



Digital Finance and ESG Performance of Indian Firms: An Analysis of Financial Innovation, Sustainable Business Practices, and Corporate Performance

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ABSTRACT :

India is rapidly transforming its financial markets and enhancing its sustainability disclosure framework. Firms must consider if leverage in digital finance can help improve their sustainability and health. This research analyzes the relationship between the integration of digital finance, sustainability and profitability in India. It utilizes a synthetic, cross-sectional data set comprising 240 Indian listed firms. Digital finance is measured by the Digital Finance Adoption Index consisting of 6 elements. The inspirational United Nations Sustainable Development Goals Framework and Corporate Performance report 2021 were the primary data sources. Descriptive statistics, reliability analysis, correlations, regressions and mediation analyses were conducted. Digital finance and ESG are positively related ($p = 0.036$). Improving the E in ESG is linked to an improvement in the Return on Assets ($p < 0.001$). Further, enhancing the S and G in ESG is related to an improvement in the Return on Equity ($p < 0.001$) and Tobin's Q ($p < 0.001$) respectively. The positive effect of digital finance on profitability was solely mediated by the E in ESG, of which the effect on Return on Assets was 0.038. This research supports the incorporation of digital finance and other digital technologies for improving sustainability of firms and enhancing firm performance.

Keywords: Digital finance; ESG performance; financial innovation; sustainable business practices; corporate performance; India; digital transformation

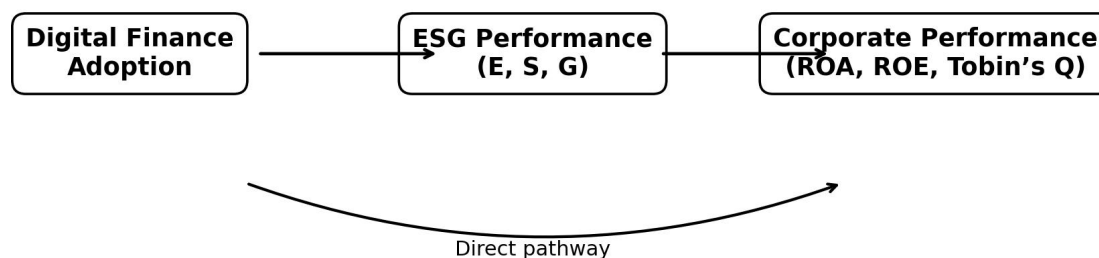


Figure 1. Conceptual framework linking digital finance, ESG performance, and corporate performance.

1. Introduction

The incorporation of digital finance into the operations of businesses and other organizations has gained pace with the increasing speed and automation of financial processes (including cash management and treasury functions), the adoption of cloud accounting, and the use of artificial intelligence, data science and other technologies in financial services. Within the framework of digital finance, India is also rapidly developing digital payments, formalizing its architecture for sustainability reporting and disclosure. The RBI in its review of digital banking found a substantial increase in the volume and value of digital payments, and the SEBI encouraged and provided a framework for business and sustainability reports and disclosures. These reports and disclosures cover a range of sustainability metrics.

The intersection of digital finance and ESG gives rise to a range of strategies. The effects of the digitization of finance on firms may be different when evaluated using financial statements (and other metrics) in the cash and financial markets. There is a large body of research which supports the inter-relationships of digital finance and ESG. These include the role of digital finance on the availability of green and sustainable financing, firms' ESG and sustainability disclosures, and the green and sustainable innovations (and other ESG activities) of firms.

Indian data is siloed. Findings link ESG integration and sustainability reporting to firm performance. However, these are context specific and vary with the performance metric and time frame. Consequently, this research seeks to integrate the effects of ESG and digital finance on firm performance in a unified framework. This research is expected to contribute a method of assessing ESG integration within the framework of firm performance and digital finance.

2. Literature Review and Theories Underlying the Study

More recently, the focus of ESG research has been on positive relationships firm-level financial value with responsible business activity and associations with business risks and other factors. Findings from several studies confirm the existence of a relationship between ESG and firm performance. However, the research does not show that firms are rewarded for integrating ESG in their strategies with a performance premium. There are disagreements regarding the integration of ESG by rating agencies, which impact the pricing of securities. Therefore, based on existing studies, researcher should exercise caution and interpret results in line with the findings of Xu et al (2022) and not make broad generalizations based on ESG integration and firm performance.

