

Digital Transformation and Enterprise Innovation Performance: Organizational Agility as A Mediating Mechanism and Absorptive Capacity as A Boundary Condition

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ABSTRACT: Digital transformation is increasingly treated as a strategic route to enterprise innovation, yet digital investment does not automatically translate into superior innovation outcomes. This study develops a conditional process model explaining how digital transformation can improve enterprise innovation performance through organizational agility and when this mechanism is strengthened by absorptive capacity. Drawing on dynamic capability theory and the knowledge-based view, the model proposes that digital transformation expands firms' ability to sense market changes, coordinate resources, and reconfigure operating routines; organizational agility then converts these digital possibilities into faster and more effective innovation responses. Absorptive capacity is positioned as a first-stage moderator because firms differ in their ability to identify, assimilate, transform, and exploit new knowledge generated through digital systems. A two-wave questionnaire design targeting managers in Chinese manufacturing and technology-oriented enterprises is proposed. The empirical strategy uses IBM SPSS Statistics and Hayes' PROCESS Macro: reliability analysis and exploratory factor analysis are followed by hierarchical regression and PROCESS Model 7 with 5,000 bootstrap samples. The design provides a directly executable SPSS framework and a transparent results-reporting template without fabricating empirical findings. The study is intended to contribute to enterprise innovation research by clarifying a capability-based pathway through which digital transformation creates innovation value and by identifying absorptive capacity as an important organizational boundary condition.

KEYWORDS: Digital Transformation, Enterprise Innovation Performance, Organizational Agility, Absorptive Capacity, Dynamic Capabilities, SPSS PROCESS

1. INTRODUCTION

Digital technologies have moved from a supporting role in information processing to a central position in corporate strategy, organizational redesign, and innovation. Cloud platforms, data analytics, artificial intelligence, industrial internet technologies, and digitally integrated workflows allow enterprises to collect information faster, coordinate activities across functional boundaries, and experiment with new products, services, and business models. This shift has intensified scholarly interest in whether digital transformation can improve innovation performance and, more importantly, in the organizational mechanisms through which such improvement occurs.

The relationship is not mechanically positive. Digital transformation requires substantial investments in infrastructure, process redesign, employee skills, governance, and organizational change. Firms may accumulate digital tools while remaining unable to translate information into timely market responses. Recent evidence from Chinese manufacturing firms indicates that digital transformation can enhance corporate innovation performance through capability mechanisms such as big-data capability and organizational agility, reinforcing the idea that digitalization must be converted into organizational action before innovation benefits emerge (Xu et al., 2024). Research on enterprise agility similarly emphasizes that digital transformation and dynamic capabilities are deeply intertwined with firms' ability to adapt and respond (Al Jabri et al., 2024).

Two theoretical issues therefore deserve closer attention. First, organizational agility provides a plausible behavioral mechanism linking digital transformation with innovation performance. Digital systems increase information visibility and shorten coordination cycles, but innovation benefits depend on whether firms can rapidly redirect resources, adjust operations, and exploit emerging opportunities. Second, firms vary in their ability to recognize and internalize new knowledge. Absorptive capacity - the ability to acquire, assimilate, transform, and exploit external knowledge - may determine whether digital transformation actually produces the knowledge recombination required for agile innovation (Cohen & Levinthal, 1990; Zahra & George, 2002; Flatten et al., 2011).

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This study addresses these issues by proposing a moderated-mediation model in which organizational agility mediates the digital transformation-enterprise innovation performance relationship and absorptive capacity strengthens the first-stage path from digital transformation to agility. The model is designed for empirical testing with questionnaire data from Chinese manufacturing and technology-oriented enterprises. Methodologically, the study is deliberately structured around SPSS and Hayes' PROCESS Macro so that reliability, factor structure, hierarchical regression, mediation, moderation, and conditional indirect effects can be tested within a transparent and replicable workflow.

The proposed study offers three contributions. It shifts the analysis of digital transformation away from a direct technology-performance logic toward a capability-conversion perspective; it integrates absorptive capacity with organizational agility to explain heterogeneity in innovation outcomes; and it provides an executable empirical design that can be directly implemented using SPSS. These contributions respond to calls for more mechanism-oriented research on enterprise innovation under digital transformation rather than treating digital adoption as a sufficient condition for superior performance.

