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TECHNOLOGICAL CAPABILITY, INNOVATIVENESS AND SUSTAINABILITY PERFORMANCE OF MEDIUM AND LARGE MANUFACTURING FIRMS IN NAIROBI COUNTY, KENYA

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ABSTRACT

This paper empirically examines the mediating role of innovativeness on the relationship between technological capability and sustainability performance of medium and large manufacturing firms in Nairobi County, Kenya. The study surveyed 302 firms and applied Hayes' PROCESS macro (Model 4) to test the direct effect of technological capability on sustainability performance and the indirect (mediated) effect of innovativeness, using bootstrap confidence intervals for inference. Technological capability has a significant and positive total effect on sustainability performance. Controlling for innovativeness, the direct effect remains positive and significant and the indirect effect via innovativeness is significant indicating complementary (partial) mediation. Technological capability positively predicts innovativeness and innovativeness positively predicts sustainability performance. This research recommends that firms should pair investments in technological capability with organizational processes that systematically translate those capabilities into innovation such as cross-functional R&D routines, eco-innovation programs, and learning systems and monitor innovation and sustainability KPIs to ensure technological assets are effectively leveraged.

KEY WORDS: *Technological Capability, Innovativeness, Sustainability Performance, Medium and Large Manufacturing Firms.*

1. INTRODUCTION

Kenya's manufacturing sector sits at the heart of the country's growth and sustainability ambitions—and nowhere is this more visible than in Nairobi County, the country's dominant manufacturing hub. According to recent county GDP statistics, Nairobi contributed, on average, 36.9% of Kenya's manufacturing gross value added between 2018 and 2022, far outpacing other counties and reflecting the capital's dense industrial clusters in Industrial Area, Ruaraka, and Embakasi (StatsKenya, 2023). Nationally, manufacturing accounted for KSh 1.15 trillion in current prices in 2023, although sector growth has been modest, underscoring the need for capability upgrading and innovation to sustain competitiveness under rising energy, input, and compliance costs (KNBS, 2024). In policy terms, the sector is expected to carry significant weight for the 20-by-30 industrial target, the green transition, and export-led growth (Kenya Association of Manufacturers [KAM], 2022).

Globally, manufacturing is being reshaped by the diffusion of advanced digital production (ADP) technologies—additive manufacturing, industrial IoT, AI, and cyber-physical systems—collectively framed as Industry 4.0. For developing economies, these trajectories pose both opportunity and risk: capability-rich firms can upgrade into cleaner, smarter production, while capability-poor firms risk widening productivity and sustainability gaps (UNIDO, 2020). Within this context, three constructs become central to firm outcomes in an emerging economy setting like Nairobi County: (i) technological capability—the firm's ability to acquire, adapt, and deploy process and product technologies; (ii) innovativeness—the propensity and capacity to generate and implement new products, processes, and business models, including green innovations; and (iii) sustainability performance—the integrated environmental, social, and economic outcomes tied to operations and strategy. Contemporary empirical work consistently links

stronger technological capabilities to higher innovation outputs and, through green innovation pathways, to improved environmental and even financial results (Yang, Shan, Xian, Xu, & Li, 2024; Liu, Liu, & Feng, 2024).

Kenya's manufacturing landscape highlights the salience of technological capability. Energy use is a binding constraint for many firms, and efficiency improvements hinge on process know-how, metering and analytics, and equipment upgrades—classic capability issues. Empirical work on Kenyan manufacturers shows that efficiency performance is heterogeneous across sub-sectors and energy forms, and that firm characteristics interact with efficiency outcomes in nuanced ways, reinforcing the view that "capability footprints" matter for sustainable operations (Macharia, Gathiaka, & Ngui, 2021). At the systems level, regulators and industry bodies have worked to mainstream energy management and audits, yet the UNEP Copenhagen Climate Centre documents persistent skills and knowledge gaps among energy professionals—gaps in measurement and verification, systems optimization (compressed air, motors, steam), and ISO-aligned energy management that can slow or dilute sustainability gains at plant level (UNEP-CCC, 2022). These findings underscore that technological capability is not simply capital deepening—it is also about human capital, routines, and absorptive capacity that allow firms to translate equipment and digital tools into measurable environmental performance.