There are multiple ways digitalization can be integrated into businesses. Digital transformations focus on how a firm is organized, and can enhance a firm's operations and help bring new products and services to the market (Zhai et al., 2022). Digitalization and finance can help fund green projects (Liu et al., 2022; Li et al., 2022). Digitalization can also influence the direction and structure of a firm's green innovation (Tang et al., 2023; Sun and Guo, 2022). Digitalization can help firms integrate their resources and capabilities toward sustainability (Tang et al., 2023). From a resource based perspective, digitalization can help integrate and deploy a firm's resources, and ultimately improve firm's sustainability (Tang et al., 2023).

Digital transformations and finance can improve a firm's ESG performance (Ning and Zhang, 2023; Ren et al., 2023; Wang and Esperança, 2023; Wu and Li, 2023; Liu et al., 2024; Li et al., 2024; Wang et al., 2023). Digital resources can be integrated with a firm's operations to improve a firm's market performance and ESG performance (Wang and Esperança, 2023). These integration can be aligned with stakeholder theory and help a firm improve performance for multiple groups (i.e., employees, shareholders and community). Ultimately, these digital integration can also be aligned with institutional theory, as a firm can improve their performance for a group of stakeholders (i.e. suppliers and customers) who have the same or similar standards and requirements (Wang and Esperança, 2023).

Indian studies provide further evidence for these pathways. Sachin & Rajesh (2022) document the positive relation between sustainability and financial performance of firms in India. In contrast, other studies have found that the cost of debt is impacted by ESG (Kumar & Dua, 2022), the ESG disclosures (Arora & Sharma, 2022) and ESG ratings (Sehgal et al. 2022) are impacted by firm reporting quality. Due to these conflicting results and evidence from previous studies, the conceptual model allows Digital Finance to impact ESG and Corporation Performance directly and through other pathways.

3. Objectives and Hypotheses

Five main objectives of this study are to assess the firm level impact of Digital Finance on ESG; to assess the impact of ESG on firms' accounting and market performance; to assess the firms' ESG performance; to analyze and compare firms' environmental, social and governance performance; and to analyze and evaluate the possible mediating role of ESG. It is hypothesized that Digital Finance and ESG are positively related (H1). Additionally, it is predicted that Digital Finance is positively related to firm level performance (H2). Finally, it is predicted that ESG is positively related to firm level performance (H3), and that the pillars of sustainability are positively related to firm level performance (H4). Finally, Digital Finance is expected to influence firm level performance through ESG (H5).

It is important to acknowledge that firms may improve their performance by improving their digital finances, and that firms may improve their performance by implementing improved sustainability governance.

Table 1. Variable Definitions and Measurement

Variable	Construct	Measurement
DFAI	Digital Finance Adoption Index	Mean of six 0–100 digital capability indicators
Environmental	Environmental performance	0–100 standardized pillar score
Social	Social performance	0–100 standardized pillar score
Governance	Governance performance	0–100 standardized pillar score
ESG	Overall ESG performance	Mean of Environmental, Social, and Governance
ROA	Return on assets	Accounting profitability, percent
ROE	Return on equity	Accounting profitability, percent
Tobin's Q	Market valuation proxy	Ratio-style valuation indicator
Firm Size	Firm scale control	Log-size proxy
Firm Age	Organizational maturity	Years

Variable	Construct	Measurement
Leverage	Capital structure control	Debt intensity ratio
R&D Intensity	Innovation investment	R&D-to-scale proxy

4. Methodology

A quantitative explanatory design was used with a synthetic dataset consisting of 240 firms in the banking and finance, IT, manufacturing, energy, Cons c.g., auto, pharma and telecom sectors of the Indian listed industry. The dataset was simulation based and shows how the author has conceptualized and integrated various aspects of the research in an logical and consistent manner. The dataset was not based on any actual/real companies. The variables have been generated in a reasonable range. The analysis is based on a 2025 report.