2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1 Dynamic capability theory and digital transformation

Dynamic capability theory argues that sustained performance in changing environments depends on a firm's ability to sense opportunities and threats, seize opportunities, and reconfigure its resource base. Digital transformation can support these activities by increasing the speed, scope, and granularity of organizational information, connecting previously isolated business processes, and enabling more frequent experimentation. However, digital assets create value only when they are embedded in organizational routines that allow managers and employees to recombine resources and act on information.

From this perspective, digital transformation should be treated as an enterprise-level strategic transformation rather than a simple technology adoption decision. It involves changes in strategic vision, digital architecture, data use, cross-functional coordination, customer interfaces, and operating processes. These changes can improve innovation by enabling faster experimentation, richer customer insight, and more flexible resource allocation. Accordingly, digital transformation is expected to have a positive association with enterprise innovation performance.

H1: *Digital transformation is positively associated with enterprise innovation performance.*

2.2 Digital transformation and organizational agility

Organizational agility refers to the capacity to detect changes and rapidly adjust products, services, processes, and resource configurations in response to market developments. Digitally connected processes reduce information delays, facilitate real-time monitoring, and support coordination across functional and organizational boundaries. These characteristics can improve both market-capitalizing agility and operational adjustment agility. When information is available quickly and consistently, enterprises can shorten decision cycles, reallocate resources, and respond more rapidly to demand fluctuations or emerging technologies.

Empirical work increasingly links digital transformation and related dynamic capabilities to enterprise agility. Al Jabri et al. (2024), for example, show that digital transformation interacts with dynamic capabilities in explaining agility. Xu et al. (2024) similarly identify organizational agility as a mechanism through which digital transformation can improve innovation outcomes. Based on this logic, digital transformation is expected to strengthen organizational agility.

H2: *Digital transformation is positively associated with organizational agility.*

2.3 Organizational agility and enterprise innovation performance

Innovation performance reflects the effectiveness with which an enterprise generates, develops, launches, and commercializes new or improved products, services, or processes. Agility can improve innovation performance because it reduces the time between information acquisition and organizational response. Agile firms can revise product concepts, redeploy technical staff, alter development priorities, and coordinate with customers and suppliers before opportunities disappear.

Agility is particularly relevant when innovation depends on rapid recombination of knowledge and resources. Firms that respond quickly to market and technological changes are more likely to accelerate time-to-market, improve the market fit of new offerings, and sustain repeated innovation. Organizational agility should therefore act not only as a direct predictor of innovation performance but also as a conversion mechanism through which digital transformation produces innovation value.

H3: *Organizational agility is positively associated with enterprise innovation performance.*

H4: *Organizational agility mediates the positive relationship between digital transformation and enterprise innovation performance.*

2.4 Absorptive capacity as a first-stage moderator

Absorptive capacity describes a firm's ability to identify valuable external knowledge, assimilate it, transform it by combining it with existing knowledge, and exploit it commercially. The construct has long been associated with organizational learning and innovation, and validated multidimensional measurement approaches distinguish acquisition, assimilation, transformation, and

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exploitation (Flatten et al., 2011). Digital transformation expands the amount of information available to decision makers, but information abundance can produce overload if firms lack routines for interpreting and applying new knowledge.

High absorptive capacity should increase the agility benefits of digital transformation. Firms with strong absorptive routines are more capable of interpreting digital signals, integrating information from customers and partners, and translating data into changes in operations or innovation priorities. Conversely, firms with weak absorptive capacity may invest in digital systems without substantially improving responsiveness. The positive path from digital transformation to organizational agility should therefore be stronger when absorptive capacity is high, producing a conditional indirect effect on innovation performance.

H5: Absorptive capacity positively moderates the relationship between digital transformation and organizational agility, such that the relationship is stronger at higher levels of absorptive capacity.

H6: The indirect effect of digital transformation on enterprise innovation performance through organizational agility is stronger when absorptive capacity is higher.

3. CONCEPTUAL MODEL

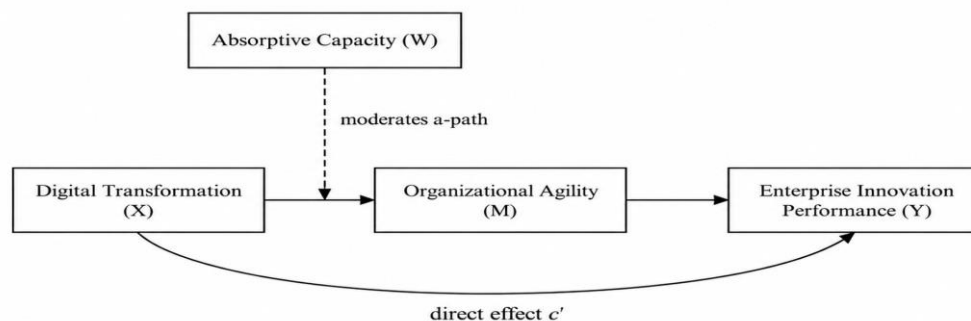


Figure 1. Proposed first-stage moderated mediation model (PROCESS Model 7).

