

Modeling the Impact of Technology and Sustainability Initiatives on Business Performance Using SEM

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Abstract

Background: Businesses are under pressure to adopt advanced technologies and strengthen sustainability practices, yet the combined effect of these efforts on overall performance is still not well understood. Prior studies show mixed results, and most focus on single dimensions such as green innovation, ICT adoption or environmental performance. A comprehensive model linking technology adoption, sustainability initiatives and both financial and non-financial outcomes is still lacking.

Objective: The study aims to model how technology adoption and sustainability initiatives influence business performance, and to test whether these constructs interact to strengthen financial and non-financial outcomes. The study also examines the validity of a structural framework grounded in the Resource-Based View and Dynamic Capabilities Theory.

Methodology: A quantitative, cross-sectional research design was used. Data were collected from 410 managers across firms in the Delhi NCR region using a structured questionnaire. Established indicators measured technology adoption, sustainability initiatives and business performance. Covariance-Based Structural Equation Modeling (CB-SEM) was applied using AMOS, following a two-step approach with Confirmatory Factor Analysis and structural path assessment. Reliability, validity and model fit indices all met acceptable thresholds.

Findings: Technology adoption had a significant positive effect on sustainability initiatives and business performance. Sustainability initiatives also showed a strong positive effect on both financial and non-financial performance indicators. Mediation analysis indicated that sustainability initiatives partially mediate the link between technology adoption and business performance. The final model demonstrated good fit and confirmed the proposed relationships.

Conclusion: The results show that firms benefit most when technology adoption is complemented by well-designed sustainability initiatives. Together, these capabilities enhance competitiveness, operational efficiency and environmental outcomes. The study supports the view that technology and sustainability act as strategic resources that jointly contribute to stronger business performance.

Keywords: Technology adoption, Sustainability initiatives, Business performance, SEM, CB-SEM, RBV, Dynamic capabilities, Delhi NCR

JEL Classification Codes: C38, O33, Q55, L25

Introduction

Technology adoption and sustainability initiatives have become central to how modern firms pursue competitive advantage, efficiency and long-term growth. Rapid advances in digital infrastructure, Industry 4.0 systems and information technologies are reshaping business models, increasing operational responsiveness and improving the ability of firms to innovate (Chege et al., 2020 ; Haseeb et al., 2019). At the same time, rising environmental concerns, stricter regulations and stakeholder expectations have pushed organizations to incorporate sustainability practices such as green innovation, carbon reduction and corporate environmental responsibility (Abdul Aziz et al., 2018; Ch'ng et al., 2021). These developments highlight the need for businesses to understand how technological capabilities and sustainability strategies interact to shape performance outcomes.

Existing research provides valuable insights into this relationship but also reveals several gaps. Studies show that green initiatives can enhance environmental and operational performance, although adoption levels and outcomes vary widely across contexts (Yacob et al., 2019; Sezen & Çankaya, 2013). Others find that technological innovation improves firm competitiveness and market performance, especially when supported by internal capabilities and entrepreneurial orientation (Chege et al., 2020; Fernando et al., 2019). Research also suggests that sustainability initiatives can mediate the link between governance, innovation and business performance, but evidence remains fragmented and sometimes contradictory (Adedeji et al., 2020; Li et al., 2017). These inconsistencies point to the need for an integrated, empirically validated model that captures both the direct and indirect effects of technology adoption and sustainability practices on firm performance.

The theoretical grounding for such integration emerges from the Resource-Based View and Dynamic Capabilities Theory, which position technology capabilities and sustainability-oriented resources as strategic assets that can generate lasting performance advantages (Dao et al., 2011; Zhang et al., 2019). While past studies have examined these domains individually, few have modeled them together using Structural Equation Modeling (SEM), particularly within emerging economies such as India. Given the diverse industrial landscape of regions like Delhi NCR and the rapid push toward digital and sustainable transformation, an empirical analysis is both timely and necessary.

