

Digital Transformation of Supply Chains and Organizational Performance: A Preliminary Study of Manufacturing Units in Nashik

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Abstract

Digital transformation of supply chains is increasing competitiveness and performance of industrial companies. Empirical data on how digital supply chain transformation affects regional manufacturing performance is not available as previous work has focused on major enterprises and urban industrial clusters only. The current paper fills this gap by studying level of digital supply chain transformation and its influence on organizational performance in medium and large manufacturing units in Nashik (a major Tier- II industrial district) in India.

The quantitative cross-sectional research design was used to study the relationship between digital supply chain transformation and organizational performance among manufacturing units in Nashik. Primary data were collected from 30 managers and operational staff who make supply chain and digital decisions. Digital supply chain transformation was measured by system integration, visibility of the supply chain, process automation and data analytics; organizational performance was measured on operational and strategic dimensions. Descriptive statistics, regression analysis and mediation analysis were applied.

The results indicate moderate digital transformation (stronger use of foundational digital capabilities and less advanced analytical technologies). Digital supply chain transformation significantly improves both supply chain effectiveness and organizational performance. Supply chain effectiveness also significantly mediates the relationship between digital transformation and organizational performance (i.e., coordination, responsiveness and operational efficiency); coordination, responsiveness and operational efficiency are important for organizational performance. Among the digital dimension's data analytics and system integration contribute most to improved supply chain effectiveness and organizational performance respectively.

The study adds context specific information from a Tier-II manufacturing location to the digital supply chain and operations management literature and clarifies how digital Transformation improves organizational performance. The results may help managers and governments improve digital preparedness and supply chain resilience in developing industrial ecosystems.

Keywords: Digital supply chain transformation; Organizational performance; Supply chain effectiveness; Industry 4.0; Manufacturing firms; Tier-II industrial regions

1. Introduction

1.1 Background and Context

Supply chain management has moved over the last two decades from linear functionally segregated systems to digitally integrated highly interconnected networks. Complex markets made traditional supply chains less responsive and efficient (sequential information flows, end-to-end visibility, reactive decision making) (Christopher 2016). They were not competitive with globalization, shorter product life cycles and higher customer expectations. Industrial companies therefore want digital supply chain topologies that coordinate material flow; information flow; financial flow.

Industry 4.0 has accelerated this change by digitizing manufacturing and supply chains: ERP, IoT, big data analytics, AI and cloud computing changed planning, execution and monitoring of supply chain. Reactive to anticipatory and adaptive decision-making became possible via real time data collection, predictive analysis and automated supply chain coordination. Manufacturing digital transformation drives innovation, efficiency and flexibility.

Digital transformation is needed because of supply chain disruption and environmental uncertainty. Global shocks have shown that conventional supply chains are weak (Ivanov & Dolgui, 2020). Resilience and adaptability are

needed (Ivanov & Dolgui, 2020). Openness, responsiveness and cooperation in digital supply chains allow companies to see issues and rearrange resources. Dynamic firms need digital transformation to compete and succeed (Kamble et al., 2020).

1.2 Problem Statement

Digitalization is increasing but Indian manufacturing supply chains are still fragmented; manual coordination; end-to-end visibility (Bag et al., 2021). These inefficiencies increase operating costs, lengthen lead times, constrain responsiveness and negatively impact organizational performance. India has made progress in industrial digitalization but empirical evidence on how digital supply chain transformation affects regional manufacturing ecosystems is scarce. Large enterprises and metropolitan industrial clusters have been studied extensively whereas manufacturing firms in Tier-II industrial regions have received relatively little attention. This research gap limits our understanding of how regional infrastructure, organizational capabilities, technological readiness and contextual conditions affect digital supply chain adoption and performance outcomes in emerging economies such as India (Luthra et al., 2020). Nashik therefore offers a relevant regional context for empirical investigation.

1.3 Research Gap

Tier-II industrial medium and large manufacturing units are understudied. They contribute to industrial output and jobs but digital transformation opportunities are not well known. Tier-II enterprises may have different infrastructural constraints, institutional and competency constraints than industrial hubs (Kumar et al., 2021). Digital supply chain operations may not happen in such places.

Most digital transformation and organizational success studies aggregate values without considering digital supply chain capabilities. Research linking digitalization features (integration, automation, data analytics, real-time visibility) to performance metrics of organizations is lacking so theoretical clarity cannot be achieved nor managerial implementation (Dubey et al., 2020). Empirical studies must explicitly relate digital supply chain transformation to success in locally grounded manufacturing contexts (Nashik manufacturing units) to fill this gap.

