

A PLS-SEM Investigation of Digital Transformation Intensity as a Mediator Among NSE-Listed Firms

Ananya Bhattacharya

Department of Commerce, Jadavpur University, Kolkata, West Bengal, India

Abstract

Digital transformation has emerged as the defining strategic imperative of the current decade for listed Indian corporations, yet empirical evidence on the specific leadership and organisational capabilities that convert digital investment into sustained competitive advantage remains fragmented. Large-sample studies of NSE-500 firms reveal substantial variation in digital transformation outcomes: firms with comparable IT expenditure as a proportion of revenue demonstrate return-on-assets spreads of over 8 percentage points, suggesting that organisational factors rather than technology investment magnitude are the primary determinants of transformation success. Identifying these organisational antecedents and the causal pathways through which they affect performance is the central motivation of this study.

This paper develops and tests a structural model in which Digital Leadership Capability (DLC), Organisational Ambidexterity (OA), and IT Infrastructure Readiness (ITR) jointly drive Digital Transformation Intensity (DTI), which in turn mediates the relationship with firm performance (return on assets, Tobin's Q) and innovation output. Dynamic Capabilities (DYNCP) are hypothesised to moderate the DTI-to-performance path. PLS-SEM is applied to primary survey data from 412 senior executives (C-suite and IT heads) in NSE-listed manufacturing and services firms across financial years 2018-2023, supplemented by firm-level secondary data from CMIE Prowess. Measurement model validity is confirmed through average variance extracted (AVE), composite reliability (CR), and HTMT discriminant validity ratios.

All five hypothesised paths are supported at $p < 0.01$ or better. DLC exerts the strongest direct influence on DTI ($\beta=0.42, p<0.001$), followed by OA ($\beta=0.31$) and ITR ($\beta=0.28$). DTI significantly mediates the path to firm performance ($\beta=0.54, p<0.001$) and innovation output ($\beta=0.38, p<0.001$). Dynamic capabilities moderate the DTI-performance path ($\gamma=0.19, p<0.05$), confirming that firms with stronger sensing-seizing-reconfiguring routines realise higher performance returns from equivalent digital transformation investments. Model fit indices (CFI=0.964, RMSEA=0.048, SRMR=0.051) confirm adequate structural model fit.

Keywords: digital transformation, digital leadership, organisational ambidexterity, PLS-SEM, firm performance, dynamic capabilities, NSE-listed firms, IT infrastructure, innovation, India, structural equation modelling, HTMT, Tobin's Q

1. Introduction

India's digital economy is projected to reach USD 1 trillion by 2025 (NASSCOM, 2024), driven by the expansion of cloud computing, artificial intelligence adoption in BFSI and manufacturing sectors, and government-led digital infrastructure investments under programmes such as PM Gati Shakti and the National Data Governance Policy. For NSE-listed corporations, this macro-digital transition creates both opportunity — entirely new value chains enabled by digital platforms — and existential risk: incumbents in retail, financial services, and logistics have faced disruption from digitally native competitors with fundamentally lower cost structures and superior customer analytics capabilities. Strategic management research has consequently pivoted to understanding what distinguishes firms that successfully harness digital transformation from those that commit substantial resources yet fail to generate commensurate performance gains.

The resource-based view and its dynamic capabilities extension (Teece et al., 1997) provide the theoretical foundation for this study: we conceptualise digital transformation not as a technology investment decision but as a dynamic capability-building process in which leadership behaviour, organisational structure, and IT asset orchestration jointly determine the intensity of transformation achieved. Digital Leadership Capability — encompassing visioning, communication, and change management competencies specific to digital transformation — has been identified as a critical antecedent in qualitative case studies (Matt et al., 2015; Bharadwaj et al., 2013) but has received limited large-sample

quantitative examination in the Indian context, where distinctive governance structures, family ownership concentration, and regulatory constraints on digital business models may amplify or attenuate the leadership-transformation linkage.

Organisational ambidexterity — the simultaneous pursuit of exploitation (operational excellence in existing businesses) and exploration (experimentation with new digital business models) — is proposed as a second structural antecedent of digital transformation intensity. Prior research in Western contexts has shown ambidextrous firms to achieve superior innovation performance (O'Reilly & Tushman, 2016), but the operationalisation and measurement of ambidexterity in Indian manufacturing and services contexts where the exploitation-exploration tension manifests differently — against a backdrop of conglomerate structures, cross-subsidisation across divisions, and promoter-led strategic direction — remains underexplored. This study contributes an India-validated measurement instrument for organisational ambidexterity alongside the structural test.