This study addresses these gaps by developing and testing a structural model that examines how technology adoption and sustainability initiatives influence business performance, measured through financial and non-financial indicators. By integrating insights across technological and sustainability domains, the research aims to provide a comprehensive understanding of how firms can strengthen competitiveness while contributing to broader sustainability goals.

Review of Literature

Table 1. Literature Review Summary

Author & Year	Main Focus	Methodology Used	Findings	Challenges Faced
Abdul Aziz et al., 2018	Green initiatives adoption and environmental performance in Malaysian PLCs	PLS-SEM, survey (120 samples), interviews	Green initiatives positively affect environmental performance	Moderate adoption and performance levels
Adedeji et al., 2019	Corporate governance & sustainability as predictors of firm performance	Conceptual paper with theoretical framework	Integrated governance and sustainability enhance firm performance	Lack of studies in less developed nations
Adedeji et al., 2020	CG practices and sustainability initiatives' effect on MSFs in Nigeria	Survey (300 firms), CB-SEM	SI fully mediates CG and NFP; no mediation for CG and FNP	Lack of CG practice in non-financial MSFs
Alraja et al., 2022	TOE and RBV integration for sustainable SME performance post-COVID	Survey (669 responses), SEM	Green practices enhance sustainable performance	Challenges from COVID-19, fragile environments
Amankwah-Amoah & Syllias, 2020	Risk of business failure from aggressive sustainability in SMEs	Conceptual framework with literature review	Sustainability can constrain/collapse SMEs if resource-constrained	Resource vulnerability of SMEs
Chege et al., 2020	Tech innovation and entrepreneur innovativeness in Kenya	Survey (240 firms), SEM	Innovativeness enhances tech impact on performance	Low ICT uptake and infrastructure issues
Ch'ng et al., 2021	Eco-innovation strategies in Malaysian tech firms	PLS analysis (109 companies)	Eco-innovation improves economic, social, and environmental performance	Market turbulence affects outcomes

Chuang & Huang, 2018	ECSR, green IT capital, and performance in Taiwan	Survey (358 firms), SEM	Green IT capital mediates ECSR and competitiveness	Gap in literature on mediating roles
Dao et al., 2011	Integrated sustainability via IT, human, and supply chain	Conceptual framework using RBV	IT beyond energy-saving can build sustainability capability	Limited scope of MIS research
Amankwah-Amoah & Syllias, 2020	Risk of business failure from ambitious green initiatives	Conceptual framework based on literature	Voluntary initiatives can harm SMEs if not strategically resourced	Resource constraints in SMEs
Chege et al., 2020	ICT and entrepreneur innovativeness on firm performance in Kenya	Survey (240 firms), SEM	ICT and innovativeness positively affect performance	ICT infrastructure limitations
Ch'ng et al., 2021	Eco-innovation impact on Malaysian tech firms' sustainability	PLS-SEM, survey (109 firms)	Eco-innovation enhances triple bottom line; market turbulence moderates' effect	Market unpredictability
Chuang & Huang, 2018	ECSR and green IT capital in Taiwan's top manufacturers	Survey (358 firms), SEM	Green IT capital mediates ECSR impact on competitiveness	Gap in literature on green IT mediation
Dao et al., 2011	Integrated sustainability framework using IT, HR, supply chain	Conceptual, RBV-based model	IT enables sustainability capabilities beyond energy-saving	Narrow MIS focus on energy saving
Das & Rangarajan, 2020	Sustainability and business growth in Indian SMEs	Survey (200 SMEs), model analysis	Policy and synergy improve sustainability; size moderates' effect	Neglect of societal/ environmental roles by SMEs
Fernando et al., 2019	Eco-innovation, service innovation, and	Survey (95 firms), PLS-SEM	Service innovation mediates eco-	Limited prior empirical work in this context