Innovativeness is the second pillar. Nairobi-based studies show that product, process, marketing, and technological innovation capabilities are positively associated with performance among manufacturers—which, in a sustainability era, increasingly includes eco-efficiency and compliance outcomes (Mboga, Datche, & Kising'u, 2023; Datche, Kising'u, & Mboga, 2022). While these county-level studies focus on economic performance, international evidence suggests that innovation—especially "green innovation"—is a primary conduit linking capabilities to triple-bottom-line results. Meta-analytic and large-sample studies show green product and process innovation improve environmental performance and can enhance financial results by reducing risk and improving resource productivity, though effects vary by innovation type and context (Yang et al., 2024; Liu et al., 2024). In particular, Liu et al. (2024) distinguish "substantive" green innovation (high-quality technological advances embedded in operations) from "strategic" green innovation (signals with lower technological depth), finding that both improve environmental performance while only substantive innovation systematically lifts financial performance—an important nuance for managers seeking credible sustainability outcomes.

A growing line of research connects digital transformation to the pace and quality of green innovation. Using panel data on manufacturing firms, Yang et al. (2024) show that digital transformation—via data analytics, automation, and platformization—significantly promotes green patenting, partly by strengthening corporate environmental responsibility; media attention further amplifies this effect. For Nairobi's medium and large firms, which already operate at larger scales and face compliance with energy and environmental regulations, investments in digital operations (sensors, MES/SCADA, predictive maintenance) can catalyze process innovations that reduce waste, energy intensity, and emissions, thereby improving sustainability performance while supporting cost competitiveness. These digital–green complementarities match national and county policy priorities that promote industrial upgrading alongside emissions reductions and circular economy initiatives (KAM, 2022).

Sustainability performance itself is multidimensional. Environmental indicators include energy intensity, renewable energy uptake, emissions, water and effluent controls, and waste valorization; social indicators span occupational health and safety, skills development, and community impacts; economic indicators cover cost savings, productivity, export performance, and long-term value creation. Empirical work indicates that firms advancing green process and product innovation frequently record measurable gains on environmental metrics—lower energy and material use, reduced pollutants—and, depending on innovation quality and market context, maintain or improve financial performance (Liu et al., 2024). For Nairobi manufacturers, KAM's sector reports emphasize policy and market enablers—tariff relief, logistics and export facilitation, ESG mainstreaming—to help firms internalize costs and realize returns from sustainability investments (KAM, 2022).

The Nairobi County focus is analytically meaningful. First, the county concentrates a large share of medium and large manufacturers—entities with greater formalization, more complex supply chains, and higher audit and disclosure expectations. Kenya's MSME framework classifies medium enterprises as those with 50–99 employees, while firms ≥100 employees are often treated as large, a threshold relevant for compliance and capability considerations that shape technology adoption pathways (KNBS MSME Survey Highlights, 2016). Second, the county's energy and

infrastructure profile (grid access, industrial feeders, access to EPCs and energy auditors) creates relatively favorable conditions for technology and process upgrading, even if skill and finance constraints persist (Macharia et al., 2021; UNEP-CCC, 2022). Third, the concentration of buyers, service providers, and knowledge institutions in Nairobi can enhance diffusion and learning effects—key to building dynamic capabilities and accelerating green innovation adoption (UNIDO, 2020).