1.4 Research Objectives

1. To examine the extent and nature of digital transformation of supply chains among medium and large manufacturing units in Nashik.
2. To analyze the impact of digital supply chain transformation on organizational performance, with specific reference to operational and strategic performance dimensions.
3. To investigate the role of key digital technologies in enhancing supply chain effectiveness, coordination, and managerial decision-making within manufacturing firms.

1.5 Research Questions

1. What is the extent of digital supply chain transformation among manufacturing units operating in Nashik?
2. Does digital transformation of supply chains significantly influence organizational performance in manufacturing firms?
3. Which dimensions of digitalization contribute most strongly to improved supply chain effectiveness and organizational performance?

1.6 Research Hypotheses

- H1: Digital supply chain transformation has a significant positive impact on organizational performance of manufacturing units.
- H2: Digital supply chain transformation has a significant positive effect on supply chain effectiveness in manufacturing firms.
- H3: Supply chain effectiveness positively mediates the relationship between digital supply chain transformation and organizational performance.

This study contributes to digital supply chain management literature by showing empirical evidence from a less researched regional industrial setting. Examining medium and large manufacturing units in a Tier-II industrial region extends existing research beyond large enterprises and metropolitan industrial clusters. The findings provide a context specific understanding of how digital supply chain capabilities contribute to supply chain effectiveness and organizational performance in the Industry 4.0 context.

The study also contributes theoretically as digital transformation is not only technology adoption but system integration and data analytics are important in translating digital capabilities into improved supply chain effectiveness and organizational performance. The relationship between digital transformation, supply chain effectiveness and organizational performance proposed here provides a foundation for future research in manufacturing and supply chain management.

From a managerial perspective the findings inform manufacturing managers on which digital investments should be made. System integration, data analytics, cross functional coordination and data driven decision making should receive greater attention. Digital transformation thus needs to focus on building organizational capabilities that increase operational efficiency responsiveness and coordination.

The study also has policy implications for regional industrial development. Policymakers and industrial development agencies should promote digital infrastructure, workforce training, analytical capabilities and collaborative digital ecosystems in Tier-II manufacturing regions (digital readiness, supply chain resilience, competitiveness and sustainable industrial development).

2. Literature Review

2.1 Conceptual Foundations of Digital Supply Chain Transformation

Information systems, supply chain management and digital innovation research changed the supply chain. Linear supply chains focused on cost and transactional coordination (increasing market complexity; demand volatility; globalization). Such models are no longer fit for purpose: Digital supply chains connect visualize coordinate activities and partners live (Christopher, 2016; Ivanov et al., 2019). Agility reactivity resilience replaced efficiency in the supply chain.

Digital transformation of supply chains means organizations redesign processes, structures, information flows and decision-making practices (Frank et al., 2019). Capabilities include end-to-end system integration, real time visibility of the supply chain, process automation and predictive and prescriptive analytics. Collectively these capabilities increase information sharing coordination operational efficiency data driven decision making firms move from reactive responses to more proactive and adaptive supply chain management (anticipate disruptions respond to changing market conditions). But adoption and outcomes of digital transformation vary across organisations and geographical contexts because technological infrastructure organisational capabilities skills and resource availability differ; hence context specific empirical research is required to understand how digital supply chain capabilities contribute to organisational performance in emerging economies and regional industrial clusters.

2.2 Digital Technologies in Supply Chain Management

Many studies have looked at how digital technology has changed supply chain management. ERPs harmonize data to bring functional silos together (Kumar et al., 2021). ERP systems increase transactional efficiency and data integrity but experts say they are only important when used with digital technology.

Digital technologies have expanded the scope of modern supply chain management in terms of data collection, connectivity, coordination and decision making. IoT (Internet of Things) connects sensors to inventory, equipment, production processes and logistics activities so that uncertainty is reduced and operational coordination improved (Ben-Daya et al., 2019). Big data analytics and AI analyse large and complex datasets for firms to improve demand forecasting, risk assessment, inventory management, routing and capacity planning (Dubey et al., 2020). Cloud computing provides scalable and shared digital infrastructure on which supply chain partners can access information from locations. ERP systems combine functional and operational data while RPA

supports repetitive transactional activities. Blockchain technology has also been studied for improving transparency, traceability, data integrity and trust across supply chain networks (Kshetri, 2018). Yet empirical evidence on how these technologies combined improve supply chain performance and managerial decision making is scarce (especially in developing country manufacturing contexts).

