

“A Study on Impact of Implementation of Advanced Technology in Logistics Industry in GMB & Co”

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ABSTRACT

This article integrates two complementary research studies to provide a comprehensive analysis of technology-driven supply chain transformation. The first study presents a quantitative survey of 120 supply chain practitioners examining how digital technology adoption, resilience investment, and sustainability integration drive operational and financial outcomes. The second study draws on primary research conducted at GMB & Co., a logistics firm in Thoothukudi, Tamil Nadu, using survey data from 125 respondents to examine how IoT, automation, AI-driven analytics, and digital supply chain systems influence operational efficiency and customer satisfaction. Together, the findings confirm that technology adoption is the strongest driver of supply chain performance ($\beta = 0.54$, $p < 0.001$), that resilience and sustainability contribute independently significant effects, and that firms investing across all three dimensions significantly outperform peers. The GMB & Co. case study further illustrates real-world adoption benefits and barriers in a mid-size Indian logistics context.

Keywords: *Supply Chain Management, Digital Technology, IoT, AI, Resilience, Sustainability, Logistics, GMB & Co.*

INTRODUCTION

Supply chain management has evolved into a strategic function in today's global economy, especially after disruptions like the COVID-19 pandemic, semiconductor shortages, and geopolitical shifts exposed supply chain vulnerabilities. At the same time, technologies such as AI, blockchain, and IoT are driving transformation, with reports indicating that digital supply chains can improve EBIT by around 3.2% annually. The logistics sector is also rapidly advancing, particularly in India where it is expected to grow at 8–10% annually, making technology adoption a key competitive factor. This article combines insights from a regional survey of 120 supply chain professionals and a case study of GMB & Co. in Thoothukudi to provide both analytical and practical perspectives.

REVIEW OF LITERATURE

A substantial body of international research underscores the transformative potential of Industry 4.0 technologies in logistics. Scholars such as Niraj Chaudhari (2019), Alexandra Lagorio (2020, 2022), and Bag et al. (2021) highlight how automation, IoT, and digital supply chain tools increase efficiency, reduce costs, and enhance communication across the supply chain. Ghadge et al. (2020) and Barreto, Amaral & Pereira (2021) further emphasize that while benefits are substantial, the transition demands significant investment in infrastructure, workforce reskilling, and organizational change management.

More recently, Mukhopadhyay et al. (2025) highlighted how Supply Chain Management Technology (SCMT) and RFID systems have measurably reduced order processing times and improved inventory accuracy. Collectively, the literature points to a consistent conclusion: technology adoption in logistics is not merely an efficiency play but a strategic imperative.

RESEARCH METHODOLOGY

Study 1 employed a structured, closed-ended questionnaire administered to 120 supply chain managers and directors across manufacturing, retail, logistics, and healthcare sectors (October–December 2025). Respondents rated their organisation's investment in three independent variables — Digital Technology Adoption (DTA), Resilience Investment (RI), and Sustainability Integration (SI) — on a five-point Likert scale. The dependent variable, Supply Chain Performance Index (SCPI), was computed as a composite of five operational metrics validated using Cronbach's Alpha ($\alpha = 0.87$). Data were analysed via descriptive statistics, Pearson correlation, multiple regression, independent-samples t-tests, and one-way ANOVA using IBM SPSS Statistics v28.

Study 2 adopted a descriptive and analytical research design using primary data from 125 respondents at GMB & Co. The sample comprised 59.2% male and 40.8% female respondents, with a majority (36%) in the 21–30 age group.

DESCRIPTIVE STATISTICS & SAMPLE PROFILE

Table 1 presents the demographic profile of the 120 respondents from Study 1. The sample is well-distributed across industry sectors, organisational sizes, and investment levels, lending external validity to the findings.