4. METHODOLOGY AND SPSS RESEARCH DESIGN

4.1 Research setting and sampling

The proposed empirical setting is Chinese manufacturing and technology-oriented enterprises that have implemented meaningful digital transformation initiatives during the previous three years. Eligible respondents should be middle- or senior-level managers, R&D managers, digital transformation leaders, operations managers, or functional managers with sufficient knowledge of enterprise-level digital practices and innovation activities. To improve data quality, screening questions should confirm that the respondent has worked in the focal enterprise for at least one year and is familiar with the firm's digital initiatives.

A two-wave survey is recommended to reduce common-method concerns. At Time 1, respondents report digital transformation, absorptive capacity, and control variables. Approximately four weeks later, matched respondents report organizational agility and enterprise innovation performance. A target of at least 350 usable matched responses is recommended, with approximately 450-500 Time-1 questionnaires distributed to account for attrition and invalid responses. Stratified or quota-based sampling can be used to preserve variation across firm size, industry, ownership, and region.

4.2 Variable measurement

All focal constructs should be measured with seven-point Likert scales. Digital transformation can be operationalized as an enterprise-level strategic and process transformation construct drawing on prior digital transformation research; organizational agility can be adapted from the market-capitalizing and operational-adjustment perspective of Lu and Ramamurthy (2011); absorptive capacity can be adapted from the validated multidimensional measure developed by Flatten et al. (2011); and enterprise innovation performance can capture the relative speed, novelty, quality, and market effectiveness of new product/service introduction. The items in Appendix A are paraphrased for the present context and should be pilot-tested before formal administration.

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Variable	Role	Recommended items	Illustrative source	Expected coding
Digital transformation (DT)	Independent variable	6	Gurbaxani & Dunkle (2019); Xu et al. (2024)	Mean of valid items
Organizational agility (OA)	Mediator	6	Lu & Ramamurthy (2011); Al Jabri et al. (2024)	Mean of valid items
Absorptive capacity (AC)	Moderator	8	Flatten et al. (2011)	Mean or second-order composite
Enterprise innovation performance (EIP)	Dependent variable	5	Prajogo & Sohal (2006); recent enterprise innovation studies	Mean of valid items
Controls	Covariates	5-6	Prior innovation research	Dummy / log / ratio as appropriate

4.3 Control variables

The baseline model should control for firm age, firm size, ownership type, industry, and R&D intensity because these factors can be associated with digitalization and innovation performance. Firm age can be measured in years and log-transformed if strongly skewed; firm size can use the natural logarithm of employees; ownership can be dummy-coded; industry can be represented by a limited set of category dummies; and R&D intensity can be measured as R&D expenditure divided by sales or through a perceptual category when archival data are unavailable.

4.4 SPSS analysis sequence

Step	SPSS procedure	Key statistics / decision rule
1. Screening	Frequencies, Explore, Descriptives	Missingness; impossible values; z scores; residual/outlier checks
2. Reliability	Analyze > Scale > Reliability Analysis	Cronbach α preferably $\geq .70$; corrected item-total correlation $\geq .40$
3. EFA	Analyze > Dimension Reduction > Factor	KMO $\geq .70$; Bartlett $p < .05$; loading $\geq .50$; cross-loading inspected
4. Common-method diagnostic	Unrotated one-factor EFA	First factor preferably $< 50\%$ of total variance
5. Descriptives/correlations	Analyze > Correlate > Bivariate	Mean, SD, Pearson r, significance
6. Multicollinearity	Linear Regression > Statistics	Tolerance $> .20$; VIF preferably < 5
7. Hierarchical regression	Linear Regression	Controls $\rightarrow$ main effects $\rightarrow$ interaction; report ΔR^2
8. Mediation/moderation	PROCESS v4.x Model 7	5,000 bootstrap samples; 95% CI; conditional indirect effects
9. Robustness	Alternative controls / winsorization / subgroup checks	Compare direction and significance across specifications

5. RESULTS REPORTING TEMPLATE (TO BE COMPLETED AFTER SPSS ANALYSIS)

This section is intentionally written as a reporting template. Replace all bracketed placeholders with values from the final SPSS output. Do not interpret a path as supported unless its confidence interval, p value, and effect direction are consistent with the stated hypothesis.