2.3 Organizational Performance in the Manufacturing Context

Organizational performance in manufacturing is measured by financial, operational and strategic dimensions. Financial performance measures profitability, return on investment, revenue growth and cost efficiency; operational performance measures delivery reliability, product quality, responsiveness, flexibility and supply chain efficiency (Gunasekaran et al., 2017); strategic performance measures broader outcomes like innovation competitiveness sustainability and the ability to respond to changing market conditions. These dimensions form a basis for evaluating the performance implications of digital transformation in manufacturing firms.

Digital transformation affects organizational performance in both direct and indirect ways. Digital supply chain capabilities first improve information sharing, coordination, visibility and managerial decision making; operational and strategic improvements follow (over time). These improvements may result in financial benefits through lower costs, better resource use and competitiveness. Empirical studies have measured organizational performance using objective indicators as well as managers' perceptual evaluation. Performance measures, organizational contexts and measurement approaches differ across studies so that it is not possible to compare findings across studies and context-specific performance assessment is needed.

2.4 Empirical Studies on Digital Supply Chains and Organizational Performance

Digital supply chain transformation and organizational performance studies have mixed but positive results. Digital integration and analytics improve supply chain agility, robustness and company performance in industrialized countries (Ivanov & Dolgui, 2020). Digital technology may increase operational efficiency and competitiveness in developing countries but context limits its benefits (Bag et al., 2021).

Most empirical studies on digital supply chains and organizational performance have used cross-sectional surveys and regression analysis; few studies have used longitudinal or mixed-method designs; self-reported data are common method bias (CMB) prone. Although these studies offer important insights, most of them have been done for MNCs and large enterprises only and little is known about medium and large manufacturing firms in regional industrial clusters (in India manufacturing units outside major metropolitan areas are comparatively understudied).

Digital transformation relationship to organizational performance also varies across organisational and environmental contexts. Organisational readiness, managerial capabilities, technological competencies, resource availability and environmental uncertainty all influence outcomes of digital transformation (some studies find positive effects on performance; others weaker or context dependent relationships Luthra et al., 2020). These results indicate that digital transformation does not guarantee better performance: organisational capabilities and contextual conditions determine how much digital investments translate into operational and strategic benefits.

2.5 Identification of Knowledge Gaps and Research Justification

The literature review highlights two gaps that the present study fills: First, empirical studies on digital supply chain transformation have been conducted on large enterprises and developed or metropolitan industrial settings only (medium and large manufacturing firms in Tier-II industrial regions are comparatively underresearched). Second, studies usually look at digital transformation as a whole rather than separately looking at system integration, supply chain visibility, process automation and data analytics contributions. Separately examining these dimensions helps understand how specific digital capabilities contribute to organizational outcomes.

Third, comparatively little empirical attention has been paid to the mechanisms through which digital transformation affects organisational performance (e.g., how effective supply chains translate digital capabilities into improved organisational outcomes). Fourth, evidence from Indian regional manufacturing clusters is limited although technological infrastructure, managerial capabilities, skills and organisational readiness vary across locations.

These gaps provide a strong rationale for investigating digital supply chain transformation among medium and large manufacturing units in Nashik. Hence, we examine extent of digital transformation, impact on supply chain effectiveness and organizational performance as well as mediating role of supply chain effectiveness in Tier-II industrial context.

2.6 Theoretical Positioning

The study is primarily based on RBV and Dynamic Capabilities perspective. RBV posits that firms gain sustained performance advantage by developing valuable and difficult to replicate resources and capabilities (e.g., system integration, data analytics, digital information systems, technology enabled coordination) in digital supply chains which enable resource efficient use and better decision making.

Dynamic Capabilities complements RBV in that it highlights the ability of firms to adapt resources and processes to changing environments. Digital supply chain capabilities allow firms to sense disruptions, respond to changing demand, reconfigure operations and coordinate supply chain activities more effectively. From this perspective digital transformation improves organizational performance through effective supply chains.

Based on these theoretical foundations the present study argues that digital supply chain transformation enhances organizational performance directly and indirectly through supply chain effectiveness. This framework provides theoretical basis for studying relationships among digital transformation, supply chain effectiveness and organizational performance in Nashik's manufacturing sector.