Table 1: Respondent Profile (n = 120)

Category	Sub-group	Frequency (n)	Percentage (%)
Industry Sector	Manufacturing	38	31.7%
	Retail & E-commerce	29	24.2%
	Logistics & 3PL	27	22.5%
	Healthcare & Pharma	26	21.7%
Organisation Size	Large (>1,000 employees)	52	43.3%
	Mid-size (200–1,000)	44	36.7%
	Small (<200 employees)	24	20.0%
SCM Experience	< 5 years	31	25.8%
	5–10 years	49	40.8%
	> 10 years	40	33.3%

Note: Source: Primary survey data, Oct–Dec 2025.

Table 2 presents descriptive statistics for all four study variables. Digital Technology Adoption scored highest among independent variables (Mean = 3.58), while Sustainability Integration recorded the lowest mean (3.07), indicating a strategic gap in green supply chain practices.

Table 2: Descriptive Statistics — Key Study Variables (n = 120)

Variable	Abbrev.	Min	Max	Mean	Std. Dev.	Skewness
Digital Technology Adoption	DTA	1.20	5.00	3.58	0.74	-0.31
Resilience Investment	RI	1.00	5.00	3.29	0.81	-0.18
Sustainability Integration	SI	1.00	5.00	3.07	0.79	0.12
Supply Chain Performance Index	SCPI	1.40	5.00	3.41	0.68	-0.22

CORRELATION & REGRESSION ANALYSIS

Pearson product-moment correlations were computed to examine bivariate relationships between the three investment dimensions and supply chain performance. Table 3 presents the full correlation matrix.

Table 3: Pearson Correlation Matrix

Variable	DTA	RI	SI	SCPI
DTA	1.000			
RI	0.612	1.000		
SI	0.478	0.531	1.000	
SCPI	0.724	0.638	0.581	1.000

Note: ** Correlation significant at the 0.01 level (2-tailed).

Digital Technology Adoption has the strongest positive relationship with SCPI ($r = 0.724, p < 0.01$). Resilience Investment also demonstrates a strong positive correlation ($r = 0.638, p < 0.01$), while Sustainability Integration registers $r = 0.581 (p < 0.01)$ — confirming that green supply chain practices contribute measurably to operational performance.

A simultaneous multiple regression model was estimated with SCPI as the dependent variable. The model yields $R^2 = 0.658$, indicating that the three investment dimensions collectively explain 65.8% of the variance in supply chain performance ($F(3,116) = 74.37, p < 0.001$).

Table 4: Regression Coefficients (Dependent Variable: SCPI)

Predictor	B (Unstd.)	Std. Error	β (Std.)	t-value	Sig. (p)	VIF
(Constant)	0.412	0.201	—	2.05	0.043	—
Digital Tech. Adoption (DTA)	0.498	0.067	0.542	7.43	< 0.001	1.72
Resilience Investment (RI)	0.301	0.058	0.359	5.19	< 0.001	1.68
Sustainability Integration (SI)	0.213	0.061	0.248	3.49	0.001	1.54

Note: VIF < 5 for all predictors confirms absence of multicollinearity.

HYPOTHESIS TESTING — T-TEST & ANOVA

An independent-samples t-test was conducted, splitting respondents at the median DTA score (Mdn = 3.60) into High-DTA ($n = 58$) and Low-DTA ($n = 62$) groups. High-DTA organisations report a mean SCPI of 3.91 compared to 2.96 for Low-DTA organisations. The t-statistic of 7.84 ($df = 118, p < 0.001$) and Cohen's d of 1.43 (very large effect) decisively rejects H_0 , confirming that digital technology investment is the single highest-leverage action a supply chain leader can take.

Table 5: Independent Samples t-Test — SCPI by Technology Adoption Group

Group	n	Mean SCPI	Std. Dev.	t-value	df	p (2-tailed)	Cohen's d
High-DTA (≥ 3.60)	58	3.91	0.54	7.84	118	< 0.001	1.43
Low-DTA (< 3.60)	62	2.96	0.61				

Note: Equal variances assumed (Levene's $F = 0.87, p = 0.353$). Cohen's $d > 1.20$ indicates a very large effect size.

