

How New Quality Productive Forces Drive SMEs' Collaborative Innovation Performance in China?

Xinxiang Gao¹, Jiawen Yu^{2,3}, Xiaoyi Liu^{1,4*}, Lili Xiao⁵

**Corresponding Author*

¹ School of Financial and Management, Sichuan University of Arts and Science, Dazhou, China

² School of Chinese and International Education, Guangzhou International Economics College, Guangzhou, China

³ Faculty of Education, Language, Psychology, and Music, SEGi University, Petaling Jaya, Malaysia

⁴ Faculty of Business Administration, City University of Malaysia, Petaling Jaya, Malaysia

⁵ Office of Science and Technology, Sichuan University of Arts and Science, Dazhou, China

Mark1870064@gmail.com; yujiawencarmen@gmail.com; 14658644@qq.com; 1056873651@qq.com
Tel: +601136876891

Abstract

This study focuses on the Chengdu-Chongqing Economic Circle, a key area in China's national regional integration strategy, to examine how new quality productive forces (NQPF) and digital transformation (DT) affect the collaborative innovation performance (CIP) of SMEs. Based on dynamic capability and collaborative innovation theory, this study employs a purposive sampling strategy and conducts a cross-sectional questionnaire survey among 314 SMEs. The findings reveal that NQPF significantly enhances CIP and has a positive impact on DT; meanwhile, DT directly promotes CIP, DT mediates the relationship between NQPF and CIP. This study includes recommendations, limitations and future research prospects.

Keywords: New Quality Productive Forces; Collaborative Innovation Performance; Digital Transformation; SMEs

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1.0 Introduction

1.1 Background of the Study

China's transition toward high-quality development has made the Chengdu-Chongqing Economic Circle (CCEC) a critical testbed for innovation-driven regional growth. As a strategically important urban cluster, the CCEC plays a central role in fostering industrial synergy and sustaining the competitiveness of SMEs, which account for the majority of firms and employment in the region (Liu et al., 2023). Enhancing the collaborative innovation performance (CIP) of SMEs is therefore essential not only for regional integration but also for strengthening ecosystem resilience and long-term economic sustainability.

To address these needs, the concept of New Quality Productive Forces (NQPF) has recently been proposed, emphasizing technological breakthroughs, reconfiguration of production factors, and industrial upgrading as the foundations for sustainable productivity growth (Xi, 2023). This concept signals a paradigm shift from quantity-driven expansion to quality-oriented innovation, which is particularly relevant to emerging clusters and knowledge-intensive SMEs.

At the firm level, however, translating NQPF into measurable collaboration outcomes is not automatic. Digital Transformation (DT) is increasingly seen as the organizational capability that enables SMEs to operationalize these structural forces. By embedding digital technologies into strategy, processes, and inter-organizational collaboration, DT allows firms to sense opportunities, reconfigure

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resources, and co-create value (Vial, 2019). In the CCEC, digital platforms, cloud-based collaboration, and intelligent manufacturing tools have reduced innovation costs and expanded cross-sector partnerships.

Despite these advances, existing research remains limited in two ways. First, prior studies largely describe government initiatives and policy objectives, offering insufficient empirical evidence on how NQPF influence firm-level outcomes. Second, while digital transformation is widely recognized as important, its mediating role in linking NQPF with SMEs' collaborative innovation performance has not been systematically examined in the CCEC context. This unresolved mechanism motivates the present study.

1.2 Problem Statement and Research Objectives

As China accelerates its modernization and regional integration strategies, the CCEC has emerged as a pivotal region for industrial transformation, cross-border collaboration, and technological advancement. Yet, despite intensive policy attention and investment, the CIP of SMEs in this region remains fragmented, uneven, and often disconnected from national innovation priorities. Many SMEs in the CCEC lack the systemic capacity to convert strategic inputs into synergistic innovation outputs, especially in the face of increasing market volatility, rising technological complexity, and global value chain restructuring.

Theoretically, NQPF—driven by disruptive technologies, novel factor configurations, and deep industrial upgrading—offer a promising foundation for enhancing innovation effectiveness. However, empirical research on how NQPF directly influences enterprise-level collaborative outcomes remains scarce, especially in emerging inland urban clusters like the CCEC. Additionally, the translation of macro-level strategic productivity goals into micro-level performance metrics remains poorly understood.