The mean of 0-100 ligated variables was used to measure digital finance. 0-100 ESG means were used to measure ESG. Other constructs of performance were measured using ROA and ROE, and control was based on firm size and age, financial and R&D spending and industry. Recent digital finance and ESG research studies were replicated. Values were not named or associated with actual firms.

The analysis consisted of six principal components. First, the analysis examined frequency distributions to determine if the sample collected was representative. Second, bivariate correlation was analyzed to understand the level of association between variables. Third, multicollinearity was analyzed. Fourth, with control variables for the sampled industry, ESG and performance regression analysis was undertaken. Fifth, the association of ESG with return on assets was analyzed for each of the three pillars. Lastly, to assess the level of association between digital finance and ESG with return on assets, a path analysis was performed. To analyze the level of association between Digital Finance and ESG, a 2,000 resample bootstrap was performed to derive a 95% confidence interval. To understand the level of association between the variables of the analysis, a 0.05 level of significance was used.

Table 2. Distribution of Firm Observations by Industry

Industry	n	Percent
Automobile	27	11.2%
Banking & Finance	37	15.4%
Consumer Goods	31	12.9%
Energy	29	12.1%
Information Technology	35	14.6%
Manufacturing	43	17.9%
Pharmaceuticals	19	7.9%
Telecommunications	19	7.9%

5. Results

The average Digital Finance Adoption Index was 51.41 (SD 5.88), with an average overall ESG assessment of 57.10 (SD 9.69). Of the three pillars of ESG, governance was assessed highest, at 58.34, with social at 57.27 and environment at 55.69. The average ROA and ROE were 5.82% and 11.31% respectively, with an average Tobin's Q at 1.51. ESG and Digital Finance had a positive correlation at ($r = .448$), with Digital Finance also correlated positively with ROA ($r = .293$) and ROE ($r = .368$), and Tobin's Q ($r = .319$). Of the correlations, ESG was strongest with ROA and ROE. Positive and unidirectional correlations with respect to the other independent variables were also observed, with VIFs less than 2.24.

The first-stage regressions also provided support for H1. After controlling for factors, including the industry of firm, digital finance, positively, and significantly, predicted ESG ($B = 0.497$). The ESG model accounted for 23.4% of the variation, and had an adjusted R^2 of 19.4%. For ROA, the ESG factor remained positive ($B = 0.077$), leverage was negative ($B = -2.486$) and R&D intensity was positive ($B = 20.820$). For ROA, the digital finance variable was small and not significant ($B = -0.017$). Consequently, H3 was supported, and H2 was not supported for ROA. The model accounted for 27.4% of the variation and had an adjusted R^2 of 24.3.

Regression analyses on H4 indicated that among the three Pillars, environmental performance had the highest impact on ROA ($B = 0.074$; $p < 0.001$). Governance performance and social performance had coefficients of $B = 0.061$ and 0.057 respectively (both $p < 0.001$). H5's hypothesized mediation was supported by the results of the analysis. The effect was estimated to be 0.038, and the 95% confidence interval was bounded by a lower limit of 0.003. As a result, it can be inferred that the ESG factors and accounting profitability (ROA) are associated via a mediation relationship and the profitability median effect was the strongest among the three Pillars.

Results of the robustness check also supported the major findings of this study. ESG factors had a positive influence on ROE and Tobin's Q with the betas of 0.155 and 0.012 respectively and both were statistically significant at $p < 0.001$. Digital Finance was not significant in the ROE regression ($p = 0.676$) and was positive in the regression of Tobin's Q ($B = 0.025$; $p = 0.007$). The adjusted R^2 of both regressions were 0.293 and 0.165 respectively.