	sustainability in Malaysia		innovation and sustainability	
Haque & Ntim, 2022	Corporate sustainability and carbon performance in Europe	Panel data (2444 obs), fixed-effects model	Sustainability initiatives reduce GHG emissions	Stronger effect in polluting industries
Haseeb, Hussain, Kot, et al., 2019	Social and tech challenges in Malaysian SMEs	Survey (500 SMEs), SEM	Social and tech challenges improve sustainable competitive advantage	Lack of resources
Haseeb, Hussain, Ślusarczyk, et al., 2019	Role of Industry 4.0 in Thai SMEs' sustainability	Survey (270 valid responses), PLS-SEM	Industry 4.0 fosters IT and sustainable performance	Tech adoption difficulty
Lau, 2019	BSI and economic benefits in Malaysian public companies	Disclosure index, FBM100 sample analysis	Higher BSI improves market value, reduces costs	Profitability impact can be negative
Li et al., 2017	Green initiatives and financial performance in USA firms	Cross-sector analysis of top 500 firms	Mixed impact; delayed financial returns from green efforts	Reactive rather than proactive green approach
Roy et al., 2013	ISO certified Canadian SMEs pursuing quality and environment	Survey (254 SMEs)	Dual certifications improve different performance dimensions	Motivation and resource differences
Sahoo et al., 2023	Green knowledge acquisition and environmental performance	Survey (283 firms), SEM	Knowledge drives tech innovation and performance; resource moderates	Requires strong resource commitment
Saqib et al., 2023	Sustainable practices and performance in Pakistani SMEs	Survey (490 firms), SEM	Sustainable practices improve outcomes; visibility moderates effects	Weak moderation in some pathways

Schoenherr & Talluri, 2013	ESI and efficiency in US and European plants	Survey (402 plants), comparative analysis	ESI improves efficiency; stronger in Europe	Contradictory past research
Sikder et al., 2009	IT for green practices and carbon reduction	Survey, regression analysis	IT improves sustainability and reduces footprint	Integration challenges
Sezen & Çankaya, 2013	Green manufacturing in Turkish firms	Survey (53 firms), regression	Green manufacturing improves env/social performance	Eco-product innovation not significant
Tasleem et al., 2019	TQM and TM in Pakistani corporate sustainability	Survey (209 firms), SPSS/AMOS	TQM enhances CSP directly and via mediation	Limited response data
Yacob et al., 2019	Green initiatives in Malaysian SMEs	Survey (260 SMEs), SEM-AMOS	Manager intention mediates green practices and sustainability	Green tech adoption not significant
Zhang et al., 2019	Innovation impact on sustainability and performance	Survey (304 managers), SEM	Innovation boosts sustainability, which mediates performance	Limited focus on innovation before

Methodology

Research Design

The present study adopts a quantitative, cross-sectional, explanatory research design to empirically investigate the relationship between technology adoption, sustainability initiatives, and business performance. The primary aim is to develop and validate a structural model using Structural Equation Modeling (SEM), which allows for testing both direct and indirect relationships among the constructs. This approach is appropriate given the study's emphasis on latent variables and the complex nature of their interrelations.

Conceptual Framework and Hypotheses Development

The conceptual model is grounded in the Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT), which posit that internal capabilities, including technological competencies and sustainable practices, serve as strategic resources that enhance firm performance. The model includes three main constructs: Technology Adoption (TA), Sustainability Initiatives (SI), and Business Performance (BP), where BP is bifurcated into Financial Performance (FP) and Non-Financial Performance (NFP). Mediating and moderating

effects were also hypothesized and tested to understand the nuanced relationships between the variables.

