	0.078	0.123	0.333	0.423	✗	
HDFC Bank	Innovation in Value Chain → Increased Economic Performance	0.626	0.270	4.139	0.001	✓	0.849
	Innovation in Value Chain → Increased ESG Performance	0.636	0.218	3.909	0.000	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.046	0.127	0.475	0.000	✓	
	Increased ESG Performance → Increased Economic Performance	0.629	0.118	4.984	0.001	✓	
	Increased ESG Performance → Enhanced Sustainability	0.418	0.154	3.403	0.000	✓	
	Increased Economic Performance → Enhanced Sustainability	0.427	0.281	2.357	0.000	✓	
YES Bank	Innovation in Value Chain → Increased Economic	0.425	0.103	4.472	0.000	✓	0.616

	Performance						
	Innovation in Value Chain → Increased ESG Performance	0.627	0.154	5.613	0.002	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.445	0.161	3.370	0.002	✓	
	Increased ESG Performance → Increased Economic Performance	0.311	0.052	0.753	0.000	✓	
	Increased ESG Performance → Enhanced Sustainability	0.754	0.116	4.083	0.000	✓	
	Increased Economic Performance → Enhanced Sustainability	0.049	0.137	0.345	0.538	✗	
IDBI Bank	Innovation in Value Chain → Increased Economic Performance	0.462	0.147	3.859	0.001	✓	0.681
	Innovation in Value Chain → Increased ESG Performance	0.471	0.263	0.498	0.000	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.045	0.081	0.627	0.468	✗	
	Increased ESG Performance → Increased Economic Performance	0.621	0.227	4.423	0.000	✓	
	Increased ESG Performance →	0.437	0.131	3.880	0.000	✓	

	Enhanced Sustainability						
	Increased Economic Performance → Enhanced Sustainability	0.128	0.175	1.364	0.524	✗	
IndusInd Bank	Innovation in Value Chain → Increased Economic Performance	0.523	0.187	4.357	0.001	✓	0.784
	Innovation in Value Chain → Increased ESG Performance	0.711	0.164	5.159	0.000	✓	
	Innovation in Value Chain → Enhanced Sustainability	0.469	0.191	3.285	0.000	✓	
	Increased ESG Performance → Increased Economic Performance	0.423	0.027	0.936	0.000	✓	
	Increased ESG Performance → Enhanced Sustainability	0.651	0.111	4.714	0.001	✓	
	Increased Economic Performance → Enhanced Sustainability	0.062	0.141	0.528	0.551	✗	

Decision at 5% level of significance
Source: Authors own computation

All banks exhibit statistically significant relationships between value chain integration and economic performance, with t-values ranging from 3.361 to 6.591 and all p-values below 0.05, indicating robust support for these relationships. Similarly, relationships between value chain integration and ESG performance are consistently accepted across banks, with t-values ranging from 3.114 to 5.701. Moreover, most banks also show significant connections between ESG performance and economic performance, underscoring the importance of sustainability metrics in influencing financial outcomes. Notably, while most banks

demonstrate a positive relationship between economic performance and sustainability, some instances of non-acceptance (not statistically significant) suggest variability in how economic success translates into sustainable practices across different institutions. Overall, the high R-squared values (ranging from 0.616 to 0.953) indicate that the models explain a substantial proportion of variance in the dependent variables, reinforcing the reliability of the relationships observed. The analysis underscores a strong alignment between sustainability-driven innovations across the value chain and enhanced economic and ESG performance within the banking sector. These findings highlight the pivotal role of strategic integration of sustainability initiatives in fostering long-term financial stability and environmental responsibility among leading banks in the transition towards Banking 5.0.