Notwithstanding these advantages, binding constraints remain. The skills report by UNEP-CCC (2022) finds capability gaps in energy systems optimization and performance measurement that limit the persistence and scaling of efficiency gains; it recommends deepening vocational and professional training aligned to regulations and standards (e.g., ISO 50001), and strengthening the pipeline of energy managers and auditors. Financing and payback risk also affect the willingness to invest in greener process technologies; local evidence suggests heterogeneity in energy efficiency outcomes by sub-sector, making capability diagnostics at the firm level essential (Macharia et al., 2021). Policy momentum is strong—the KAM "20by30 Plan" and national strategies aim to raise the manufacturing GDP share while embedding ESG commitments—but the translation from policy to plant-level routines requires managerial attention to capability building, data readiness, and innovation governance (KAM, 2022).

Bringing these strands together, a plausible mechanism for Nairobi's medium and large manufacturers is as follows. First, technological capability (equipment, IT/OT integration, skilled teams, and supplier linkages) raises the firm's innovation capacity. County-level Kenyan studies already confirm that innovation capabilities (product, process, marketing, and technological) are associated with better firm performance (Mboga et al., 2023). Second, when that innovativeness is directed toward green product and process changes—eco-design, cleaner production, resource-efficient processes—empirical research predicts improvements in environmental performance and, for high-quality innovations, competitive and financial payoffs (Liu et al., 2024). Third, digital transformation can accelerate and deepen green innovation by reducing information asymmetries, enabling real-time monitoring, and strengthening accountability through disclosure—effects documented in recent panel studies (Yang et al., 2024). Finally, the Nairobi industrial ecosystem—buyers demanding ESG, sector associations offering training, and regulators enforcing energy management—provides the institutional scaffolding that increases the returns to capability and innovation investments (KAM, 2022; UNIDO, 2020).

This study is therefore motivated by a practical and theoretical gap. Practically, while national and international evidence link capabilities and innovation to sustainability outcomes, there is limited Nairobi-specific firm-level analysis that jointly examines technological capability, innovativeness, and multidimensional sustainability performance among medium and large manufacturers. Theoretically, emerging work differentiates the quality of green innovation (substantive vs. strategic) and highlights the role of digital enablers and organizational capabilities; applying these insights to the Nairobi context can clarify which capability bundles and innovation types yield durable environmental and financial gains (Liu et al., 2024; Yang et al., 2024). Given Nairobi County's outsized role in Kenya's manufacturing GDP and the country's net-zero and industrialization ambitions, understanding these relationships is timely and policy-relevant (StatsKenya, 2023; KNBS, 2024).

2. LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

TBL Theory provides that sustainability in companies involves performance on economic, environmental and social indicators (Elkington, 1997). In medium and large manufacturers, technological capability and firm innovativeness translate into TBL gains by lowering unit costs, cutting emissions and waste, and improving worker safety; advanced manufacturing, clean energy, and digital controls can make production less polluting and more energy-efficient (Chen, 2008; Schaltegger & Burritt, 2018). Yet TBL also emphasizes context: volatile input prices, shifting environmental standards, and uncertain markets—as in Nairobi County's export-linked value chains—can complicate the conversion of technology into sustained TBL performance. When turbulence forces short-term firefighting or diverts capital from continuous improvement, the direct payoff from technological investments may attenuate unless firms channel capability and innovativeness toward eco-efficiency and social value (Schaltegger & Burritt, 2018).

Dynamic Capabilities Theory (DCT) holds that firms achieve durable advantages not by owning assets alone but by sensing opportunities and threats, seizing them with timely investments, and reconfiguring tangible and intangible resources as conditions shift (Teece, Pisano, & Shuen, 1997; Teece, 2018). In stable environments, manufacturers can routinize technology for efficiency; under heightened dynamism—energy shocks, regulatory updates, supply

disruptions—static deployment becomes insufficient. Firms must build dynamic capabilities such as rapid experimentation, data-driven decision-making, organizational learning, and strategic flexibility to repeatedly realign technologies, processes, and business models with evolving sustainability goals (Eisenhardt & Martin, 2000; Teece, 2018). In this study's setting, dynamic capabilities are expected to moderate and mediate how technological capability and innovativeness improve sustainability performance: only firms that continually reconfigure capabilities will consistently deliver economic productivity, environmental efficiency, and social responsibility in Nairobi's competitive manufacturing ecosystem.