Concurrently, DT has been widely acknowledged as a catalyst for innovation network reconfiguration, real-time resource integration, and inter-organizational knowledge sharing (Vial, 2019). Yet, SMEs in the CCEC exhibit varying levels of digital maturity, and few studies have explored whether DT acts as a mediating mechanism between NQPF and CIP, particularly in multi-industry and cross-city collaboration contexts. This gap leaves a critical question unanswered: under what conditions and mechanisms can NQPF be effectively translated into collaborative innovation benefits through DT? In response to the challenges and theoretical gaps, the purpose of this study is to empirically test the mediating effect of DT between NQPF and CIP among SMEs in the CCEC. This purpose encompasses four specific objectives that together examine both the direct and indirect pathways of influence. Research Objectives: RO1) To investigate the direct effect of NQPF on the CIP of SMEs in the CCEC. RO2) To investigate whether NQPF positively influences SMEs' DT adoption and capability development in the CCEC. RO3) To investigate the effect of DT on SMEs' CIP in the CCEC. RO4) To investigate the mediating role of DT in the relationship between NQPF and CIP in the CCEC.

2.0 Literature Review

2.1 Theoretical Foundation

This study, grounded in Dynamic Capability Theory (DCT), Collaborative Innovation Theory (CIT), and the emerging theoretical perspective of NQPF, collectively provide a robust framework for explaining the mechanisms through which DT mediates the relationship between NQPF and CIP in SMEs.

Originally proposed by Teece (2007), DCT, referring how enterprises adjust, integrate, and reconfigure internal and external capabilities to address fast switching environments. In this research, DCT helps interpret how SMEs leverage NQPF as a form of strategic capability to sense technological changes, seize opportunities, and transform internal processes. DT, a dynamic capability, illustrates the ability of enterprise to realign its processes, technologies, and organizational routines in response to digital pressures. Therefore, DCT underpins the mechanism by which NQPF enhances SMEs' capabilities to engage in DT and achieve superior innovation outcomes.

CIT emphasizes the value of inter-organizational collaboration, knowledge exchange, and shared innovation processes in enhancing firms' innovation performance (Chesbrough, 2006). Under the regional integration strategy of the Chengdu-Chongqing Economic Circle, collaborative innovation is particularly relevant, as SMEs are encouraged to build partnerships with universities, research institutes, and platform enterprises to improve innovation outcomes (Wang et al., 2024). DT facilitates such collaboration by enabling real-time communication, resource sharing, and coordinated development across organizational boundaries. CIT therefore supports the hypothesized direct effect of DT on CIP, and its mediating role in linking NQPF to innovation outcomes.

NQPF represents a newly proposed conceptual framework in China's high-quality development agenda. It emphasizes breakthroughs in technology, innovative allocation of production factors, and deep industrial transformation, with a particular focus on significantly improving total factor productivity. Unlike traditional productivity, NQPF integrates digital, intelligent, and green dimensions into enterprise development strategies (Liu et al., 2023). It acts as a strategic driver for dynamic capabilities and collaborative innovation by reshaping how firms combine labor, capital, and data as key inputs. This research positions NQPF as the foundational variable, triggering a chain of strategic responses that culminate in innovation performance, especially within the context of regional innovation ecosystems.

DCT provides the logic of enterprise capacity reconfiguration, CIT outlines the structure of innovation collaboration, and the theoretical lens of NQPF aligns with China's modernization strategy by defining the structural forces behind productivity transformation. Together, these theories form the conceptual backbone of this study and guide the formulation of hypotheses and model design.

2.2 Hypothesis Development

NQPF and CIP

NQPF represents a strategic shift from quantity-driven to quality-oriented development, driven by technological breakthroughs, factor reallocation, and industrial transformation (Xi, 2023). While previous studies confirm that productivity-enhancing forces can strengthen firms' innovation capacity (Wang et al., 2024), most research assumes a direct and automatic link between structural upgrading and collaborative outcomes. This creates a theoretical tension: on one hand, dynamic capability theory argues that firms must reconfigure internal resources to realize external opportunities (Teece, 2007); on the other hand, policy-driven narratives often overlook the firm-level mechanisms needed to bridge macro forces and micro-outcomes. This unresolved gap calls for examining whether and how NQPF drives CIP in resource-constrained SME ecosystems such as the CCEC.