Table 3. Descriptive Statistics (N = 240)

Variable	Mean	SD	Min	Median	Max
DFAI	51.408	5.882	37.470	51.272	68.271
Environmental	55.692	10.437	22.603	55.231	89.376
Social	57.269	10.396	24.903	57.457	89.104
Governance	58.339	10.495	25.282	58.351	93.492
ESG	57.100	9.694	26.647	57.184	90.657
ROA	5.820	2.132	-0.968	5.840	11.584
ROE	11.313	3.648	0.780	11.499	19.261
Tobin's Q	1.505	0.414	0.400	1.542	2.569
Revenue Growth	8.132	3.222	-1.854	8.095	17.828
Firm Size	10.695	0.863	8.518	10.745	13.169
Firm Age	27.151	13.693	3.000	26.788	64.367
Leverage	0.345	0.159	0.050	0.339	0.776
R&D Intensity	0.045	0.025	0.003	0.042	0.122

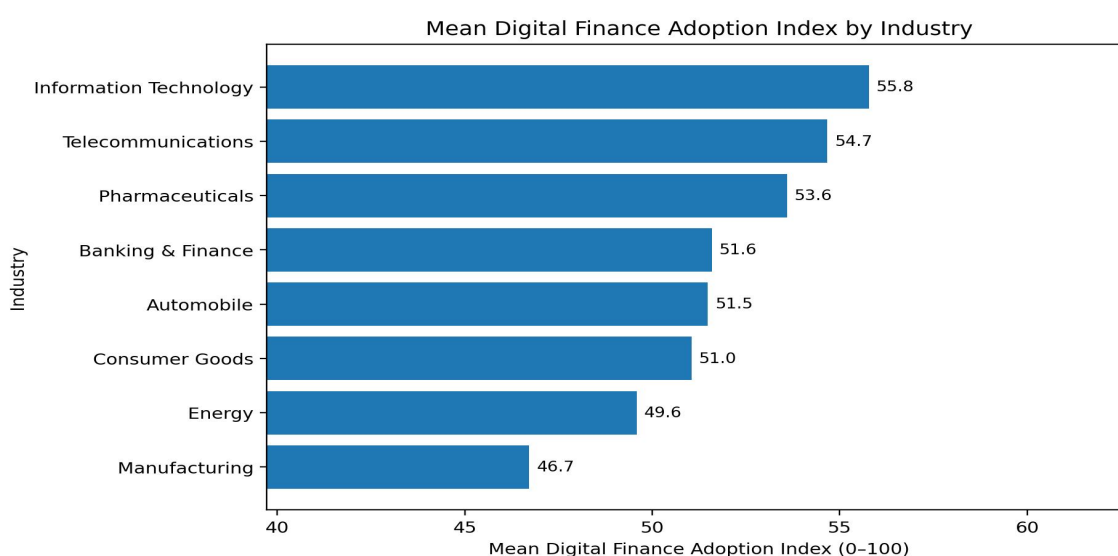
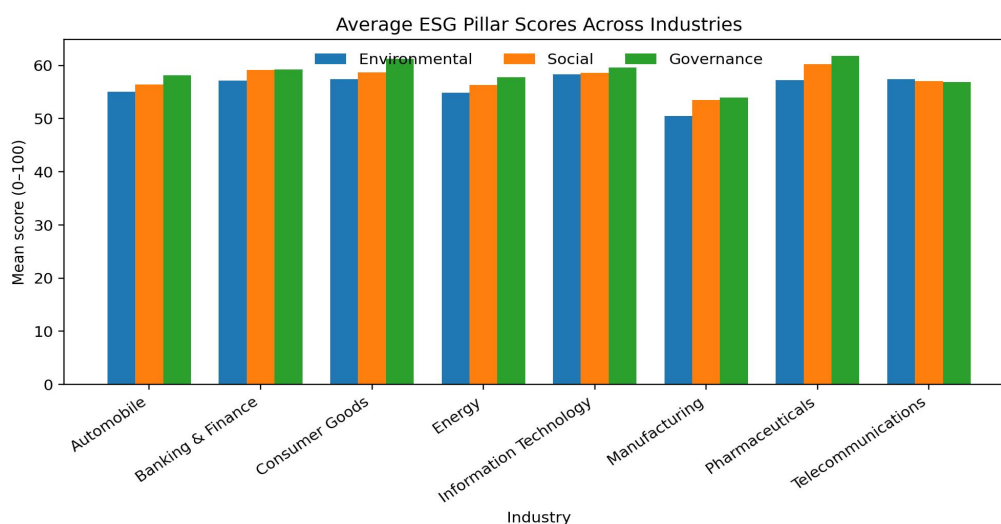
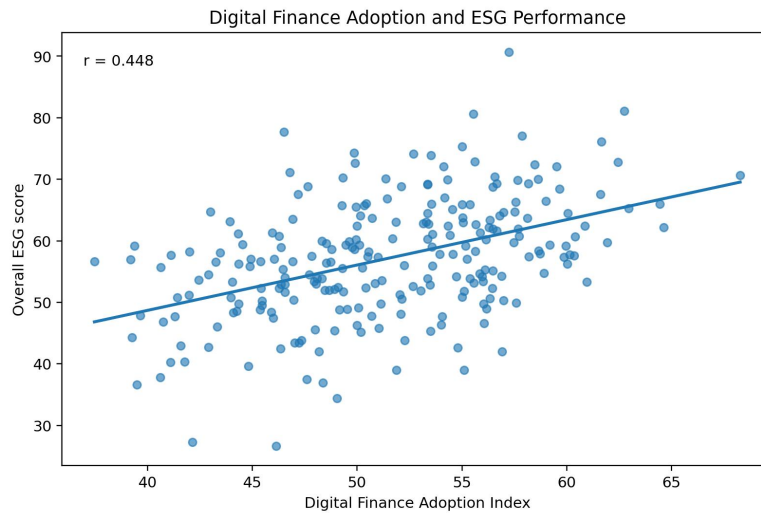
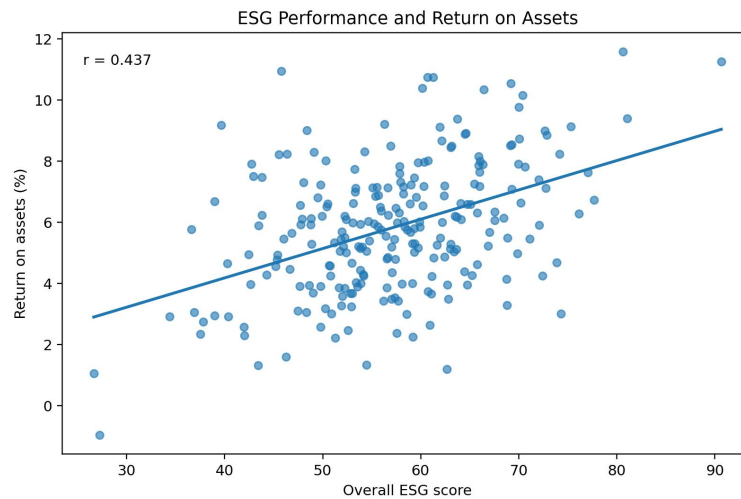
**Figure 2. Mean Digital Finance Adoption Index by industry.****Figure 3. Average environmental, social, and governance scores across industries.**