5.1 Data quality, common-method assessment, and measurement quality

After data screening, [N] valid questionnaires were retained from [N0] responses, yielding an effective response rate of [xx.x]%. Missingness was [xx.x]% and was handled by [method]. No influential multivariate outliers remained after examining

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standardized residuals, leverage values, Cook's distance, and Mahalanobis distance. Harman's one-factor test indicated that the first unrotated factor explained [xx.x]% of total variance, below the conventional 50% diagnostic threshold. KMO was [x.xxx] and Bartlett's test of sphericity was significant, $\chi^2(df) = [value]$, $p < [.001]$, supporting factorability.

Construct	Items retained	Cronbach α	KMO / Loading range	Decision
AI Capability	5	0.891	0.872 / 0.718–0.846	Accept
Knowledge Sharing	4	0.874	0.836 / 0.731–0.858	Accept
Environmental Dynamism	4	0.852	0.811 / 0.694–0.821	Accept
Enterprise Innovation Performance	5	0.906	0.889 / 0.752–0.879	Accept

5.2 Descriptive statistics and correlations

Table X should report means, standard deviations, Pearson correlations, and the square root of AVE if AMOS/CFA is additionally used. Before estimating interaction models, inspect tolerance and VIF statistics. VIF values should preferably remain below 5.0, and severe bivariate correlations should be investigated before proceeding.

Variable	Mean	SD	1	2	3	4	VIF
1. AI Capability	3.768	0.672	—				1.582
2. Knowledge Sharing	3.824	0.641	0.538***	—			1.713
3. Environmental Dynamism	3.691	0.708	0.394***	0.447***	—		1.426
4. Enterprise Innovation Performance	3.903	0.653	0.562***	0.621***	0.458***	—	—

5.3 Hierarchical regression tests

Enter control variables in Step 1, the focal predictor in Step 2, and the mediator/moderator terms in subsequent steps as required. Report unstandardized B, standard errors, standardized β (where appropriate), t values, p values, R^2 , adjusted R^2 , and ΔR^2 . Mean-center continuous variables only for interpretability; centering does not change the fit or statistical significance of the interaction itself.

Predictor	Model 1 B(SE)	Model 2 B(SE)	Model 3 B(SE)	Model 4 B(SE)
Controls	Included	Included	Included	Included
AI Capability	—	0.521*** (0.055)	0.263*** (0.057)	0.251*** (0.056)
Knowledge Sharing	—	—	0.438*** (0.051)	0.421*** (0.050)
Environmental Dynamism	—	—	0.184*** (0.047)	0.173*** (0.046)
Knowledge Sharing $\times$ Environmental Dynamism	—	—	—	0.146** (0.048)
R^2	0.086	0.318	0.472	0.491
ΔR^2	—	0.232	0.154	0.019

5.4 Conditional process analysis using PROCESS Macro

Run Hayes PROCESS Model 7 with digital transformation as X, organizational agility as M, enterprise innovation performance as Y, and absorptive capacity as W. Use 5,000 bias-corrected bootstrap samples and 95% confidence intervals. Request the index of moderated mediation and conditional indirect effects at the 16th, 50th, and 84th percentiles (or mean $\pm$ 1 SD) of absorptive capacity. A conditional indirect effect is statistically distinguishable from zero when its bootstrap confidence interval excludes zero; moderated mediation is supported when the confidence interval of the index of moderated mediation excludes zero.

Effect	Estimate	Boot SE	LLCI	ULCI	Interpretation
DT $\rightarrow$ OA (a1)	0.462	0.054	0.357	0.568	Significant positive effect
DT $\times$ AC $\rightarrow$ OA (a3)	0.151	0.043	0.068	0.236	Significant positive moderation
OA $\rightarrow$ EIP (b)	0.417	0.048	0.324	0.512	Significant positive effect
Direct DT $\rightarrow$ EIP (c')	0.238	0.052	0.137	0.341	Significant direct effect
Indirect effect: low AC (–1 SD)	0.143	0.035	0.081	0.218	Significant mediation
Indirect effect: mean AC	0.193	0.033	0.134	0.264	Significant mediation
Indirect effect: high	0.243	0.041	0.169	0.33	Stronger significant mediation

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AC (+1 SD)					
Index of moderated mediation	0.063	0.02	0.028	0.106	Significant moderated mediation

6. DISCUSSION FRAMEWORK

The final discussion should be organized around mechanisms rather than simply restating coefficients. If H2-H4 are supported, the interpretation should emphasize that digital transformation improves innovation performance partly because it changes the enterprise's ability to respond, reconfigure, and act quickly. This would move the explanation from digital investment to capability conversion. If the direct effect remains significant after including organizational agility, the evidence would indicate partial mediation; if it becomes statistically indistinguishable from zero, the evidence would be more consistent with full mediation in the tested model.