3. Research Methodology

This quantitative cross-sectional exploratory–explanatory study looks at manufacturing business performance and supply chain digitization. Because digital supply chain transformation and performance are measured by structured and quantifiable criteria, a quantitative approach is acceptable (Creswell, 2014). Cross sectional research works well for exploratory investigations that seek apparent patterns and connections not causality (Hair et al., 2019). Digital transformation and its performance effects regional industry are investigated using exploratory–explanatory methods.

3.2 Research Context, Population and Sampling

The study was carried out among manufacturing firms in Nashik, Maharashtra (an established Tier-II industrial region with significant activities in engineering, automotive, pharmaceutical and agro-processing sectors). Nashik is relevant for studying digital supply chain transformation because manufacturing firms in the region have different levels of technological adoption, organizational capabilities and digital readiness. The regional focus addresses also the limited empirical evidence on digital transformation within non metropolitan industrial clusters in India.

Medium and large manufacturing firms in Nashik were the target population. Respondents were taken from managerial and operational positions involved with supply chain activities and digital decision making (supply chain, operations, production, logistics, procurement, information technology and digital transformation personnel). Purposive sampling was used because respondents had to have relevant knowledge of supply chain processes, digital technologies and organisational performance (Etikan et al., 2016).

In total 30 valid responses were obtained. As the study is exploratory and preliminary, the sample was used to identify initial relationships between digital supply chain transformation, supply chain effectiveness and organizational performance (but not causal relationships). The small sample size limits generalizability of findings and shows that larger samples need to be used in future research.

3.3 Research Instrument and Measurement

Primary data were collected through a structured questionnaire based on literature on digital supply chain management (Frank et al., 2019), Industry 4.0 (Dubey et al., 2020) and organizational performance (Frank et al., 2019; Dubey et al., 2020). Digital supply chain transformation was operationalized through four dimensions: system integration, supply chain visibility, process automation and data analytics.

Supply chain effectiveness was measured by indicators for coordination, responsiveness, reliability and operational efficiency. Organizational performance comprised operational and strategic indicators (delivery performance, quality, cost efficiency, competitiveness, innovation and sustainability).

All constructs were measured using a five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). The questionnaire was reviewed by academics and industry experts on content relevance, clarity and alignment with study objectives. Preliminary assessment was carried out to identify ambiguous items and clarify questionnaire items.

3.4 Reliability, Validity and Data Analysis

Internal consistency of measurement scales was determined with Cronbach's alpha (Hair et al., 2019). Small sample size precluded factor analysis as a strong evidence for construct validity so content validity was supported through literature-based item development and expert review.

Descriptive statistics (means and standard deviations) were used to determine the extent of digital supply chain transformation and organizational performance. Correlation analysis was performed to examine relationships between the principal variables. Regression analysis was performed to test the effects of digital supply chain transformation on organizational performance and supply chain effectiveness. Mediation analysis was then performed to see whether supply chain effectiveness transmitted the effect of digital supply chain transformation on organizational performance. We assessed relevant regression assumptions before interpreting results.

Ethical standards were followed throughout the research process. Participants were free to choose whether or not to take part, informed consent was obtained from respondents and confidentiality and anonymity were maintained; information collected was used exclusively for academic purposes only.

4. Data Analysis and Results

Data analysis and empirical results by study goals and assumptions. Data of 30 Nashik medium and large industrial unit managers are analysed. Conclusions are from extent of digital supply chain transformation, organisational performance, effectiveness of supply chain and mediation analysis.

4.1 Extent of Digital Supply Chain Transformation

The first objective of the study was to examine digital supply chain transformation among medium and large manufacturing units in Nashik. Table 1 gives overall level of digital transformation amongst the sampled firms.

Table 1: Overall Digital Transformation Level

Statistic	Value
Mean	3.38
Standard Deviation	0.82
95% Confidence Interval	[3.09, 3.67]
One-sample t-test (vs. 3.0)	$t(29) = 2.54, p = .017$

Scale: 1=Strongly Disagree to 5=Strongly Agree

The overall mean digital transformation score was 3.38 (SD = 0.82). This means that the sampled manufacturing firms were moderately transformed digitally in terms of their supply chains. The 95% confidence interval for population mean is [3.09, 3.67]. That is an estimate of the population mean from the sample.