F. FINDINGS

The survey reflects a diverse demographic profile with significant representation across genders, age groups, and educational qualifications. Majority of respondents are aware (77.92%) of their bank's sustainability practices, indicating proactive engagement. All dimensions (Primary Activities, Support Activities, Economic Performance, ESG Performance, Sustainability Functioning) demonstrate strong validity and reliability. High Cronbach's Alpha (>0.6), Composite Reliability (>0.6), and Average Variance Extracted (>0.5) scores affirm the robustness of the measurement model. RMSEA (0.062), CFI (0.941), and IFI (0.926) values indicate a good fit of the proposed model to the data, suggesting it accurately represents observed relationships. Direct influences show that enhancing innovation across the value chain significantly improves economic performance and strengthens ESG adherence. Indirect effects highlight how improvements in economic and ESG performance pathways contribute to enhanced sustainability outcomes. All banks exhibit statistically significant relationships between value chain integration and economic performance (t-values 3.361 to 6.591, $p < 0.05$). Consistent acceptance of relationships between value chain integration and ESG performance across banks (t-values 3.114 to 5.701). High R-squared values (0.616 to 0.953) indicate strong explanatory power of the models for economic and ESG performance outcomes.

G. DISCUSSION AND IMPLICATIONS

This study shows that value chain innovation is key to taking Indian banking to Banking 5.0 which is a combination of technology and sustainability. Innovations in both main activities (customer centric solutions and stakeholder engagement) and support functions (governance, human resources and data analytics) improves economic performance, ESG compliance and overall sustainability. The highest correlations were found between value chain innovation and ESG performance and between ESG performance and sustainability outcomes, thus ESG is a strategic driver of long-term value. ESG acts as a bridge between innovation and broader institutional resilience and social impact. Banks vary in their ability to convert economic benefits into long term outcomes which is influenced by factors like corporate culture and

digital readiness. Importantly Banking 5.0 is a paradigm shift beyond digital transformation, it includes ethical, environmental and social considerations in banking through technologies like AI and blockchain all in line with ESG and sustainable development goals.

Theoretical Implications

This paper contributes to the theory of Banking 5.0 and sustainable banking. By including ESG and sustainability metrics in Porter's value chain, this research gives a multi faceted view of how banking can be restructured to achieve economic and sustainability goals. The results show that organisational resources such as governance systems, human capital and data capabilities are not only important for competitive advantage (as RBV suggests) but also for ESG and sustainability targets—so integrating RBV with sustainability theory. The paper provides a robust measurement model with validated constructs and high reliability indices (Cronbach's Alpha > 0.8, AVE > 0.5) for future research across geographies or sectors, including longitudinal studies.

H. MANAGERIAL IMPLICATIONS

The study provides insights for banking professionals to get technological advancements and service innovations to deliver social, environmental and financial outcomes, bank management must tie innovation to ESG goals. The framework can be used as a planning and diagnostic tool to measure a bank's progress towards Banking 5.0. It will help identify value chain improvement opportunities. Support activities require investments in data governance, organisational culture that enables sustainable decision making and human capital development. Customised transformation plans should be developed taking into account stakeholder expectations, market orientation and public vs private ownership given the differences between banks. Clear communication through sustainability reports, ESG disclosures and internal involvement will increase stakeholder trust and regulatory compliance as employees become more aware of sustainable activities.

I. CONCLUSION

This study investigated how innovation and sustainability may coexist in the context of Banking 5.0, with a focus on innovation in banking value chain. The research successfully achieved its objectives by providing a comprehensive framework for innovation in sustainable banking practices across the value chain. The framework's validity and reliability are backed by a detailed review of both primary and secondary data, as well as a qualitative assessment using a structured questionnaire. The findings demonstrate that innovation has a significant impact on ESG, sustainability, and economic performance in the banking business. It has been proved that major activities in the framework, such as digital transformation, customer-centric solutions, and stakeholder engagement, increase economic performance, promote ESG principles, and advance sustainable operations. The study's approach, which integrated robust statistical methodologies with assessment standards, verifies the framework's applicability and utility for reviewing and promoting sustainable banking

practices. Furthermore, the study demonstrates that there is strong empirical support for the links between ESG results, economic performance, and innovation along the value chain. Strategic innovation initiatives have a positive influence on sustainability indicators, demonstrating their importance in boosting resilience and long-term value development within Banking 5.0 frameworks. In conclusion, this study provides informative information about how innovation and sustainability are strategically integrated in the banking industry, as well as practical recommendations for enhancing organizational procedures and advancing greater social and environmental goals. Subsequent research may expand on these findings by examining the impacts over time and fine-tuning the proposed framework in various international banking contexts.