H1: NQPF positively influences CIP.

NQPF and DT

Existing literature frequently frames DT as a general outcome of technological progress (Teece, 2007), but few studies specify the conditions under which NQPF stimulates SMEs' adoption of digital tools. This raises a theoretical tension between macro innovation strategies and micro absorptive capacities: while NQPF provides structural momentum, SMEs often lack the resources or routines to fully capture such momentum (Liu et al., 2023). Practically, studies also underexplored challenges such as fragmented regional infrastructure and talent shortages that impede SMEs' digitalization in inland regions like the CCEC. Addressing these oversights is essential for clarifying how structural upgrades cascade into firm-level DT.

H2: NQPF positively influences DT.

DT and CIP

The role of DT in enabling collaborative innovation is widely acknowledged, as digital platforms lower transaction costs and facilitate resource integration (Chesbrough, 2006). However, the literature has tended to present this relationship in general terms without interrogating boundary conditions. Theoretically, questions remain as to whether DT enhances collaboration only when supported by strong institutional ecosystems, or whether SMEs with limited digital maturity can still leverage DT effectively. Practically, SMEs in the CCEC face unique barriers—such as weak cross-regional digital infrastructure and limited ecosystem interoperability—that are not fully addressed in national-level studies. This raises the need for context-specific testing of DT's contribution to CIP.

H3: DT positively influences CIP.

The Mediating Role of DT

While existing research suggests that DT mediates between structural change and performance, it often assumes resource-rich environments and overlooks SMEs operating under constraints. This presents a theoretical gap: how do macro-level productive forces translate into collaborative outcomes when internal digital capabilities are uneven? Moreover, practical questions remain unanswered regarding whether SMEs in the CCEC—who face funding, talent, and network limitations—can rely on DT as a sufficient bridge between structural policy initiatives and measurable innovation performance (Teece, 2007; Liu et al., 2023). By focusing on this mediation, our study addresses both the theoretical tension and practical blind spots in the current literature.

H4: DT mediates the relationship between NQPF and CIP.

Therefore, the research model of this study is shown in Figure 1.

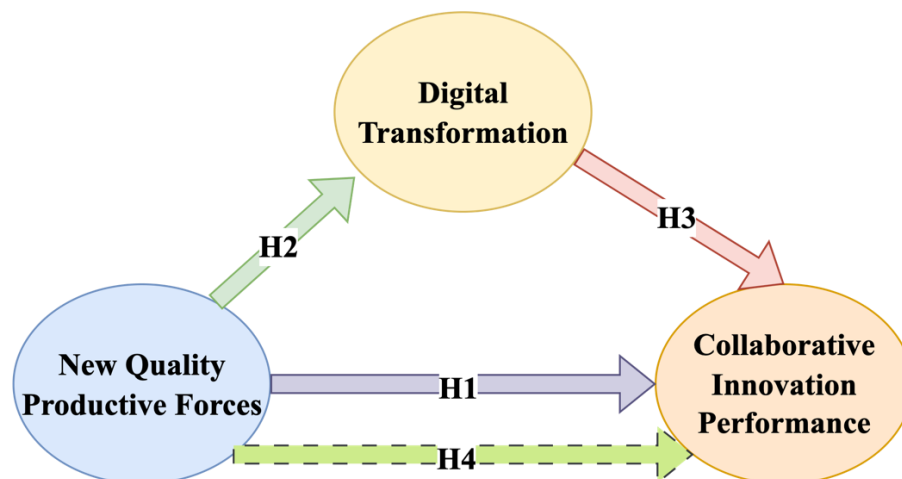


Fig. 1: Research model

3.0 Methodology

3.1 Sampling and Data Collection

The research targeted a population of over two million SMEs situated in the CCEC, as documented by the National Bureau of Statistics of China (2024). Since SMEs are the backbone of the regional economy yet remain underrepresented in empirical studies, this population provided both relevance and timeliness for the study. Owing to the vast scale and geographic dispersion, a purposive sampling method was adopted to select SMEs with active participation in digital transformation (DT) and collaborative innovation. This non-random technique was appropriate because the research questions focus specifically on firms with experience in NQPF implementation and inter-firm collaboration, thus requiring an information-rich sample (Palinkas et al., 2015).