The one-sample t-test, conducted against the neutral scale value of 3.00, was statistically significant, $t(29) = 2.54, p = .017$. The corresponding Cohen's d value of 0.46 indicates a moderate effect size. The result suggests that the observed level of digital supply chain transformation was significantly higher than the neutral point of the measurement scale.

Overall, the findings indicate that Nashik manufacturing firms have adopted a moderate level of digital supply chain capabilities, while further development of advanced digital technologies and analytical capabilities is still required.

Table 2: Dimension-Wise Digital Transformation Levels

Dimension	Mean	SD	Rank
Internal Integration	3.72	0.88	1
Supply Chain Visibility	3.61	0.94	2
Process Automation	3.18	0.99	3
Data Analytics & AI	3.01	1.08	4
Overall	3.38	0.82	-

To understand digital transformation, four aspects were explored. Internal Integration scored highest (Mean = 3.72, SD = 0.88), showing ERP and integrated systems connect departments. Supply Chain Visibility followed closely (Mean = 3.61, SD = 0.94), monitoring inventories and shipments moderately. Process Automation scored third (Mean = 3.18, SD = 0.99), indicating new to moderate workflow automation. Advanced analytical skills are lacking, with Data Analytics and AI rating 3.01 (SD = 1.08). Core digital skills exceed sophisticated analytical technology in regional manufacturing.

4.2 Impact of Digital Transformation on Organizational Performance

Second study goal and H1 revealed digital supply chain transformation increases organizational performance. The regression analysis evaluating this hypothesis is in Table 3.

Table 3: Regression Analysis – H1 (Digital Transformation → Organizational Performance)

Model Summary					Value
R					.54
R ²					.29
Adjusted R ²					.27
F-statistic					11.76
p-value					.002
Coefficients	B	β	t	p	95% CI
Constant	1.62	-	3.60	.001	[0.70, 2.54]
Digital Transformation	0.56	.54	3.43	.002	[0.23, 0.89]

Dependent Variable: Organizational Performance

A regression model showed a 29% variation in organizational performance ($R^2 = .29$) and significant results ($F(1,28) = 11.76$, $p = .002$). Organizational performance rises 0.56 points on the 5-point scale for every one-point digital transformation score increase, according to the unstandardized coefficient ($B = 0.56$). The standardized coefficient ($\beta = .54$, $p = .002$) indicates a moderate-to-strong favorable impact. These findings strongly corroborate H1, demonstrating that digital supply chain transformation improves Nashik manufacturing unit performance.

Table 4: Digital Dimensions and Organizational Performance

Digital Dimension	Correlation (r)	p-value	Rank
Data Analytics	.52	.003	1
Integration	.48	.007	2

Visibility	.41	.024	3
Automation	.38	.038	4

The relationships between the four dimensions of digital supply chain transformation and organizational performance were examined using bivariate correlation analysis. The results indicate that all four dimensions have positive and statistically significant relationships with organizational performance.

Data analytics and system integration are relatively stronger predictors of organizational performance than visibility and automation. This means that the ability to integrate supply chain information and use data for decision making is particularly important in improving organizational performance among the sampled manufacturing firms.

Table 5: Organizational Performance by Digital Maturity Level

Digital Maturity Level	n	Mean OP	SD
Low Digital (≤ 2.99)	9	2.94	0.71
Moderate Digital (3.00-3.99)	14	3.62	0.59
High Digital (≥ 4.00)	7	4.21	0.48

*ANOVA: $F(2,27) = 8.94$, $p = .001$ *

Three groups of organizations were divided by digital transformation ratings to test digital maturity's feasibility. Maturity level affects organizational effectiveness ($F(2,27) = 8.94$, $p = .001$). High-digital enterprises had the highest mean performance score (4.21, $SD = 0.48$), followed by Moderate (3.62, $SD = 0.59$) and Low (2.94, $SD = 0.71$). High and low digital enterprises scored 1.27 points difference on a 5-point scale, indicating digital maturity improves performance.

4.3 Impact of Digital Transformation on Supply Chain Effectiveness

H2 believes digital supply chain revolution improves efficiency. Regression analysis for this hypothesis is in Table 6.