For future scope of study, the following may be considered - Including a variety of banks, such as private sector banks, regional rural banks, and cooperative banks, to better reflect the full Indian banking industry. Collecting views from professionals in many disciplines to better understand the key issues of sustainable financing in India and other comparable developing nations. Investigating how financial technology (fintech) and innovation may boost the banking value chain while also improving ESG performance. This is particularly significant in India, where technology is fast transforming how banks operate and lend sustainably.

REFERENCES

Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33–46. https://doi.org/10.1002/smj.4250140105

Assfaw, A. M. (2019). Firm-Specific and Macroeconomic Determinants of Banks Liquidity: Empirical Investigation from Ethiopian Private Commercial Banks. *Journal of Accounting Finance and Auditing Studies*, *5*(2), 123–145. https://doi.org/10.32602/jafas.2019.24

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Calderon, F., & Chong, L. C. (2014). Dilemma of sustainable lending. *Journal of Sustainable Finance & Investment*, *4*(2), 192–209. https://doi.org/10.1080/20430795.2014.883302

Cek, K., & Eyupoglu, S. (2020). Does Environmental, Social and Governance Performance Influence Economic Performance? *Journal of Business Economics and Management*, *21*(4), 1165–1184. https://doi.org/10.3846/jbem.2020.12725

Devalle, A., Fiandrino, S., & Cantino, V. (2017). The Linkage between ESG Performance and Credit Ratings: A Firm-Level Perspective Analysis. *International Journal of Business and Management*, *12*(9), 53. https://doi.org/10.5539/ijbm.v12n9p53

Elkington, J. (1994). Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development. *California Management Review*, *36*(2), 90–100. https://doi.org/10.2307/41165746

Fearne, A., Martinez, M. G., & Dent, B. (2012). Dimensions of sustainable value chains: implications for value chain analysis. *Supply Chain Management an International Journal*, *17*(6), 575–581. https://doi.org/10.1108/13598541211269193

Freeman, R. E. (2010). *Stakeholder Theory*.

Gutiérrez-Ponce, H., & Wibowo, S. A. (2023). Do sustainability activities affect the financial performance of banks? the case of Indonesian banks. *Sustainability*, *15*(8), 6892. https://doi.org/10.3390/su15086892

Hergert, M., & Morris, D. (1989). Accounting data for value chain analysis. *Strategic Management Journal*, *10*(2), 175–188. https://doi.org/10.1002/smj.4250100207

Hubbard, G., Rice, J., & Galvin, P. (2014). *Strategic Management*. Pearson Australia.

Jiang, H., Xu, S., Cui, J., & Subhani, G. (2023). The impact of bank capital, liquidity and funding liquidity on sustainable bank lending: Evidence from MENA region. *Economic Analysis and Policy*, *79*, 713–726. https://doi.org/10.1016/j.eap.2023.06.043

Kim, S., Kumar, N., Lee, J., & Oh, J. (2021). ESG Lending. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3865147

Lamarque, E. (2005). IDENTIFYING KEY ACTIVITIES IN BANKING FIRMS: a COMPETENCE-BASED ANALYSIS. In *Advances in applied business strategy* (pp. 29–47). https://doi.org/10.1016/s0749-6826(04)07002-7