G*Power 3.1.9.7 was conducted, applying a power of 0.95, which indicated a minimum sample size of 129. This justified our target of distributing 600 questionnaires, ensuring adequate statistical power while accounting for expected non-responses. With the support of local industrial zones and government agencies, the research team distributed paper-based questionnaires through face-to-face administration between February and May 2025. This method was chosen to enhance clarity of items, build trust with SME respondents, and reduce the likelihood of missing data compared to online-only surveys. Ultimately, 314 valid responses were obtained, representing a 52.33% response rate. Among respondents, 29.62% ($n = 93$) were executives, 61.14% ($n = 192$) were mid-level managers, and 9.24% ($n = 29$) were technical personnel, which provides a balanced perspective from strategic, managerial, and operational levels.

3.2 Measurement Instruments and Data Analysis Techniques

This study used all item scales adapted from prior research, each rated on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). To ensure linguistic accuracy, a double translation procedure, following Brislin (1986), was applied: translating the English version into Chinese and then back-translating to confirm semantic equivalence. Specifically, NQPF was measured using nine items from Cheng et al. (2025), which reflect technological upgrading, industrial restructuring, factor reallocation, and productivity improvements. DT was assessed using five items adapted from Merín-Rodríguez et al. (2024), which capture digital integration, process redesign, and business model transformation. CIP was operationalized using four items from Liu et al. (2021), covering innovation efficiency, inter-firm collaboration, and partnership satisfaction. A pilot test with 40 SMEs was conducted to refine the instrument, and Cronbach's alpha exceeded the 0.70 threshold for all constructs (Hair et al., 2021), confirming internal consistency (NQPF = 0.92; DT = 0.89; CIP = 0.87). Harman's single-factor test was also performed to address potential common method bias, with results showing the first factor accounted for 36.4% of variance—below the 50% threshold (Podsakoff et al., 2003).

For hypothesis testing, this study employed Partial Least Squares Structural Equation Modeling (PLS-SEM). Compared to Covariance-Based SEM (CB-SEM), which emphasizes model fit and theory confirmation, PLS-SEM is better suited for predictive research, complex models with mediating effects, and studies involving non-normal data or relatively small to medium sample sizes (Hair et al., 2021). Our research is exploratory in nature, focusing on testing the mediating mechanism of DT between NQPF and CIP in SMEs. Moreover, the sample size of 314, although adequate, makes PLS-SEM preferable due to its robustness in handling moderate sample sizes and its ability to maximize explained variance (R^2) of dependent constructs. While CB-SEM could offer stronger confirmatory fit indices, PLS-SEM was deliberately chosen because our objective is to examine causal pathways and predictive relevance, rather than to confirm a pre-established theory strictly. This choice is further justified by the model's inclusion of mediation, which benefits from the bootstrapping procedures embedded in PLS-SEM for estimating indirect effects. Thus, the analytical strategy, which combines SPSS for descriptive analysis and PLS-SEM for structural testing, is consistent with both the research objectives and the nature of the data.

4.0 Findings

4.1 Descriptive Analysis Results

Table 1 presents the outcomes of the descriptive statistics and correlation analysis. The mean for NQPF, DT and CIP were 4.271, 4.527, and 4.437, respectively, suggesting that respondents generally held positive perceptions of these dimensions. By Kline (2011), the skewness and kurtosis values for all variables fell within acceptable thresholds (i.e., skewness < 3.0 and kurtosis < 10.0), indicating no significant deviations from normality. Moreover, the strongest bivariate correlation observed was 0.781, which did not exceed the critical value for concerns about multicollinearity, thus confirming the appropriateness of the dataset for further multivariate analysis.