Fitz-Oliveira and Tello-Gamarra (2024) conducted a meta-analytic review of 23 studies (5,882 firms) and confirmed a positive—yet heterogeneous—effect of technological capability on manufacturing performance; the authors traced variability to how capability/performance are measured, data sources, and contextual moderators, underscoring that capability pays but is contingent on methods and settings, a nuance highly relevant to Nairobi's diverse medium/large plants. Yang, Shan, Xian, Xu, and Li (2024) used panel data to show that firms' digital transformation strengthens green innovation outputs and, through them, improves environmental performance; the study highlights organizational learning and external pressure (e.g., media attention) as amplifiers, implying that Nairobi firms with stronger digital capabilities convert technology into measurable sustainability gains more effectively. Liu, Liu, and Feng (2024) distinguished "substantive" versus "symbolic" green innovation and found that substantive (technology- and process-deep) efforts lift both environmental and financial outcomes more than symbolic disclosure, implying that manufacturers must invest in real capabilities (not just reporting) to shift sustainability performance.

Cillo at al., (2019) synthesized sustainable-innovation research and showed that dynamic technological and organizational capabilities channel firms' innovation toward triple-bottom-line outcomes, suggesting that Kenyan manufacturers should combine technology investments with routines for sensing, learning, and reconfiguring to realize sustainability payoffs. Wang, Li, Li, and Wang (2021) analyzed 642 industrial enterprises and demonstrated that green process innovation directly improves economic performance while green product innovation works indirectly; environmental performance and market competitiveness mediated both effects—evidence that capability-driven process upgrades in factories can pay back on both efficiency and sustainability.

Afum, Osei-Ahenkan, Agyabeng-Mensah, Owusu, Kusi, and Ankomah (2020) surveyed Ghanaian manufacturing SMEs and found green manufacturing practices improve economic, environmental, and social performance via green supply-chain integration, suggesting capability complementarities (operations + supplier links) are crucial for African plants targeting holistic sustainability. Albort-Morant, Leal-Rodríguez, and De Marchi (2018) showed that absorptive capacity and relationship learning jointly propel green-innovation performance, clarifying that the payoffs from tech capability rise when firms can acquire/assimilate external knowledge—salient for Nairobi manufacturers partnering with OEMs and universities.

Fitzgerald, Therkelsen, Sheaffer, and Rao (2023) documented persistent energy-efficiency and CO_2-reduction gains from ISO 50001 energy-management systems in manufacturing, indicating that codified technological/managerial routines convert equipment and data capabilities into durable sustainability performance.

Macharia, Gathiaka, and Ngui (2021) estimated energy efficiency in Kenya's manufacturing sector and linked efficiency to firm characteristics and managerial practices, implying that technological capability (e.g., metering, process control) and managerial know-how are practical levers for Nairobi plants' sustainability metrics. Wako and Mwanzia (2024) examined digital-innovation strategy among Nairobi County manufacturers and found positive performance effects, arguing that data analytics and process digitization raise operational results—mechanisms that also cut waste and energy use, aligning technological capability with environmental outcomes. Mboga, Datche, and Kising'u (2023) studied Nairobi City County manufacturers and reported that product, process, marketing, and technological innovation capabilities each significantly raise firm performance, reinforcing the case that a balanced innovation-capability portfolio underpins sustainability improvements.

Datche, Kising'u, and Mboga (2022) showed that environmental dynamism moderates the innovation-capability→performance link in Nairobi manufacturers; when markets/technologies shift quickly, firms with stronger capabilities sustain their edge—evidence that dynamic capability is vital for maintaining sustainability performance under volatility.