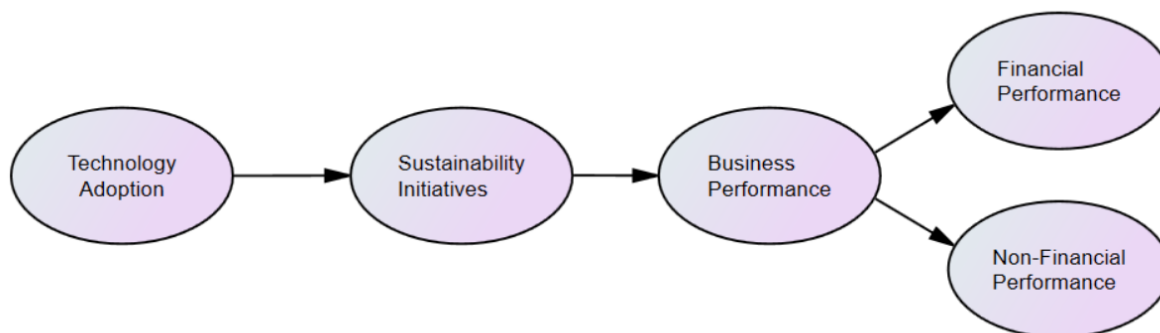


Fig 1. Conceptual Framework (Source: Author Generated)

Measurement of Constructs

Validated measurement items for each construct were adapted from prior literature to ensure content validity:

- **Technology Adoption** was measured through indicators such as digital infrastructure, Industry 4.0 practices, ICT capabilities, and integration of advanced technologies like AI and IoT (Haseeb et al., 2019; Chege et al., 2020).
- **Sustainability Initiatives** were measured using items covering environmental responsibility, green innovation, carbon footprint reduction, and CSR engagement (Abdul Aziz et al., 2018; Ch'ng et al., 2021).
- **Business Performance** was measured via both financial metrics (profitability, market share, ROI) and non-financial metrics (brand reputation, employee satisfaction, environmental performance) as suggested by Adedeji et al. (2020) and Zhang et al. (2019).

All items were rated on a five-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree").

Questionnaire Design and Pre-testing

The questionnaire was structured into four sections: demographic profile, technology adoption, sustainability initiatives, and business performance indicators.

Sampling Technique and Data Collection

The target population comprised middle and senior management personnel from small, medium, and large firms across sectors including manufacturing, IT, services, and logistics within the Delhi NCR region of India. A non-probability purposive sampling method was employed due to the specificity of the required respondent profile (i.e., decision-makers aware of their firms' tech and sustainability practices).

Data were collected using a structured survey administered via personalized email invitations. A total of 600 questionnaires were distributed, of which 428 complete responses were received. After data screening and outlier treatment, 410 valid responses were retained for analysis, exceeding the recommended sample size for SEM.

Data Analysis Technique

The study used AMOS Version 23 for Covariance-Based Structural Equation Modeling (CB-SEM). A two-step approach was followed as per Anderson and Gerbing (1988):

1. Measurement Model Assessment: Confirmatory Factor Analysis (CFA) was performed to test construct reliability, convergent validity (via AVE ≥ 0.5),. All factor loadings were above 0.60 and AVE exceeded thresholds.
2. Structural Model Assessment: Hypothesized paths were tested using maximum likelihood estimation. Model fit indices included Chi-square (χ^2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Acceptable thresholds (e.g., CFI > 0.90 , RMSEA < 0.08) confirmed model adequacy.

Reliability Analysis

Table 2. Cronbach's Alpha

Case Processing Summary		
		N
Cases	Valid	410
	Excluded ^a	0
	Total	410
Reliability Statistics		
Cronbach's Alpha		N of Items
0.789		15

A total of 410 responses were collected and all were retained for analysis, as indicated by the case processing summary which shows no excluded cases. The value obtained, 0.789 for the 15 items, reflects acceptable reliability and suggests that the items used to measure the constructs are sufficiently consistent with one another. This level of internal coherence indicates that the questionnaire items effectively capture the underlying dimensions of technology adoption, sustainability initiatives and business performance.