Table 1. Descriptive statistics and correlation analysis

	Mean	SD	Skewness	Kurtosis	1	2	3
1. NQPF	4.271	0.693	0.714	-0.598	1		
2. DT	4.527	0.714	0.529	-0.443	0.651	1	
3. CIP	4.437	0.762	0.972	-1.124	0.693	0.581	1

4.2 Measurement Model Results

The measurement model was assessed across four dimensions: indicator reliability, construct reliability, convergent validity, and discriminant validity. As shown in Table 2 and Figure 2, all standardized factor loadings ranged between 0.743 and 0.878, which are

well above the recommended cutoff of 0.70 (Hair et al., 2022). This indicates that each item effectively represents its underlying construct. Furthermore, internal consistency was evaluated using Cronbach's alpha and composite reliability (CR), and all coefficients exceeded the commonly accepted threshold of 0.70 (Nunnally & Bernstein, 1994; Rahman et al., 2020). Together, these outcomes confirm that the measurement scales demonstrate adequate reliability and maintain stability across constructs.

Table 1. Construct validity and reliability.

Structure	Items	Factor Loadings	Alpha	CR	AVE
New Quality Productive Forces	NQPF1	0.847	0.942	0.945	0.683
	NQPF2	0.877			
	NQPF3	0.837			
	NQPF4	0.743			
	NQPF5	0.849			
	NQPF6	0.864			
	NQPF7	0.822			
	NQPF8	0.764			
	NQPF9	0.823			
Digital Transformation	DT1	0.771	0.893	0.896	0.702
	DT2	0.849			
	DT3	0.856			
	DT4	0.832			
	DT5	0.878			
Collaborative Innovation Performance	CIP1	0.787	0.869	0.872	0.719
	CIP2	0.873			
	CIP3	0.854			
	CIP4	0.874			