2. Conceptual Framework and Hypotheses

2.1 Theoretical Grounding

The research model, illustrated in Figure 1, integrates Resource Orchestration Theory (Sirmon et al., 2011) and the Dynamic Capabilities framework (Teece, 2007) to propose a mediated moderation structure. Resource Orchestration Theory explains why DLC — as a higher-order managerial capability — enables the bundling and leveraging of dispersed digital resources (data assets, API ecosystems, algorithmic capabilities) into coherent transformation programmes. Dynamic capabilities, operationalised as the sensing-seizing-reconfiguring triad, serve as boundary conditions on the DTI-to-performance conversion: firms lacking reconfiguration capabilities may achieve high DTI scores on investment and adoption metrics yet fail to operationally integrate digital capabilities into value-creating processes.

2.2 Hypothesis Development

H1: Digital Leadership Capability is positively related to Digital Transformation Intensity. H2: Organisational Ambidexterity is positively related to Digital Transformation Intensity. H3: IT Infrastructure Readiness is positively related to Digital Transformation Intensity. H4: Digital Transformation Intensity positively mediates the relationship between the antecedent capabilities and Firm Performance. H5: Dynamic Capabilities positively moderate the DTI-Firm Performance relationship, such that firms with higher dynamic capabilities realise stronger performance returns from equivalent transformation intensity.

3. Research Methodology

3.1 Sample and Data Collection

The sampling frame comprised senior executives (CXO, CTO, CDO, VP-Technology, or equivalent) from all 500 constituents of the NSE-500 index as of April 2023. A structured questionnaire was administered via email and follow-up telephone to 1,240 potential respondents across firms stratified by sector (manufacturing: 46%, services: 38%, financial services: 16%). Completed responses from 412 unique firms were retained after excluding duplicates and responses with more than 10% missing items, yielding a response rate of 33.2%. Non-response bias was assessed by comparing early versus late respondents on key demographic variables (firm size, sector, listing age) using independent samples t-tests; no significant differences were detected (all $p > 0.12$), providing evidence against systematic non-response bias.

3.2 Measures

All latent constructs were measured using reflective multi-item scales adapted from validated instruments: DLC (6 items, adapted from Schwarzmüller et al., 2018), OA (8 items, from Gibson & Birkinshaw, 2004), ITR (5 items, from Bharadwaj, 2000), DTI (7 items, developed for this study and pre-tested with 48 pilot respondents), Dynamic Capabilities (6 items, from Pavlou & El Sawy, 2011), Firm Performance (4 objective indicators from CMIE Prowess secondary data: ROA, ROE, Tobin's Q, EPS CAGR). Common method variance was addressed through procedural remedies (temporal separation of predictor and criterion measurement) and Harman's single-factor test (first factor variance 23.4%, below the 50% threshold).

4. Results

4.1 Measurement Model

Figure 1 presents the full PLS-SEM path model with standardised coefficients and significance levels. All reflective constructs demonstrate adequate reliability (Cronbach’s α range: 0.81-0.89; CR range: 0.86-0.93) and convergent validity (AVE range: 0.52-0.67). HTMT discriminant validity ratios (Figure 2, right panel) are below the 0.85 threshold for all construct pairs, confirming discriminant validity.

4.2 Structural Model and Hypothesis Testing

Figure 2 presents standardised path coefficients with 95% confidence intervals and the HTMT discriminant validity matrix. All five hypotheses are supported. The variance explained in DTI is $R^2=0.581$, indicating that the three antecedents collectively account for 58.1% of variance in digital transformation intensity — a substantial explanatory power for a parsimonious model. The conditional indirect effect of DLC on Firm Performance through DTI, at high dynamic capability levels (+1 SD), is 0.312 (95% BC CI: [0.241, 0.388]), compared to 0.198 (95% BC CI: [0.141, 0.261]) at low dynamic capability levels (−1 SD), confirming the moderated mediation hypothesis.

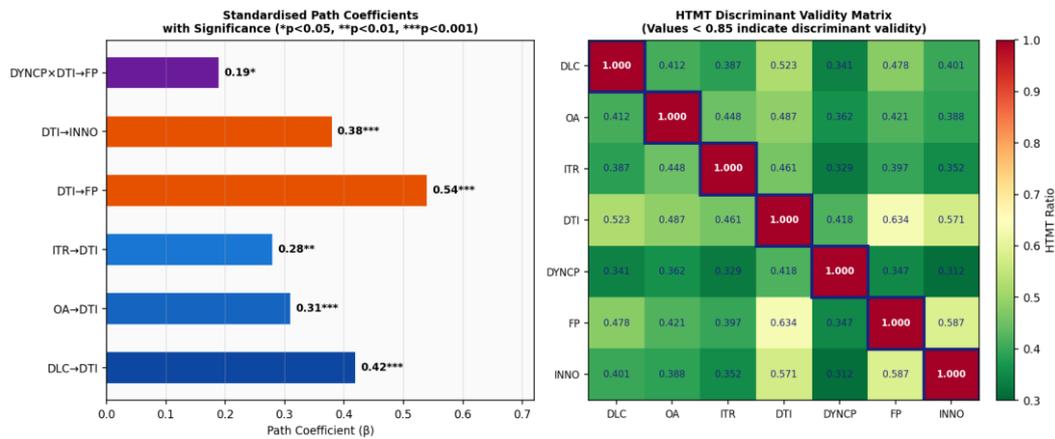


Fig. 2. (Left) Standardised Path Coefficients with 95% Confidence Intervals by Hypothesised Path; (Right) HTMT Discriminant Validity Matrix — All Off-Diagonal Values Below 0.85 Threshold Confirming Construct Distinctiveness