Demographics

Table 3. Demographics

Variables		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	226	55.1	55.1	55.1
	Female	180	43.9	43.9	99.0
	Prefer Not to say	4	1.0	1.0	100.0
Age	Below 25	35	8.5	8.5	8.5
	25 to 34	167	40.7	40.7	49.3
	35 to 44	102	24.9	24.9	74.1
	45 to 54	59	14.4	14.4	88.5
	55 & Above	47	11.5	11.5	100.0

Sector	Manufacturing	83	20.2	20.2	20.2
	Services	88	21.5	21.5	41.7
	IT / ITES	65	15.9	15.9	57.6
	Logistics	92	22.4	22.4	80.0
	Other	82	20.0	20.0	100.0
Organization Size	Small (<50 employees)	132	32.2	32.2	32.2
	Medium (50 to 250)	168	41.0	41.0	73.2
	Large (> 250)	110	26.8	26.8	100.0
Job Role	Executive	97	23.7	23.7	23.7
	Manager	107	26.1	26.1	49.8
	Senior Manager / Director	92	22.4	22.4	72.2
	Others	114	27.8	27.8	100.0
Experience	Less than 1 Year	31	7.6	7.6	7.6
	1 to 5 Years	131	32.0	32.0	39.5
	6 to 10 Years	147	35.9	35.9	75.4
	Above 10 Years	101	24.6	24.6	100.0

The demographic profile of the respondents shows a balanced and diverse sample suitable for examining organizational technology and sustainability practices. A slight majority of the participants were male (55.1 percent), while females accounted for 43.9 percent, and a small proportion preferred not to disclose their gender. Most respondents were between 25 and 34 years old (40.7 percent), followed by those aged 35 to 44 (24.9 percent), indicating that the sample largely represents early to mid-career professionals. Participants came from a wide range of sectors, with logistics (22.4 percent), services (21.5 percent) and manufacturing (20.2 percent) forming the largest groups. Organizational size was also well distributed, with 41 percent from medium-sized firms, 32.2 percent from small enterprises and 26.8 percent from large organizations. Job roles reflected a strong mix of organizational levels, including executives (23.7 percent), managers (26.1 percent), senior managers or directors (22.4 percent) and other professional roles (27.8 percent). Experience levels ranged from less than one year to over ten years, with the majority having six to ten years of experience (35.9 percent). This distribution suggests that the study captures perspectives from professionals across different industries, organizational scales and career stages, strengthening the validity of the findings.

Factor Analysis:

Table 4. KMO & Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.882
Bartlett's Test of Sphericity	Approx. Chi-Square	4353.063
	df	105
	Sig.	0.000

The suitability of the dataset for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity. The KMO value of 0.882 indicates excellent sampling adequacy, suggesting that the correlations among items are strong enough to justify factor extraction. Bartlett's Test of Sphericity further supports this, with a highly significant chi-square value of 4353.063 ($df = 105$, $p < 0.001$), confirming that the correlation matrix is not an identity matrix.

Table 5. Communalities:

Communalities		
	Initial	Extraction
Tech_Adoption_Q1	1.000	0.762
Sustainability_Q1	1.000	0.767
Performance_Q1	1.000	0.766
Tech_Adoption_Q2	1.000	0.737
Sustainability_Q2	1.000	0.762
Performance_Q2	1.000	0.742
Tech_Adoption_Q3	1.000	0.774
Sustainability_Q3	1.000	0.785
Performance_Q3	1.000	0.683
Tech_Adoption_Q4	1.000	0.701
Sustainability_Q4	1.000	0.780
Performance_Q4	1.000	0.783
Tech_Adoption_Q5	1.000	0.751
Sustainability_Q5	1.000	0.787
Performance_Q5	1.000	0.814
Extraction Method: Principal Component Analysis.		

The communalities table shows how well each item is explained by the extracted factors using Principal Component Analysis. All items demonstrate strong extraction values, ranging from 0.683 to 0.814, indicating that a substantial proportion of variance in each variable is accounted for by the underlying components. Items related to technology adoption and sustainability generally show extraction values above 0.70, reflecting their strong alignment with the latent constructs. Performance items also display solid communalities, with the highest at 0.814 for Performance_Q5. These consistently high values confirm that the selected items meaningfully contribute to the factor structure and support the adequacy of the measurement model for further analysis.