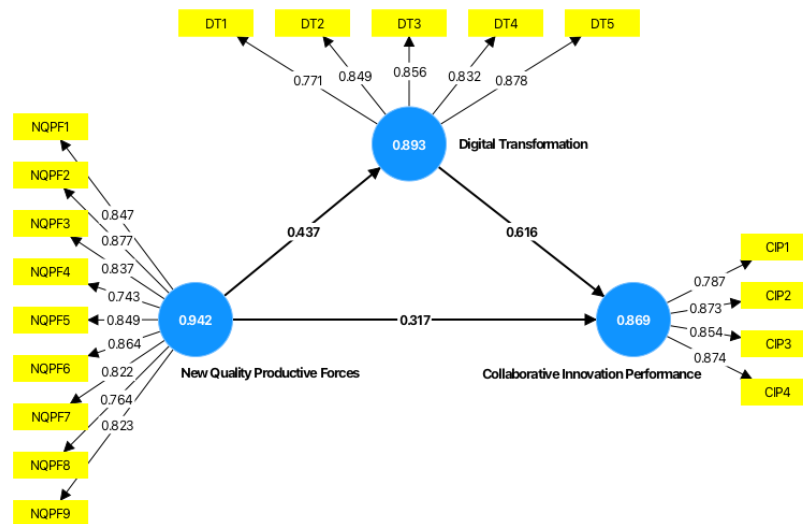


Fig. 2: Factor Loadings and Cronbach's alpha

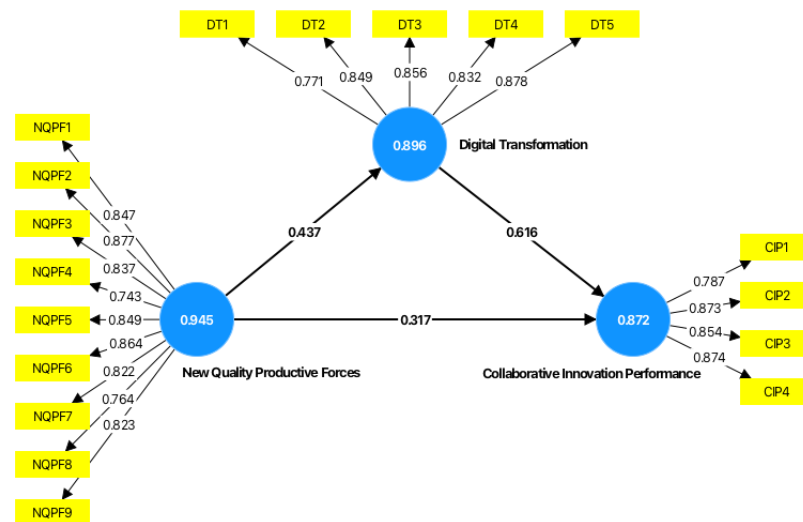


Fig. 3 Factor Loadings and Composite Reliability

Convergent validity was evaluated through the Average Variance Extracted (AVE). The AVE values for all constructs ranged between 0.683 and 0.702, which are comfortably above the recommended minimum of 0.50 (Hair et al., 2022). These results suggest that, on average, each construct accounts for more than two-thirds of the variance in its respective measurement items, confirming the adequacy of the indicators in representing the intended latent dimensions. To assess discriminant validity, we applied the heterotrait-monotrait (HTMT) ratio of correlations following Henseler et al. (2016). The HTMT values for all constructs were well below the conservative benchmark of 0.85, providing evidence that the constructs are distinct and not excessively correlated. In addition, variance inflation factor (VIF) values for all items were lower than the cutoff value of 5 (see Table 3), which indicates no serious multicollinearity concerns and further supports the robustness of the measurement model (Hair et al., 2022).

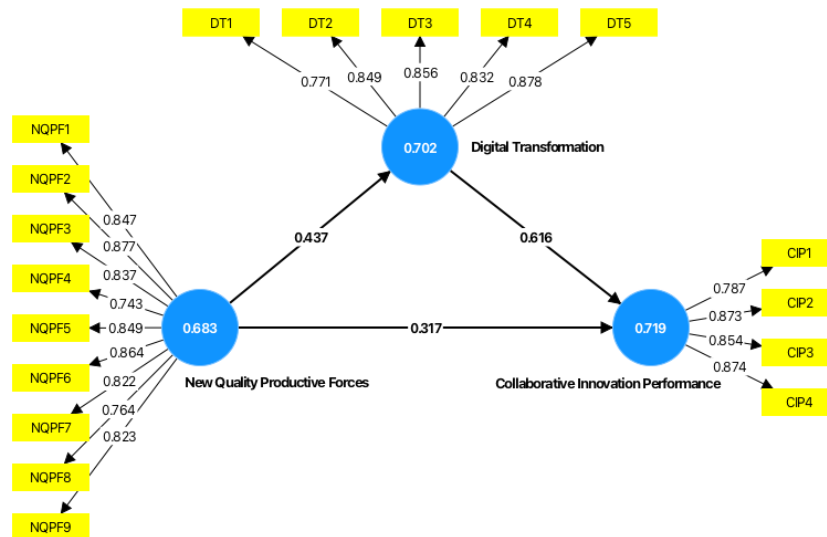


Fig. 4 Factor Loadings and AVE.

Table 3. HTMT criterion and VIF.

	CIP	DT	NQPF	VIF
CIP				1.237
DT	0.559			1.237
NQPF	0.383	0.379		1.000

4.3 Structural Model Results

After establishing the reliability and validity of the measurement model, the structural model was assessed to test the hypothesized relationships among NQPF, DT, and CIP. The analysis was conducted using SmartPLS with a bootstrapping procedure of 5,000 resamples, which provides robust estimates of path significance even under non-normal data conditions (Hair et al., 2022). This step directly evaluates the core research questions (RQ1–RQ4) by estimating the strength and significance of the structural paths.

Table 4. Direct and indirect hypotheses testing results.

NO.	Structural Path	Coefficient	T-statistics	Test result
H1	QPFN → CIP	0.317***	12.244	Supported
H2	QPFN → DT	0.437***	12.167	Supported
H3	DT → CIP	0.616***	26.698	supported
H4	QPFN → DT → CIP	0.269***	12.676	Supported

