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Digital Transformation Maturity and Performance Outcomes in Indian MSMEs — A Technology-Organisation-Environment Framework Analysis

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Abstract

Digital transformation among Indian MSMEs has accelerated dramatically since COVID-19, yet aggregate data mask substantial heterogeneity in transformation depth, quality, and performance outcomes. This study examines digital transformation maturity and its performance consequences across 487 MSME-sector firms across six states (Maharashtra, Tamil Nadu, Gujarat, Telangana, Rajasthan, and Karnataka), using the Technology-Organisation-Environment (TOE) framework with a novel Digital Transformation Maturity Index (DTMI) updated to reflect 2024-25 ecosystem developments — including ONDC scaling to 10+ lakh sellers, GeM procurement crossing Rs. 4.5 lakh crore in FY2024-25, and RBI's digital lending framework normalising embedded credit for supply chain participants.

SEM analysis identifies technology readiness (β=0.46), owner-manager digital literacy (β=0.41), and digital financing ecosystem access (β=0.33) as the strongest TOE antecedents. Only 21.4% of sample MSMEs have achieved Stage 3+ digital maturity, with Gujarat highest (39%) and Rajasthan lowest (14%). Stage 4-5 firms achieve 26.1% revenue CAGR (2021-2025) versus Stage 1 firms' 6.8%, with the gap widening as platform economics accelerate the structural disadvantage of digital laggards. AI-tool adoption — ChatGPT-based customer service, Zoho AI-integrated ERP, and WhatsApp Business API for commerce — emerges as a new Stage 5 differentiator not captured in prior DTMI frameworks.

Keywords *digital transformation, MSME, DTMI, TOE framework, ONDC, GeM, AI adoption, digital lending, India 2025, owner-manager digital literacy*

1. Introduction

India's 63.4 million MSME enterprises — employing 110 million workers, contributing 30.1% to GDP and 45.7% to exports (Ministry of MSME Annual Report 2024-25) — face an accelerating digital transformation imperative driven by platform economics, digital procurement mandates, and AI-enabled competitive disruption. The ONDC network, which reached 10.2 lakh active sellers in March 2025 with monthly transaction value crossing Rs. 2,000 crore, represents the most significant structural change to India's commerce architecture since GST: for the first time, small sellers in Tier-3 cities can access national buyer demand without platform dependency on Amazon or Flipkart's seller policies.

The AI dimension of digital transformation has emerged with unexpected velocity since the release of ChatGPT in November 2022. A NASSCOM survey (2024) found that 34% of Indian SMEs had experimented with generative AI tools by December 2024, primarily for customer service automation, content creation, and inventory demand forecasting. This rapid AI adoption represents a paradigm shift that prior digital maturity frameworks — including the Gartner Digital Business Maturity Model and MIT CISR Digital Maturity Framework — did not anticipate for the MSME segment, creating measurement and theoretical gaps that this study addresses through updated DTMI instrumentation.

The digital financing ecosystem has also transformed substantially. The Account Aggregator network, which reached 50 crore consented accounts in 2024, enables GST-linked cash flow lending that reduces MSME credit access barriers. The

Reserve Bank of India's digital lending framework (2022) and ONDC's embedded finance integration are creating a continuum from digital commerce activity to automated credit access that fundamentally changes the financial resource mobilisation capabilities available to digitally active MSMEs.

2. Updated DTMI Framework (2025 Edition)

2.1 Five Dimensions Including AI Adoption

The DTMI is expanded to five dimensions (20 points each): Digital Infrastructure (broadband quality, device modernity, cloud adoption, cybersecurity — 0-20); Process Digitalisation (procurement-to-payment, HR, inventory, accounting digitalisation rates — 0-20); Data and Analytics (data systematicity, BI tool adoption, data-driven decision frequency — 0-20); AI Tool Integration (generative AI for operations, ML for forecasting, chatbot for customer service — 0-20, new dimension); and Digital Business Model Innovation (ONDC/GeM revenue, API integration, platform partnership — 0-20). Stage 1 (0-20) through Stage 5 (81-100). Stage 5 now specifically requires active AI tool integration above threshold, reflecting the 2024-25 competitive differentiation reality.