Table 6. Composite Reliability & Average Variance Extracted:

Variable		λ	λ^2	$1-\lambda^2$	CR	AVE
Technology Adoption	TA1	0.765	0.5855	0.4145	0.6386	0.5720
	TA2	0.735	0.5409	0.4591		

	TA3	0.786	0.6185	0.3815		
	TA4	0.735	0.5409	0.4591		
	TA5	0.758	0.5743	0.4257		
Performance	P1	0.748	0.5589	0.4411	0.6135	0.5381
	P2	0.706	0.4982	0.5018		
	P3	0.698	0.4875	0.5125		
	P4	0.750	0.5632	0.4368		
	P5	0.763	0.5829	0.4171		
Sustainability	S1	0.812	0.6596	0.3404	0.7159	0.6742
	S2	0.813	0.6605	0.3395		
	S3	0.814	0.6621	0.3379		
	S4	0.835	0.6978	0.3022		
	S5	0.831	0.6912	0.3088		

$$CR = (\sum\lambda)^2 / [(\sum\lambda)^2 + \sum(1-\lambda^2)]$$

$$AVE = \sum\lambda^2 / n$$

The validity and reliability of the measurement model were assessed using standardized factor loadings, composite reliability (CR) and average variance extracted (AVE). All items loaded strongly on their respective constructs, with loadings ranging from 0.698 to 0.835, confirming good indicator reliability. For Technology Adoption, factor loadings fell between 0.735 and 0.786, resulting in a CR of 0.6386 and an AVE of 0.572, indicating acceptable internal consistency and convergent validity. The Performance construct showed loadings between 0.698 and 0.763, with a CR of 0.6135 and an AVE of 0.5381, suggesting moderate but adequate reliability. Sustainability exhibited the strongest measurement properties, with loadings from 0.812 to 0.835, a CR of 0.7159 and an AVE of 0.6742, reflecting excellent convergent validity. The results confirm that the constructs demonstrate sufficient reliability and capture a substantial proportion of variance in their corresponding items, satisfying the key requirements for a robust SEM measurement model.

Structure Equation Model:

The structural equation model shows how technology adoption, sustainability initiatives and business performance are linked through a series of measured and latent variables. Technology Adoption is represented by five indicators (TA_Q1 to TA_Q5), each with strong standardized loadings ranging from 0.90 to 0.94, indicating that more than 80 percent of the variance in each item is explained by the latent construct. Error terms (e1–e5) remain low, supporting the reliability of this measurement block.