A one-way ANOVA examined performance differences across three combined investment tiers (Low, Medium, High). The F-statistic of 62.48 ($F(2,117), p < 0.001$) and eta-squared of 0.517 confirm that investment tier explains 51.7% of total variance in SCPI. Tukey HSD post-hoc tests reveal that every pairwise group comparison is statistically significant: High-Investment organisations achieve a mean SCPI of 4.18 — 52.6% higher than Low-Investment counterparts (2.74).

Table 6: ANOVA — SCPI by Combined Investment Tier & Post-Hoc Results

Investment Tier	n	Mean SCPI	Std. Dev.	Sig. vs Low	Sig. vs Medium
Low Investment	32	2.74	0.52	—	$p < 0.001$
Medium Investment	51	3.43	0.49	$p < 0.001$	—
High Investment	37	4.18	0.41	$p < 0.001$	$p < 0.001$

Note: $F(2,117) = 62.48, p < 0.001, \eta^2 = 0.517$. Tukey HSD post-hoc tests for all pairwise comparisons.

CASE STUDY: GMB & CO., THOOTHUKUDI

GMB & Co., established in 2015 and headquartered in Thoothukudi, Tamil Nadu, is a partnership firm engaged in container transport services, dock operations, and cargo shipping. As a mid-size logistics service provider with an annual turnover between ₹5–25 crore, GMB & Co. represents the growing segment of organized logistics players in India navigating the twin pressures of customer demand and digital disruption.

The study of 125 respondents affiliated with GMB & Co. generated rich findings. Technology adoption drivers included cost reduction (22.4%), regulatory compliance (21.6%), business agility (20%), customer demand for transparency (18.4%), and competitive pressure (17.6%). Key barriers were high initial capital investment (27.2%), lack of skilled personnel (24.8%), data security concerns (22.4%), legacy system integration (15.2%), and workforce resistance to change (10.4%).

Operational impact findings were overwhelmingly positive: the majority of respondents strongly agreed that technology improved supply chain visibility (36%), reduced human errors in warehouse operations (31.2%), enhanced inventory management (33.6%), and improved inter-departmental communication (33.6%). On customer satisfaction, 34.4% strongly agreed that real-time tracking significantly increased satisfaction levels. For ROI, 34.4% strongly agreed and 32.8% agreed that technology implementation yielded positive returns.

Statistical analysis provided additional depth. The Chi-square test revealed a significant association between respondents' age and perception of ROI ($\chi^2 = 215.7, p = .000$), while Pearson correlation ($r = -0.551, p = .000$) between educational qualification and inventory management perceptions indicated that more highly educated respondents hold more nuanced views of technology effectiveness. One-way ANOVA results ($F = 106.659, p = .000$) confirmed that occupation significantly influences perceptions of technology's ROI impact.

DISCUSSION

The findings from both studies indicate that while digital technology adoption, resilience investment, and sustainability integration significantly improve supply chain performance, a notable portion of performance variation is influenced by factors such as organisational culture and leadership. Importantly, sustainability shows a strong positive impact, challenging the belief that it compromises efficiency. The strong relationships among the three dimensions suggest a “transformation flywheel,” where progress in one area supports others, highlighting the need for an integrated investment approach. The GMB & Co. case further demonstrates that even mid-sized firms can benefit from technology adoption, while the negative link between education level and technology perception suggests that more educated employees have higher expectations, emphasizing the importance of involving them in

implementation strategies.

CONCLUSION & MANAGERIAL IMPLICATIONS

The analysis confirms that technology-driven supply chain transformation significantly enhances performance at both sector and firm levels. Organizations that invest in digital technology, resilience, and sustainability achieve superior and compounding results. Key implications include prioritizing digital adoption, treating resilience as essential, and integrating sustainability into core strategy, while emphasizing comprehensive rather than incremental investments. For mid-sized firms like GMB & Co., success depends on financial support, employee training, phased technology adoption, cybersecurity, and continuous feedback. Overall, supply chain excellence has become a vital competitive advantage, achievable through systematic and evidence-based investments

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