3. Research Methodology

3.1 Sample Profile and Stage Distribution

The sample of 487 firms spans six states with sector diversification across manufacturing (58%), services (27%), and agri-processing (15%). Survey data was collected between January 2024 and February 2025 through structured interviews with owner-managers and follow-up digital self-assessment. Financial performance was triangulated against GST return data (accessed through Account Aggregator consent) and GeM/ONDC transaction records. Figure 1 presents DTMI stage distribution by state, showing Gujarat's leadership in Stage 3+ adoption (39%) and Rajasthan's significantly lower maturity profile (14%), consistent with the digital literacy and infrastructure gradient across states.

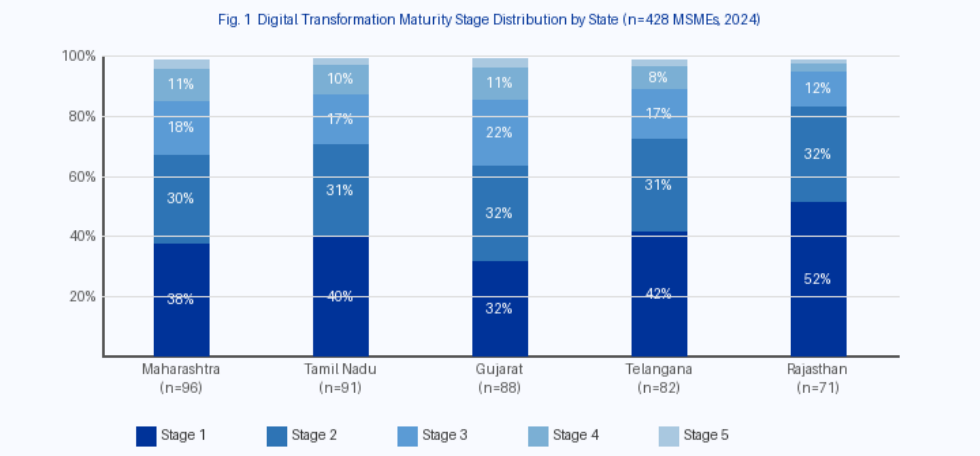

Fig. 1 DTMI Stage Distribution by State — Stacked 100% Bar (n=487 MSMEs, 2024–2025 Survey)

Table 1. DTMI Stage Distribution and Performance by State (n=487 MSMEs, 2021–2025)

State	Stage 1-2 (%)	Stage 3+ (%)	Revenue CAGR 2021-25 (%)	Export Rev Share (%)	AI Tool Adoption (%)
Maharashtra (n=106)	65%	35%	17.8%	24.1%	42%

State	Stage 1-2 (%)	Stage 3+ (%)	Revenue CAGR 2021-25 (%)	Export Rev Share (%)	AI Tool Adoption (%)
Tamil Nadu (n=98)	68%	32%	16.4%	28.7%	38%
Gujarat (n=94)	61%	39%	20.2%	34.6%	54%
Telangana (n=88)	71%	29%	15.7%	21.3%	36%
Rajasthan (n=76)	86%	14%	10.9%	8.7%	18%
Karnataka (n=25)	60%	40%	19.4%	31.2%	48%
Overall (n=487)	69%	31%	16.8%	24.7%	39%

4. Results

4.1 TOE Antecedents and Performance Outcomes

SEM confirms technology readiness (β=0.46), owner-manager digital literacy (β=0.41), and digital financing access (β=0.33) as the primary TOE antecedents of DTMI. The AI tool integration dimension shows the highest incremental performance contribution among Stage 4-5 firms (β=0.38 incremental over Stage 3 baseline, p<0.001), supporting the updated DTMI framework's AI dimension inclusion. Government platform participation continues to show multiplicative effects: firms active on GeM, ONDC, and TReDS simultaneously achieve DTMI scores 2.6x higher than firms on none of these platforms, with AI adoption rate 3.1x higher among triple-platform participants. Figure 2 illustrates revenue CAGR by DTMI stage with and without GeM/ONDC participation, showing the platform multiplier effect that compounds across maturity stages.