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Were (2021) analyzed Kenya's furniture-manufacturing sector and found innovation-capability in strategy execution is positively associated with firm performance, highlighting implementation discipline (routines, skills) as the bridge from technological assets to sustained results relevant for wider Nairobi manufacturing. Yego, Sang, and Kibet (2021) focused on Nairobi SMEs and showed process innovation improves performance, suggesting that systematic upgrades in production (lean, cleaner technologies) are practical pathways through which even medium-sized plants can enhance sustainability indicators. Wang, Zhang, Zhang, and Wang (2022/2023) used conditional-process analysis to show that capability deployment and contextual factors shape green-innovation performance; firms that align tech resources with real-time sensing/learning deliver stronger environmental results. Hence, we hypothesize that:
H_{01}: Innovativeness has a mediating effect on the relationship between technological capabilities and firms' sustainability performance.

3. RESEARCH METHODOLOGY

3.1 Sample size and data

The study targeted 1,900 medium and large manufacturing firms drawn from different sectors including food and beverage (570), textile and apparel (190), chemicals (228), metals and machinery (190), wood and paper products (152), plastic and rubber (190), electronics and electronic equipment (95), and construction materials (285). These firms are registered under the Kenya Association of Manufacturers (KAM) and have been in operation for more than five years. The study targeted both medium and large manufacturing firms, given their contribution to industrial output and sustainability, and the likelihood of having established technological capabilities and innovation processes. The unit of analysis was the firm, while the unit of inquiry consisted of owners or managers involved in day-to-day operational decision-making. The sample size was computed using Yamane's formula (Yamane, 1967) as cited by Thompson and Lange (2011). This is given by:

$$n = \frac{1900}{1 + N(e)^2}$$

Whereas, N=204 and e=5%

$$n = \frac{1900}{1 + 1900(0.05)^2}$$

A sample of n=330 was adopted.

3.2 Measurement of variables

The study used a five-point Likert scale to measure technological capability. Environmental dynamism and sustainability performance.

Table 1:Measurement of variables

Variable	Dimensions	Number of Measurement items	Sample Items	Source
Firm Sustainability Performance	1. Economic Sustainability Performance 2. Social Sustainability Performance 3. Environmental Sustainability Performance	30 items anchored on a 5 point-Likert scale	- Our firm generates revenue from the sale of new products - Our firm improved employees' safety at the workplace - Our firm reduced energy consumption	Dyllick&Hockerts (2002)Chow& Chen (2012) Pedersen *et al.,* (2018) Globocnik *et al., (*2019)

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Firm Innovativeness	1. Product Innovativeness 2. Process Innovativeness 3. Management System Innovativeness	17 items anchored on a 5 point-Likert scale	- In the last five years our firm has introduced a range of new products - We constantly improve our business processes - We improve our leadership behavior to enhance staff motivation	Golgeci & Ponomarov (2015) Wang & Ahmed (2004) Globocniketal(2018) Tsai *et al.,* (2001)
Technological capability	1. Acquisition of skills, 2. Knowledge, 3. Experience 4. Establishment of firm systems	10 items anchored on a 5 point-Likert scale	- We recruit staff who are qualified, - We do a lot of in-house market research. - We constantly improve our business processes	Wang and Ahmed (2004), Tsai, Huang, and Kao (2001), and Mafabi *et al.,* (2012).

Source, Researcher, (2024)

3.3 Model Specification

Hypotheses one to three was tested using Model 3 in the multiple linear regression.

$SP= \beta_0 + \beta_1 TC + e_1$……. Model 1

$SP= \beta_{0+} + \beta_1 TC + \beta_2 INN + e_2$……. Model 2

$INN= \beta_0 + \beta_1 TC + + e_2$……. Model 3

Where

SP = Sustainable performance

β_0 = Constant Term

$\beta_1, \beta_2, \beta_3, \beta_4$ = Beta coefficients

TC = Technological capability

INN = Innovatiness

e = Error Term

4. DATA ANALYSIS AND PRESENTATION

4.1 Response rate

A total of 330 questionnaires were distributed, and 302 were correctly filled and returned, yielding a high response rate of 91.52%, which exceeds the recommended threshold for robust survey research. The target population consisted of 1,900 medium and large manufacturing firms in Nairobi County, Kenya. Data cleaning involved screening for missing values and outliers, with no missing values detected, while identified outliers were removed to avoid biasing the analysis.