Manurung, K. a. A., Siregar, H., Fahmi, I., & Hakim, D. B. (2024). Value chain and ESG performance as Determinants of Sustainable lending in Commercial Bank: A Systematic Literature review. *Aptisi Transactions on Technopreneurship (ATT)*, *6*(1), 41–55. https://doi.org/10.34306/att.v6i1.381

Menicucci, E., & Paolucci, G. (2022). ESG dimensions and bank performance: an empirical investigation in Italy. *Corporate Governance*, *23*(3), 563–586. https://doi.org/10.1108/cg-03-2022-0094

Miralles-Quirós, M. M., Miralles-Quirós, J. L., & Redondo-Hernández, J. (2019). The impact of environmental, social, and governance performance on stock prices: Evidence from

the banking industry. *Corporate Social Responsibility and Environmental Management*, *26*(6), 1446–1456. https://doi.org/10.1002/csr.1759

Naimi-Sadigh, A., Asgari, T., & Rabiei, M. (2021). Digital transformation in the value chain disruption of banking services. *Journal of the Knowledge Economy*, *13*(2), 1212–1242. https://doi.org/10.1007/s13132-021-00759-0

Porter, M. E. (2003). *The competitive strategy: Techniques for Analyzing Industries and Competitors*. Free Press.

Pyka, I., & Nocoń, A. (2023). Green lending policy from the perspective of a holistic approach to bank risk. *Ruch Prawniczy Ekonomiczny I Socjologiczny*, *85*(3), 71–99. https://doi.org/10.14746/rpeis.2023.85.3.06

Rebai, S., Azaiez, M. N., & Saidane, D. (2012). Sustainable Performance Evaluation of Banks using a Multi-attribute Utility Model: An Application to French Banks. *Procedia Economics and Finance*, *2*, 363–372. https://doi.org/10.1016/s2212-5671(12)00098-6

Scannella, E. (2015). What drives the disintegration of the loan origination value chain in the banking business. *Business Process Management Journal*, *21*(2), 288–311. https://doi.org/10.1108/bpmj-02-2014-0017

Strakova, J., Simberova, I., Partlova, P., Vachal, J., & Zich, R. (2021). The value chain as the basis of business model design. *Journal of Competitiveness*, *13*(2), 135–151. https://doi.org/10.7441/joc.2021.02.08

Sultan, A., & Saurabh, N. (2013). Achieving Sustainable Development through Value Chain. *International Journal of Managing Value and Supply Chains*, *4*(2), 39–46. https://doi.org/10.5121/ijmvsc.2013.4204

Tarmuji, I., Maelah, R., & Tarmuji, N. H. (2016). The Impact of Environmental, Social and Governance Practices (ESG) on Economic Performance: Evidence from ESG Score. *International Journal of Trade Economics and Finance*, *7*(3), 67–74. https://doi.org/10.18178/ijtef.2016.7.3.501

Teece, D. J. (2017). Business models and dynamic capabilities. *Long Range Planning*, *51*(1), 40–49. https://doi.org/10.1016/j.lrp.2017.06.007

Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility*, *8*(2), 169–178. https://doi.org/10.1108/jgr-11-2016-0029

Wei-Shong, L. P., & Kuo-Chung, M. A. (2006). The internal performance measures of bank lending: a value-added approach. *Benchmarking an International Journal*, *13*(3), 272–289. https://doi.org/10.1108/14635770610668785

Werner, R. A. (2015). A lost century in economics: Three theories of banking and the conclusive evidence. *International Review of Financial Analysis*, *46*, 361–379. https://doi.org/10.1016/j.irfa.2015.08.014

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180. https://doi.org/10.1002/smj.4250050207

Wu, K., Tseng, M., Yang, W., Ali, M. H., & Chen, X. (2022). Re-shaping sustainable value chain model under post pandemic disruptions: A fast fashion supply chain analysis. *International Journal of Production Economics*, *255*, 108704. https://doi.org/10.1016/j.ijpe.2022.108704