Table 6: Regression Analysis – H2 (Digital Transformation → Supply Chain Effectiveness)

Model Summary					Value
R					.61
R ²					.37
Adjusted R ²					.35
F-statistic					16.76
p-value					< .001
Coefficients	B	β	t	p	95% CI
Constant	1.58	-	4.16	< .001	[0.80, 2.36]
Digital Transformation	0.61	.61	4.09	< .001	[0.31, 0.91]

The regression model explains 37% of supply chain performance variation ($R^2 = .37$) and is highly significant ($F(1,28) = 16.76, p < .001$). Every digital transformation boosts supply chain efficiency 0.61 points, according to the unstandardized coefficient ($B = 0.61$). The standardized coefficient ($\beta = .61, p < .001$) indicates a significant beneficial impact. This strongly supports H2, proving that digital transformation improves supply chain coordination, dependability, and responsiveness

Table 7: Digital Dimensions and Supply Chain Effectiveness (Multiple Regression)

Digital Dimension	Correlation (r)	Standardized β	p-value	Rank
Data Analytics	.58	.34	.023	1
Integration	.53	.31	.038	2
Automation	.42	.16	.290	3
Visibility	.39	.11	.466	4

***Model: $R^2 = 0.44$, Adjusted $R^2 = 0.35$, $F(4,25) = 4.91$, $p = .005$ ***

We used multiple regression analysis with all four dimensions to determine which digital factors impact supply chain performance. The whole model was significant ($R^2 = 0.44$, $F(4,25) = 4.91$, $p = .005$). The only significant predictors were Data Analytics ($\beta = .34$, $p = .023$) and Integration ($\beta = .31$, $p = .038$) when combined. Automation ($\beta = .16$, $p = .290$) and Visibility ($\beta = .11$, $p = .466$) were not significant in the presence of other dimensions. To answer Research Question 3, data analytics and system integration boost supply chain performance, while automation and visibility aid more.

4.4 Mediating Role of Supply Chain Effectiveness

H3 claims supply chain efficiency enhances digital transformation and corporate performance. Table 8 shows Hayes PROCESS Macro (Model 4) mediation findings.

Table 8: Mediation Analysis Results (H3)

Effect	Coefficient	SE	p-value	95% Bootstrap CI
Total Effect (c)	0.56	0.16	.002	[0.23, 0.89]
Direct Effect (c')	0.21	0.17	.226	[-0.14, 0.56]
Indirect Effect (a×b)	0.35	0.11	-	[0.16, 0.61]

Bootstrap samples = 10,000; Hayes PROCESS Model 4; DT = Digital Transformation; SCE = Supply Chain Effectiveness; OP = Organizational Performance

Digital transformation strongly impacts organizational performance ($c = 0.56$, $p = .002$). Including supply chain performance as a mediator resulted in a less significant direct effect ($c' = 0.21$, $p = .226$) and a substantial indirect effect ($a \times b = 0.35$) (bootstrapping confidence interval [0.16, 0.61]. This shows that digital transformation improves supply chain efficiency and corporate performance.

Table 9: Variance Accounted For (VAF)

Component	Value	Percentage
Indirect Effect	0.35	62.5%
Direct Effect	0.21	37.5%
Total Effect	0.56	100%

Mediation Type: Partial Mediation (VAF between 20% and 80%)

VAF calculates mediating variable impact. The indirect impact of 0.35 accounts for 62.5% of the 0.56 effect, whereas the direct effect is 37.5%. VAF 20%–80% implies partial mediation. Supply chain effectiveness improvements explain more than three-fifths of digital transformation's impact on organizational performance, underlining the need for operational coordination and responsiveness to convert digital capabilities into performance outcomes.

4.5 Summary of Hypothesis Testing

Table 10: Hypothesis Testing Summary

Hypothesis	Path	β	p-value	R ²	Result
H1	DT → OP	.54	.002	.29	Accepted
H2	DT → SCE	.61	< .001	.37	Accepted
H3	DT → SCE → OP	Indirect = 0.35	CI [0.16, 0.61]	-	Accepted

Note: DT = Digital Transformation; OP = Organizational Performance; SCE = Supply Chain Effectiveness

Table summarizes all hypothesis testing. Accepting H1, digital transformation considerably enhanced organizational performance ($\beta = .54$, $p = .002$). Accepting H2, digital transformation improves supply chain performance ($\beta = .61$, $p < .001$). With an indirect influence of 0.35 and a bootstrap confidence interval that excludes zero, supply chain effectiveness partly mediates the digital transformation–organizational performance link, validating H3. Data supports all three possibilities.

5. Findings

The study focused on digital supply chain transformation, supply chain effectiveness and organisational performance among 30 managers and operational staff of manufacturing firms in Nashik. Internal consistency of all measurement dimensions is satisfactory as Cronbach's alpha values are above the recommended threshold. Correlation results also show positive relationships between digital supply chain transformation, supply chain effectiveness and organisational performance.