4.2 Descriptive Statistics

The study demonstrated strong firm sustainability performance, with a mean of 3.8602 and a standard deviation of 0.50000, indicating that firms in the sample generally perform well in areas related to economic, social, and environmental sustainability. The firms exhibited a relatively high level of technological capability (mean = 3.5781, SD = 0.60060), suggesting they possess the necessary skills, knowledge, and systems to support innovation and performance. Innovativeness was also reported at a high level (mean = 3.678, SD = 0.35950).

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Table 2: Descriptive statistics results

	N	Minimum	Maximum	Mean	Std. Deviation
Technological Capability	302	1	5	3.5781	.60060
Innovativeness	302	1.0	5.00	3.678	.35950
Firm Sustainability Performance	302	1	5	3.8602	.50000

Source: Research Data, 2024

4.3 Diagnostic Test

The study satisfied all key assumptions for reliable regression analysis. Normality was confirmed by the Jarque-Bera test (JB = 0.0785), with skewness (−0.039) and kurtosis (2.0789) values indicating a symmetric and normal distribution. Linearity was supported through the P-P plot, where residuals aligned along the diagonal line, suggesting a linear relationship between variables. Multicollinearity was not a concern, as all tolerance values were above 0.20 and VIF values were below 4.0, indicating no excessive correlation among independent variables. Homoscedasticity was also confirmed, as the plot of standardized residuals showed no funneling and residuals were within the acceptable ±2 range. Additionally, the reliability of measurement instruments was established with Cronbach's alpha values exceeding 0.70 across all constructs: firm sustainability performance (α = .931), technological capability (α = .829), firm innovativeness (α = .947).

4.4 Correlation Results

The Pearson correlation results show that technological capability is positively and significantly correlated with firm sustainability performance (r = 0.558, p = 0.000) at the 5% significance level. Innovativeness is also positively and significantly related to firm sustainability performance (r = 0.581, p = 0.000). Moreover, innovativeness and technological capability exhibit a weak and significant positive correlation (r = 0.332, p = 0.000). Since all p-values are less than 0.05, the relationships among these variables are statistically significant. These findings suggest that both technological capability and environmental dynamism contribute positively to firm sustainability performance.

Table 3: Pearson Correlation Coefficients

		FSP	TC	INN
Sustainability Performance	Pearson Correlation	1		
	Sig. (2-tailed)			
Technological Capability	Pearson Correlation	.558**	1	
	Sig. (2-tailed)	.000		
Innovativeness	Pearson Correlation	.581*	.332*	1
	Sig. (2-tailed)	.000	.000	

Source: Research Data, 2024

4.3 Regression Results

In this paper, the influence of technological capability (TC) on firm sustainability performance (FSP) among medium and large manufacturing firms in Nairobi County was examined, focusing on whether innovation (INN) mediates this relationship. Mediation was tested with Hayes' PROCESS Macro Model 4, which estimates the indirect (mediated) effect and its confidence interval via bootstrap resampling—a recommended approach for mediation inference (Hayes, 2022; Preacher & Hayes, 2008).

The analysis shows a strong, positive total effect of TC on FSP (unstandardized c = 0.4647, p < .001; standardized β = .5582). When INN is included, the direct effect remains positive and significant (unstandardized c′ = 0.3418, p < .001; β = .4105), while the indirect effect of TC on FSP via INN is also significant (unstandardized ab = 0.1229; 95% bootstrap CI [0.0358, 0.2059]; completely standardized β = .1476, 95% bootstrap CI [0.0466, 0.2351]). Because both

direct and indirect effects are positive and significant, this pattern is consistent with complementary (partial) mediation (Zhao, Lynch, & Chen, 2010). Approximately 26% of the total effect of TC on FSP operates indirectly through INN (0.1229/0.4647 ≈ 26%).