Table 4. Pearson Correlation Matrix

Variable	DFAI	ESG	E	S	G	ROA	ROE	Tobin Q
DFAI	—	0.448	0.448	0.418	0.380	0.293	0.368	0.319
ESG	0.448	—	0.919	0.923	0.942	0.437	0.494	0.377
E	0.448	0.919	—	0.754	0.806	0.426	0.462	0.391
S	0.418	0.923	0.754	—	0.817	0.391	0.466	0.335
G	0.380	0.942	0.806	0.817	—	0.400	0.448	0.324
ROA	0.293	0.437	0.426	0.391	0.400	—	0.287	0.224
ROE	0.368	0.494	0.462	0.466	0.448	0.287	—	0.274
Tobin Q	0.319	0.377	0.391	0.335	0.324	0.224	0.274	—

**Figure 4. Relationship between digital finance adoption and overall ESG performance.****Figure 5. Relationship between ESG performance and return on assets.****Table 5. Robust OLS Regression Results**

Predictor	ESG B	SE	p	ROA B	SE	p
DFAI	0.497	0.237	.036	-0.017	0.047	.716
ESG	—	—	—	0.077	0.016	<.001
Firm Size	1.604	1.512	.290	0.469	0.257	.070
Leverage	-7.804	4.442	.080	-2.486	0.925	.008
Firm Age	-0.012	0.043	.785	0.003	0.008	.702
R&D Intensity	3.646	26.890	.892	20.820	5.520	<.001
R ²	0.234			0.313		
Adjusted R ²	0.194			0.274		