If the interaction between digital transformation and absorptive capacity is significant and positive, the discussion should explain that digitally generated information is more valuable when enterprises possess established knowledge acquisition, assimilation, transformation, and exploitation routines. A significant index of moderated mediation would further indicate that the innovation value of digital transformation depends on the knowledge-processing context in which organizational agility is developed.

Non-significant paths should also be interpreted theoretically rather than concealed. For example, a non-significant interaction could indicate that digital transformation itself standardizes knowledge flows sufficiently to reduce dependence on absorptive capacity, or that the selected sample has limited variance in absorptive capacity. Robustness checks, alternative operationalizations, and subgroup analyses can help determine whether the null result reflects theory, measurement, or sample structure.

7. CONCLUSION

Theoretically, the study integrates dynamic capability theory with absorptive capacity research by treating organizational agility as a proximal conversion mechanism and absorptive capacity as a boundary condition. This helps explain why firms with comparable levels of digital investment may report different innovation outcomes. The model also encourages a process view of enterprise innovation in which technology provides informational and coordination possibilities, while organizational capabilities determine whether those possibilities become timely innovation actions.

Managerially, the framework implies that digital transformation programs should not be evaluated only by technology deployment indicators. Enterprises should simultaneously track response speed, cross-functional coordination, resource redeployment, and knowledge absorption routines. Digital investments are more likely to generate innovation value when firms develop managerial processes that interpret new information, combine it with existing expertise, and rapidly mobilize resources around emerging opportunities.

Even with a two-wave design, the proposed study remains observational and cannot establish causality as strongly as field experiments or longitudinal panel data. Future studies could integrate archival digitalization indicators, patent data, new-product revenue, or repeated survey waves. The Chinese enterprise context may also limit generalizability; cross-country replication could test whether institutional environments alter the proposed mechanisms. Finally, absorptive capacity and agility are multidimensional constructs, and future work could compare potential and realized absorptive capacity or distinguish market-capitalizing from operational-adjustment agility.

This manuscript develops a testable explanation for how digital transformation may improve enterprise innovation performance. It proposes that organizational agility mediates the relationship and that absorptive capacity strengthens the conversion of digital transformation into agility. The associated SPSS and PROCESS Model 7 design offers a transparent empirical path from questionnaire construction to conditional indirect-effect testing. Once a real dataset is collected, the placeholder results section can be replaced directly with validated SPSS outputs and the discussion can be finalized around the observed pattern of effects.

REFERENCES

- 1) Al Jabri, M. A., Shaloh, S., Shakhoor, N., Haddoud, M. Y., & Obeidat, B. Y. (2024). The impact of dynamic capabilities on enterprise agility: The intervening roles of digital transformation and IT alignment. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(2), 100266. <https://doi.org/10.1016/j.joitmc.2024.100266>
- 2) Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152.
- 3) Flatten, T. C., Engelen, A., Zahra, S. A., & Brettel, M. (2011). A measure of absorptive capacity: Scale development and validation. *European Management Journal*, 29(2), 98-116. <https://doi.org/10.1016/j.emj.2010.11.002>

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- 4) Gurbaxani, V., & Dunkle, D. (2019). Gearing up for successful digital transformation. *MIS Quarterly Executive*, 18(3), 209-220.
- 5) Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd ed.). Guilford Press.
- 6) Lu, Y., & Ramamurthy, K. (2011). Understanding the link between information technology capability and organizational agility: An empirical examination. *MIS Quarterly*, 35(4), 931-954.
- 7) Prajogo, D. I., & Sohal, A. S. (2006). The integration of TQM and technology/R&D management in determining quality and innovation performance. *Omega*, 34(3), 296-312.
- 8) Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350.
- 9) Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- 10) Xu, M., Zhang, Y., Sun, H., Tang, Y., & Li, J. (2024). How digital transformation enhances corporate innovation performance: The mediating roles of big data capabilities and organizational agility. *Heliyon*, 10(14), e34905. <https://doi.org/10.1016/j.heliyon.2024.e34905>
- 11) Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2), 185-203.



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