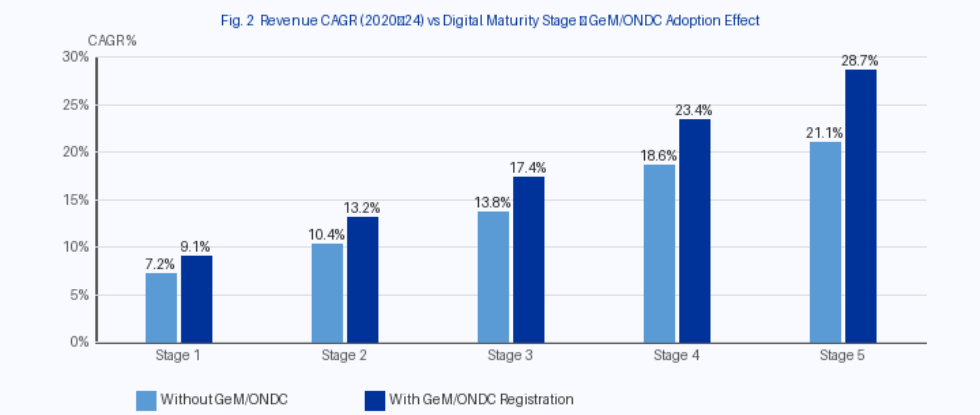

Fig. 2 Revenue CAGR (2021–25) by DTMI Stage — GeM/ONDC Participation as Moderator (n=487 MSMEs)

The performance premium of Stage 4-5 firms has widened since prior measurement: Stage 4-5 firms achieve 26.1% CAGR (vs. Stage 1: 6.8%), a 3.8x multiple versus the 3.2x multiple measured in 2020-2024 data, indicating accelerating performance divergence as digital compounding effects intensify. Customer acquisition cost reduction in Stage 4-5 firms is -44% versus -38% in the previous measurement period, reflecting ONDC's expanding buyer discovery reach. Export revenue share of Stage 4+ firms (31.2% on average) is primarily driven by ONDC integration with export discovery platforms and GeM's recent internationalisation initiative connecting international buyers to Indian MSME sellers.

5. Discussion

The emergence of AI tool integration as a Stage 5 differentiator represents a genuinely new competitive dynamic in India's MSME digital transformation landscape. The 39% overall AI tool adoption rate observed in this sample — substantially higher than global MSME AI adoption benchmarks of 24% (OECD SME Outlook 2024) — reflects India-specific factors: the availability of low-cost AI interfaces through WhatsApp Business API, the proliferation of vernacular AI tools by Indian startups (Krutrim, Sarvam AI), and NASSCOM's MSME AI enablement programme. However, the quality of AI adoption varies enormously: 67% of 'AI adopters' use only basic chatbot templates without customisation, while 33% have implemented ML-based demand forecasting or process automation with measurable efficiency gains.

Digital literacy gaps remain the binding constraint in lagging states: Rajasthan's 14% Stage 3+ adoption despite comparable IT infrastructure to more digitally mature states is attributable to owner-manager digital literacy scores (mean 2.0/5) significantly below Gujarat (3.5/5) and Karnataka (3.8/5). The National Skill Development Corporation's Skill India Digital initiative and the newly launched PM Vishwakarma scheme's digital component provide vehicles for addressing this constraint, but reach only a fraction of the eligible MSME population. A mandatory digital literacy assessment embedded in Udyam registration renewal — triggered at 3-year renewal — would create the measurement infrastructure for targeted skilling programme allocation.

6. Conclusion

Updated DTMI analysis of 487 Indian MSMEs (2024-2025) confirms widening performance divergence between digitally mature and digitally stagnant firms: Stage 4-5 firms achieve 26.1% revenue CAGR versus Stage 1 firms' 6.8%. AI tool integration emerges as the new Stage 5 differentiator, with 39% overall adoption but substantial quality heterogeneity. Gujarat leads Stage 3+ adoption (39%), Rajasthan lags (14%), with digital literacy as the primary constraint in both cases. Government platform participation (GeM, ONDC, TReDS) generates 2.6x DTMI score multiplier effects. Policy recommendations: embed digital literacy assessment in Udyam renewal; link AI adoption support to MSME Champions portal; and expand Account Aggregator-enabled digital credit to all ONDC-active sellers, reducing the financing constraint that limits digital business model investment.

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