Path estimates further illuminate the mechanism. TC significantly predicts INN (path a = 0.3080, $p < .001$; $\beta = .3318$; mediator-model $R^2 = .1101$). In turn, INN significantly predicts FSP controlling for TC (path b = 0.3990, $p < .001$; $\beta = .4450$). The outcome model that includes both TC and INN explains 48.78% of the variance in FSP ($R^2 = .4878$), an increase of $\Delta R^2 \approx .1763$ over the TC-only (total-effect) model ($R^2 = .3115$). This gain reflects the substantive contribution of INN to explaining sustainability outcomes beyond TC alone.

Substantively, these results suggest that firms with stronger technological capability achieve better sustainability performance partly because they translate that capability into higher levels of innovation. This is consistent with resource-based and dynamic-capabilities views, which posit that valuable, hard-to-imitate capabilities (like TC) enable firms to reconfigure resources and innovate, thereby improving performance (Barney, 1991; Teece, Pisano, & Shuen, 1997). It also aligns with research linking (green) innovation to environmental and sustainability outcomes (Chen, Lai, & Wen, 2006; Dangelico & Pujari, 2010). Practically, managers should not only invest in technological assets but also ensure organizational processes and culture convert those assets into innovation—since that translational step materially boosts sustainability performance.

Table 4: Regression Results

Component	Path	b	SE	t	p	95% CI (LL, UL)	β (std)	Model R^2
Mediator model	TC → INN	0.3080	0.0506	6.0911	<.001	0.2085, 0.4075	0.3318	0.1101
Outcome model (with mediator)	TC → FSP | INN	0.3418	0.0365	9.3566	<.001	0.2699, 0.4136	0.4105	0.4878
	INN → FSP | TC	0.3990	0.0393	10.1427	<.001	0.3216, 0.4764	0.4450	0.4878
Total effect (without mediator)	TC → FSP	0.4647	0.0399	11.6513	<.001	0.3862, 0.5431	0.5582	0.3115
Indirect effect	TC → INN → FSP	0.1229	0.0429 (BootSE)	—	—	0.0358, 0.2059 (BootCI)	0.1476	—

Source: Research Data, 2024

5. CONCLUSION AND RECOMMENDATION

This study examined how innovativeness channels the influence of technological capability toward sustainability performance among medium and large manufacturing firms in Nairobi County. The evidence indicates that technological capability contributes to better environmental, social, and economic outcomes both directly and by fostering higher levels of innovativeness. In other words, technology alone is not sufficient; its value is realized when organizations systematically translate technological assets into new products, processes, and practices. This pattern aligns with resource-based and dynamic-capabilities perspectives: firms that purposefully reconfigure and leverage their technological resources through innovation are better positioned to advance sustainability performance in complex competitive environments.

Firms should continue investing in technological capability while deliberately building complementary innovation routines that convert those investments into sustainability-enhancing outputs. This includes establishing cross-functional teams, structured idea pipelines, dedicated R&D budgets, and incentive systems that reward eco-innovation and continuous learning. Technology architectures should be flexible and modular so they can be reconfigured as conditions change, and management systems should embed environmental scanning, regulatory monitoring, and market intelligence to guide timely adaptation. Organizations will benefit from tracking innovation inputs and outputs alongside sustainability KPIs to ensure that technological resources are being effectively transformed into measurable performance gains. Externally, collaboration with universities, start-ups, and industry bodies—such as the Kenya Association of Manufacturers—can provide complementary knowledge and accelerate diffusion of sustainable technologies and practices. Policymakers and industry associations can amplify these efforts by offering real-time regulatory guidance, targeted innovation incentives, and capacity-building programs that strengthen firms' adaptive and innovation capabilities. Together, these actions help ensure that technological investments consistently translate into resilient, sustainability-focused innovations.

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