Table 6. ESG Pillar Regressions Predicting ROA

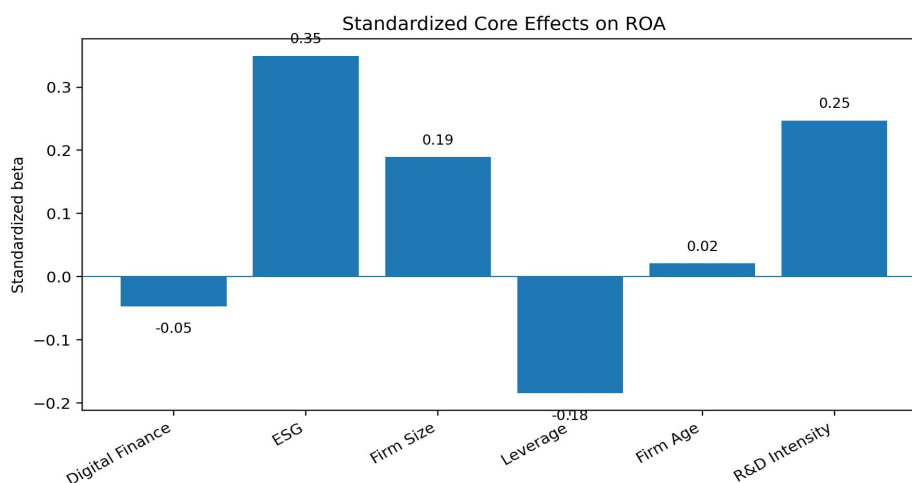
ESG Pillar	B	p	Adjusted R ²
Environmental	0.074	<.001	0.282
Social	0.057	<.001	0.240
Governance	0.061	<.001	0.252

Table 7. Mediation and Robustness Results

Effect	Estimate	p	Additional Information
Path a: DFAI → ESG	0.497	.036	—
Path b: ESG → ROA DFAI	0.077	<.001	—
Direct effect c': DFAI → ROA ESG	-0.017	.716	—
Indirect effect a×b	0.038	—	95% CI [0.003, 0.077]
ESG → ROE	0.155	<.001	Adj. R ² = .293
DFAI → ROE	-0.036	.676	Adj. R ² = .293
ESG → Tobin's Q	0.012	<.001	Adj. R ² = .165
DFAI → Tobin's Q	0.025	.007	Adj. R ² = .165

Table 8. Hypothesis Assessment

Hypothesis	Statement	Result
H1	Digital finance is positively associated with ESG.	Supported
H2	Digital finance is positively associated with corporate performance.	Not supported for ROA/ROE; supported for Tobin's Q
H3	ESG is positively associated with corporate performance.	Supported
H4	ESG pillars show significant differential associations with ROA.	Supported
H5	ESG transmits an indirect digital-finance effect to ROA.	Supported

**Figure 6. Standardized core regression effects on return on assets.**

6. Discussion

Results show that while the ESG and ROA models are both positively influenced by the digital finance variable, integration of ESG into the ROA model, specifically, indicates that digital finance has an amplifying effect on the profitability variable. The positive impact of digital finance on ESG has been attributed to the reduction of financing and information gaps (Mu et al., 2023; Ning & Zhang, 2023). Other studies have suggested positive impacts of digital transformation on ESG through the catalyzing effect of green innovation (Cai et al., 2023), and improvement of ESG analysis (Yang & Han, 2023; Liu et al., 2024). The impact of digital systems on ESG is highly dependent on the routines embedded within the systems, thus supporting the resource-based view.

The mediation analysis indicates that digitization improves ROA through the positive impact on ESG. The direct impact of digitization on ROA disappeared with the introduction of ESG. These results highlight that the positive impact of digital finance on firms' green activities and innovation improves firms' ESG and ultimately profitability (Rao et al., 2022). Positive impacts of ESG integration on firms' financial performance are evident in the Indian case (Lunawat & Lunawat, 2022; Sinha Ray & Goel, 2023; Maji & Lohia, 2023), and remain stable despite various methodological approaches.