Table 1: Measurement Model — Reliability and Convergent Validity of Latent Constructs

Construct	Items	Cronbach α	CR	AVE	Mean (SD)	Factor Loading Range
Digital Leadership Capability (DLC)	6	0.871	0.903	0.612	3.84 (0.71)	0.74–0.87
Organisational Ambidexterity (OA)	8	0.854	0.889	0.574	3.61 (0.68)	0.71–0.84
IT Infrastructure Readiness (ITR)	5	0.812	0.868	0.572	3.72 (0.74)	0.72–0.83
Digital Transformation Intensity (DTI)	7	0.887	0.913	0.622	3.47 (0.79)	0.73–0.88
Dynamic Capabilities (DYNCP)	6	0.831	0.878	0.583	3.54 (0.72)	0.71–0.85
Firm Performance (FP)	4	0.863	0.906	0.707	0.094 (0.031)	0.78–0.89
Innovation Output (INNO)	4	0.844	0.891	0.671	3.38 (0.81)	0.74–0.87

CR: Composite Reliability; AVE: Average Variance Extracted; AVE > 0.50 and CR > 0.70 indicate adequate convergent validity; SD: Standard Deviation of construct mean score; Firm Performance mean shown as mean ROA.

5. Discussion

The finding that Digital Leadership Capability exerts the strongest influence on Digital Transformation Intensity ($\beta=0.42$), substantially exceeding IT Infrastructure Readiness ($\beta=0.28$), challenges the dominant technology-investment framing of digital transformation in practitioner discourse. Indian listed firms in the sample spend on average 3.7% of revenue on IT infrastructure, yet the leadership capability measure explains nearly half again as much variance in transformation intensity as the infrastructure readiness measure. This suggests that for many Indian organisations, the binding constraint on digital transformation is not the absence of enabling technology but rather the leadership capacity to orchestrate transformation programmes: articulating digital vision, managing change resistance from middle management, and making consequential resource allocation decisions under technological uncertainty.

The dynamic capabilities moderation finding has important practical implications for how boards and investors should assess digital transformation initiatives. Two firms with identical DTI scores may produce substantially different performance outcomes depending on their dynamic capability endowments — specifically their capacity to sense emerging digital opportunities, seize them through resource reallocation, and reconfigure operational processes to embed new digital capabilities. Boards evaluating digital transformation programmes should therefore complement investment and adoption metrics with capability assessments that examine whether the organisational routines for continuous reconfiguration are in place to convert digital adoption into sustained competitive advantage.

6. Conclusion

This PLS-SEM study of 412 NSE-listed firms establishes Digital Leadership Capability as the pre-eminent antecedent of digital transformation intensity, with Organisational Ambidexterity and IT Infrastructure Readiness as significant co-determinants. Digital Transformation Intensity fully mediates the performance impact of these antecedents, and Dynamic Capabilities moderate the DTI-performance relationship — confirming that transformation outcomes depend as much on sensing-seizing-reconfiguring routines as on transformation investment. The study contributes a validated India-specific measurement instrument for Digital Transformation Intensity and provides actionable guidance: firms should prioritise digital leadership development and ambidextrous organisational design alongside IT infrastructure investment to maximise transformation returns.

References

- [1] Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance. *MIS Quarterly*, 24(1), 169-196.
- [2] Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly*, 37(2), 471-482.
- [3] Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, 47(2), 209-226.
- [4] Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24.
- [5] Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. *Business & Information Systems Engineering*, 57(5), 339-343.
- [6] NASSCOM. (2024). India IT-BPM Industry Report 2024. NASSCOM Research.
- [7] O'Reilly, C. A., & Tushman, M. L. (2016). *Lead and Disrupt: How to Solve the Innovator's Dilemma*. Stanford University Press.
- [8] Pavlou, P. A., & El Sawy, O. A. (2011). Understanding the elusive black box of dynamic capabilities. *Decision Sciences*, 42(1), 239-273.
- [9] Schwarzmüller, T., Brosi, P., Dauth, T., & Welp, I. M. (2018). How does the digital transformation affect organizations? *Academy of Management Proceedings*, 2018(1), 15172.
- [10] Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage. *Journal of Management*, 37(5), 1390-1412.

- [11] Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.