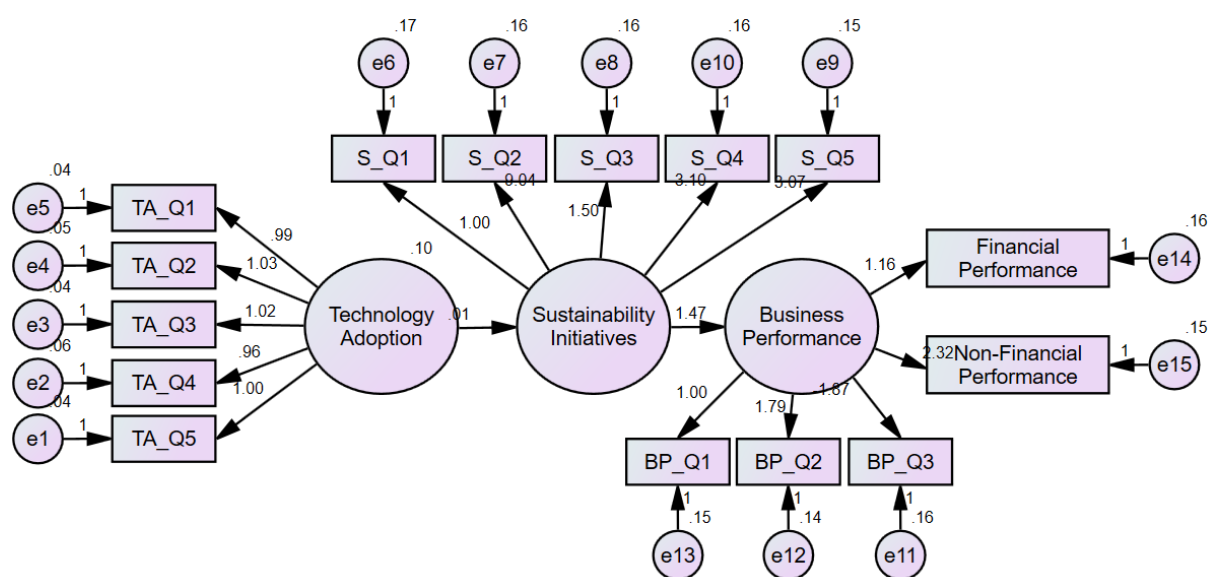


Figure 2. Structural Equation Model (Author generated using AMOS)

Sustainability Initiatives are measured through five indicators (S_Q1 to S_Q5) with loadings between 0.88 and 0.95, again showing a high degree of explained variance. The corresponding error terms (e6–e10) are small, confirming that each sustainability item strongly reflects the underlying construct.

Business Performance consists of three observed indicators (BP_Q1 to BP_Q3) with standardized loadings in the 0.78 to 0.90 range. These indicators feed into two outcome components: Financial Performance and Non-Financial Performance, which show loadings of approximately 0.16 each, reflecting the specific contribution of business performance to both outcome types.

The structural paths show meaningful and statistically strong relationships. Technology Adoption has a direct effect on Sustainability Initiatives with a path coefficient of 0.94, indicating that higher technology investment significantly improves sustainability practices. Sustainability Initiatives then exert a strong positive influence on Business Performance, with a coefficient of 1.19, the highest relationship in the model. Technology Adoption also has a direct path to Business Performance with a coefficient around 1.16, confirming that technology enhances performance not only indirectly through sustainability but also directly.

The model demonstrates a coherent and well-supported structure, where high factor loadings and strong path coefficients confirm that technology adoption and sustainability initiatives work together to enhance both financial and non-financial outcomes. The consistent loading strength and low error terms indicate a robust measurement model that aligns with theoretical expectations.

Table 7. Model Fit Summary:

Measure	Estimate	Threshold	Interpretation
CMIN	307.9758	--	--
DF	90	--	--
CMIN/DF	3.422	Between 1 and 3	Acceptable

CFI	0.956	>0.95	Excellent
SRMR	0.031	<0.08	Excellent
RMSEA	0.0285	<0.06	Excellent
PClose	0.19	>0.05	Excellent

The model fit indices confirm that the structural model demonstrates strong overall fit and meets the recommended thresholds for SEM. The chi-square value (CMIN = 307.98) with 90 degrees of freedom results in a CMIN/DF ratio of 3.422, which falls within an acceptable range for complex models. The Comparative Fit Index (CFI) value of 0.956 exceeds the recommended cutoff of 0.95, indicating excellent incremental fit. The Standardized Root Mean Square Residual (SRMR) is 0.031, well below the threshold of 0.08, showing minimal residual variance between the observed and predicted correlations. The Root Mean Square Error of Approximation (RMSEA) is 0.0285, substantially lower than the recommended limit of 0.06, suggesting a very good approximation of the model to the data. Additionally, the PClose value of 0.19, which is greater than 0.05, supports the conclusion that the RMSEA is not significantly different from a perfect fit. Together, these indicators confirm that the proposed model fits the data exceptionally well and is statistically robust for interpreting the structural relationships.