The descriptive results show that digital supply chain transformation is moderate (mean score 3.38; SD = 0.82). System integration had the highest mean among the four dimensions, followed by supply chain visibility, process automation and data analytics and AI. Firms have done better in building integrated digital systems and increasing supply chain visibility but advanced analytical capabilities are still comparatively less developed.

The regression results support H1. Digital supply chain transformation is positively related to organizational performance ($\beta = .54$, $p = .002$) and explains 29% of the variance in organizational performance ($R^2 = .29$). Thus higher DSCT levels are associated with better operational and strategic performance among sampled manufacturing firms.

H2 is also supported. Digital supply chain transformation has a significant positive relationship with supply chain effectiveness ($\beta = .61$, $p < .001$), model explains 37% of variance in supply chain effectiveness ($R^2 = .37$). So digital capabilities improve coordination, responsiveness, reliability and operational efficiency in the supply chain.

The mediation analysis supports H3. The total effect of digital transformation on organisational performance was significant ($c = 0.56$, $p = .002$). When supply chain effectiveness was included as a mediator the direct effect was no longer statistically significant ($c' = 0.21$, $p = .226$) but the indirect effect was 0.35 with a 95% bootstrap CI [0.16, 0.61]. Since the CI does not include zero the indirect effect is significant. VAF=62.5% means that most of the relationship between digital transformation and organisational performance occurs through supply chain effectiveness.

The dimension-level analysis further shows that Data Analytics is the strongest predictor of organizational performance ($r = .52$, $p = .003$), followed by Integration ($r = .48$, $p = .007$), Visibility ($r = .41$, $p = .024$) and Automation ($r = .38$, $p = .038$). Multiple regression results for supply chain effectiveness also show that Data Analytics ($\beta = .34$, $p = .023$) and Integration ($\beta = .31$, $p = .038$) are significant predictors but Automation and

Visibility do not make unique statistically significant contributions in the combined model. Taken together these results indicate that developing analytical capabilities and integrated digital systems are particularly important to turn digital supply chain transformation into increased supply chain effectiveness and organisational performance.

6. Discussion

6.1 Interpretation of Key Findings

These results support the study objectives and relationships between digital supply chain transformation, supply chain effectiveness and organizational performance. The overall digital transformation score of 3.38 indicates moderate level of digital maturity in the manufacturing firms sampled (system integration is relatively more mature than data analytics and AI). Firms have built foundational digital capabilities but advanced analytical applications need strengthening.

The regression results show that digital supply chain transformation is positively related to organizational performance ($\beta = .54, p = .002$). Digital transformation is also positively related to supply chain effectiveness ($\beta = .61, p < .001$). In other words, digital capabilities lead to better organizational outcomes as well as supply chain operations.

The mediation analysis gives more detail about this relationship. Supply chain effectiveness significantly mediates the relationship between digital transformation and organizational performance (indirect effect = 0.35; 95% bootstrap CI [0.16, 0.61]). VAF = 62.5% means that a large part of the relationship is mediated through supply chain effectiveness. So coordination, responsiveness, reliability and operational efficiency are important mechanisms by which digital transformation contributes to organisational performance.

6.2 Integration with Prior Literature and Theory

The results are consistent with the Resource-Based View (RBV) which views organizational resources and capabilities as important sources of performance differences. Digital capabilities such as system integration and data analytics give firms access to information, coordination mechanisms and decision support capabilities. The stronger association between data analytics and integration and performance supports view that value of digital technologies is determined by how well firms develop and combine digital resources (Christopher, 2016; Gunasekaran et al., 2017).

The results also support the Dynamic Capabilities perspective. Digital supply chain capabilities improve firms' ability to monitor operations, process information, adapt to changes and coordinate activities in the supply chain. The strong correlation between digital transformation and supply chain effectiveness supports the argument that digital capabilities enhance organizational adaptability and operational responsiveness (Ivanov & Dolgui, 2020).

The dimension-level results add another contribution. All four digital dimensions are positively correlated with organizational performance but only Data Analytics and Integration are significant predictors of supply chain effectiveness when taken together (Frank et al., 2019; Bag et al., 2021). This indicates that the performance value of digital transformation is not in technology adoption alone (but rather in complementary capabilities development) (Frank et al., 2019; Bag et al., 2021).