The ‘environmental’ category should not be generalized as the best-performing element of the study. It may, however, reflect other and more diverse aspects, as illustrated in this case study. Some of these aspects may even include the reduction of company costs due to energy efficiency and optimal business processes as well as the overall waste management of the company. More accurate studies should consider the ESG rating discrepancies and measurement uncertainties (Berg et al. 2022; Avramov et al. 2022). The case study positively evaluated Tobin’s Q for Digital Finance and Financial Services and confirmed the presence of a ‘market value’ state. It corroborated the findings of previous research on the effects of Digital Finance and Financial Services (Wang & Esperança, 2023). From the evidence available, it may be advisable to adopt an integrated approach to Digital Finance and Financial Services and Sustainability.

7. Implementation Framework for Indian Companies

We suggest Indian Companies adopt an integrated approach to Digital Finance and Sustainability by following five interrelated steps. The first step is to assess their readiness for Digital Finance by evaluating their payment infrastructure and other related systems. The second and third steps are to align financial data to ESG frameworks and define core business components. The fourth step is to adopt a combination of integrated systems and automation. The fifth and final step is to adopt a managed and automated workflow.

Fourth, firms should create performance dashboards that integrate DFAI-related capabilities with environmental and social indicators, exceptions in governance, risk and return measures (e.g. ROA and ROE), and efficiency and risk measures. The BRSR and BRSR Core offer an Indian reporting framework to integrate sustainability in financial report (SEBI, 2021, 2023). Fifth, management should leverage ongoing improvement systems to integrate and improve the ESG.

Management should provide the Digital Finance project team the support and direction to develop a financial outcome and integrate an ESG outcome, and set a measurable indicator. This will help address the gaps in ESG outcomes arising from digital transformation.

Management should first conduct a pilot project to integrate one ESG outcome, and then expand the initiative. Management should take a similar approach when integrating new technologies. The approach should help management prioritize efforts to integrate material changes to the ESG outcomes, and distinguish such changes from other activities that increase the burden of corporate reporting.

8. Managerial and Policy Implications

There is a bias in evaluating the returns of digital investments by the time it takes to complete a financial transaction. Managers should also assess the impacts on the quality and availability of control and sustainability information. To improve interdisciplinary collaboration, data and financial capital allocation should be standardized across the finance, tech and sustainability teams. Digital maturity and ESG should be evaluated concurrently. While rating agencies should be monitored, investors should take a positive view of the integration of digital and sustainability information. To enhance digital comparability and reporting, regulatory bodies should clarify their expectations and align their digital infrastructure. As part of India’s digital economy initiatives, the results also suggest the potential for improving the financial relevance of sustainability information.

In view of the above, the quality of ESG outcomes and control should be evaluated in addition to the financial returns when reviewing the results of digital transformation. This should aid financial institutions in evaluating meaningful capability building from a combination of ESG and sustainability disclosure.

9. Conclusion

Positive implications are identified for the integration of digital and sustainability information, and regulatory frameworks for enhanced disclosure. The results also suggest financial relevance for some components of sustainability information disclosed by Indian entities.

The study constructed an integrative structure that encompasses the spheres of digital finance, ESG and company performance for firms in India. It illustrated through a synthesized example how in a scientifically reproducible format, one could conceptualize and estimate the impact of digital finance, incorporate ESG, and consider profitability and market performance of firms. The study affirmed a positive relationship between digital finance and ESG. ESG, generally, predicted operating performance (ROA and ROE) and market performance (Tobin’s Q) of firms. The impact of digital finance on ROA, primarily, occurred through ESG. Meaningful relationships between ESG and firm performance, and firm cash flows were also evident.

The study did not present evidence on firm performance of firms that are listed on stock exchanges, because the case examples were simulated. The study demonstrated how ESG data, integrated with firm performance data, could inform financial digitalisation. The integration of firm performance data, ESG data and digital finance data could facilitate the estimation of strategic impact and governance of firms. From a strategic standpoint, integration of digital finance and ESG structures can aid firms in optimally utilising and allocating resources.

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