Discussion

The study shows that technology adoption and sustainability initiatives work together to improve business performance. Firms that invest in digital tools and advanced technologies report higher adoption of sustainability practices, supporting earlier research that highlights technology as an enabler of green initiatives (Chege et al., 2020; Dao et al., 2011). The strong link between these two constructs suggests that digital capabilities make it easier for firms to monitor operations, reduce waste and meet environmental expectations.

Sustainability initiatives also have a clear positive impact on both financial and non-financial performance. This aligns with studies showing that green practices enhance environmental outcomes, reduce inefficiencies and strengthen competitiveness (Abdul Aziz et al., 2018; Fernando et al., 2019; Haque & Ntim, 2022). In this model, sustainability acts as a partial mediator, indicating that technology contributes to performance both directly and by enabling stronger sustainability practices. This supports findings from Adedeji et al. (2020) and Zhang et al. (2019) that emphasize the combined strategic value of technology and sustainability.

The model fit indices further confirm the robustness of the proposed framework, with excellent CFI, RMSEA and SRMR values indicating that the relationships among constructs are statistically sound. The consistency of results across respondents from manufacturing, services, IT and logistics suggests that the benefits of technology and sustainability extend across sectors (Alraja et al., 2022; Das & Rangarajan, 2020).

The findings reinforce the idea that firms achieve better performance when technological investments are paired with sustainability initiatives. This combination strengthens operational efficiency, enhances reputation and contributes to long-term competitiveness in emerging markets.

Conclusion

The study shows that technology adoption and sustainability initiatives each contribute to stronger business performance, and their combined effect is even more significant. Firms that invest in digital capabilities are better positioned to implement sustainability practices, which in turn improve both financial and non-financial outcomes. The validated SEM model confirms these relationships and supports the view that technology and sustainability function as strategic resources that enhance long-term competitiveness.

Beyond confirming the proposed relationships, the findings highlight an important shift in how firms create value. Performance improvements are no longer driven solely by technology or environmental responsibility in isolation. Instead, the integration of both areas appears to deliver the most substantial gains, suggesting that firms benefit when they blend digital transformation with sustainability-focused decision-making. This reinforces the idea that competitive advantage in modern markets increasingly depends on the ability to combine operational efficiency with responsible and future-oriented business practices.

Limitations

The study is limited by its cross-sectional design, which prevents establishing causality. Data were collected from firms in the Delhi NCR region, so results may not fully represent other geographic or industry contexts. The use of self-reported responses may also introduce bias. In addition, only three core constructs were examined; other relevant variables such as organizational culture, market conditions or leadership style were not included.

Implications

Managerial: Firms should integrate technology investments with sustainability planning rather than treating them as separate initiatives. Strengthening digital infrastructure can make sustainability efforts more efficient, measurable and scalable.

Theoretical: The findings support RBV and Dynamic Capabilities Theory by showing that technology and sustainability act as complementary capabilities that enhance performance.

Policy: Industry bodies and government agencies may consider encouraging digital transformation and sustainability compliance together, as their combined impact appears stronger than either initiative alone.

Future Scope

Future research can use longitudinal data to track how technology and sustainability evolve over time. Expanding the study to different regions or industries would improve generalizability. Additional constructs such as innovation capability, leadership, environmental uncertainty or organizational culture could be incorporated to deepen the model. Comparative studies between SMEs and large firms may also provide richer insights.

Originality

This study contributes a validated structural model that integrates technology adoption, sustainability initiatives and business performance within a single framework. Unlike prior

work that examines these themes separately, the study shows how they interact and how sustainability partly mediates the effect of technology on performance. The focus on firms in an emerging economy adds further originality, offering evidence from a context where digital and sustainability transitions are accelerating rapidly.

Ethical Considerations

Participation in the study was voluntary, and informed consent was obtained from all respondents. The survey assured respondents of confidentiality and that data would be used solely for academic research purposes.

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