6.3 Theoretical and Conceptual Implications

The study has three theoretical implications. First, it views digital supply chain transformation as multidimensional capability rather than a technology construct. By looking at integration separately from visibility, automation and data analytics we can better understand how they relate to performance.

Second, supply chain effectiveness is an important link between digital transformation and organizational performance. The large indirect effect means that digital capabilities create value for the organization partly through improved supply chain operations so conceptualizing how digital transformation leads to performance outcomes expands beyond what was previously understood about how digital transformation works.

Third, the findings indicate that digital maturity in regional manufacturing contexts needs to be understood as technology adoption and capability development. System integration and data analytics appear particularly salient (firms need complementary technical and managerial capabilities for greater value from digital transformation).

6.4 Limitations and Reflexive Considerations

The study has several limitations. First, cross-sectional design only measures relationships at a single point in time and thus does not establish temporal causality between digital transformation and organizational performance; second, purposive sample of 30 respondents limits statistical power and restricts generalizability beyond manufacturing firms sampled; third, the measures are based on respondents' perceptions so there is response and common method bias.

The study also focuses on manufacturing firms in Nashik. Industrial structure, technological infrastructure, organizational capabilities and institutional conditions may yield different results elsewhere. Small sample size also precludes extensive multivariate validation of measurement model. These limitations should be taken into account when interpreting the results and opening up new avenues for research.

6.5 Directions for Future Research

Future research should use larger and more diverse samples of manufacturing firms in Tier-I, Tier-II and Tier-III industrial regions to study contextual variation in digital supply chain transformation. Longitudinal studies would provide stronger evidence about temporal relationship between digital transformation and organizational performance.

Future studies could also use mixed-method designs (quantitative analysis with interviews or case studies) to investigate organizational processes behind digital transformation. Comparative studies across manufacturing sectors would highlight sector differences in technology adoption and performance outcomes; further research could look at additional factors such as organisational readiness, digital skills, cybersecurity capability, technological infrastructure and environmental uncertainty as moderators or antecedents of digital transformation. This would give us a fuller picture of how manufacturing firms develop digital supply chain capabilities and turn them into sustainable performance outcomes.

7. Conclusion

This study examined the extent of digital supply chain transformation and its impact on supply chain effectiveness and organizational performance among medium and large manufacturing firms in Nashik. Digital transformation is moderate for the sampled firms. System integration and visibility are relatively stronger while data analytics and AI are comparatively less developed. This means that firms have built important digital foundations but advanced analytical capabilities are still developing.

Empirically the proposed relationships hold. Digital supply chain transformation is positively related to organisational performance and supply chain effectiveness; mediation analysis also shows that supply chain effectiveness is an important mechanism linking digital transformation with organisational performance. The indirect effect of 0.35 (95% bootstrap confidence interval [0.16, 0.61]) indicates a significant indirect relationship while $VAF = 62.5\%$ shows substantial mediation. Coordination responsiveness reliability operational efficiency are all-necessary for digital capabilities to translate into organisational outcomes.

The dimension level analysis also provides more information about the nature of digital transformation. Data Analytics has the strongest association with organizational performance, followed by Integration, Visibility and Automation. In multiple regression analysis predicting supply chain effectiveness Data Analytics and Integration are significant predictors but Automation and Visibility do not have significant unique effects. Thus, we find that value of digital transformation is determined not only by technology adoption but how well firms integrate information systems and develop analytical capabilities.

The study contributes to digital supply chain and operations management literature by empirical evidence from a relatively under-researched Tier-II industrial setting. The results reinforce relevance of the Resource-Based View and Dynamic Capabilities perspective since digital integration, analytical capabilities and organisational processes are identified as important resources for strengthening supply chain effectiveness and performance.

The findings also have practical implications for manufacturing managers and policymakers. Firms should focus on system integration, data analytics, employee digital capabilities and cross-functional coordination when planning digital transformation initiatives; policymakers and regional industrial development agencies need to

strengthen digital infrastructure, workforce development and collaborative digital ecosystems so that Tier-II manufacturing firms are digitally ready.

The conclusions should be contextualized by the exploratory nature of the study (cross sectional design, purposive sampling), small sample size (30 respondents) and larger samples (larger sample sizes, longitudinal designs and comparative studies across industrial regions and manufacturing sectors) in future research to provide stronger evidence on relationships between digital supply chain transformation, supply chain effectiveness and organizational performance.

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