1 Notes: *p < 0.05, **p < 0.01, ***p < 0.001 (two-tailed test).

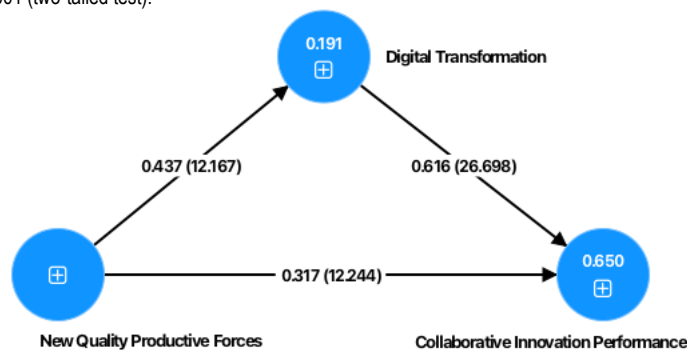


Fig. 4 Structural model (Path coefficients & T values & R²)

The detailed outcomes of this analysis are presented in Table 4 and Figure 5. Hypotheses were considered supported when the p -value was below 0.05 or the t -statistic exceeded 1.96, consistent with established SEM standards. As reported in Table 5 and visualized in Figure 5, the results confirmed that NQPF exerts a significant positive effect on both DT and CIP, while DT itself strongly enhances CIP. Importantly, DT was also found to mediate the relationship between NQPF and CIP. These findings provide empirical support for the theoretical argument that digital transformation acts as a critical mechanism translating macro-level productive forces into firm-level collaborative innovation outcomes.

Beyond path significance, we evaluated the model's explanatory and predictive power using R-squared (R^2) and Stone–Geisser's Q-squared (Q^2) (Table 5). R^2 reflects the proportion of variance explained in the endogenous constructs; consistent with Cohen (1992), values above 0.26 indicate practically meaningful explanatory power in organizational research. In addition, Q^2 was positive for both Digital Transformation ($DT = 0.187$) and Collaborative Innovation Performance ($CIP = 0.340$), demonstrating out-of-sample predictive relevance obtained via the blindfolding procedure. Interpreted substantively, the positive Q^2 for DT indicates that NQPF meaningfully predict firms' digital capability formation (addressing RQ2), while the stronger Q^2 for CIP is consistent with DT being the proximal driver of collaborative outcomes (addressing RQ3 and supporting the mediation in RQ4). Finally, the SRMR of 0.057 falls well below the 0.10 benchmark (and under the more conservative 0.08 guideline), indicating an acceptable overall fit of the structural model. Taken together, these indices justify moving from statistical significance to substantive interpretation of the hypothesized pathway ($NQPF \rightarrow DT \rightarrow CIP$) and bolster confidence in the research design.

Table 5. Predictive relevance of the model.

	R Square	$Q^2 (= 1 - SSE/SSO)$
DT	0.191	0.187
CIP	0.650	0.340

5.0 Discussion

This study investigates the mechanisms through which NQPF influence CIP, with DT playing a mediating role, based on empirical data from 512 SMEs in the Chengdu-Chongqing Economic Circle. The findings provide robust support for all four proposed hypotheses, offering significant theoretical insights and managerial implications.

The findings confirm (H1) that NQPF has a significant and positive impact on CIP ($\beta = 0.317$, $t = 12.244$, $p < 0.001$). This indicates that SMEs that embrace breakthrough technologies, reconfigure production factors innovatively, and pursue industrial upgrading tend to achieve superior collaborative innovation outcomes. Theoretically, this supports Dynamic Capability Theory (Teece, 2007), but it also highlights a tension: while NQPF exert a positive effect, their direct contribution is moderate compared to DT. This suggests that macro-level structural forces alone do not guarantee performance gains unless they are embedded in firm-level digital routines, a finding that nuances prior assumptions about productivity-led innovation (Wang et al., 2024).

As posited in H2, the relationship between NQPF and DT ($\beta = 0.437$, $t = 12.167$, $p < 0.001$) validates the idea that structural transformation stimulates digital adoption. For SMEs in second-tier cities of the Chengdu-Chongqing Economic Circle, this implies that policy-driven modernization is a necessary precursor to digital infrastructure. However, the strength of the subsequent link between DT and CIP raises a surprising insight: DT appears to be more than a pathway—it acts as a dominant driver that overshadows the direct influence of NQPF.

The strongest direct effect (H3) emerges between DT and CIP ($\beta = 0.616$, $t = 26.698$, $p < 0.001$). This supports Collaborative Innovation Theory (Liu et al., 2021), but also underscores a contradiction: why does DT exert nearly double the effect of NQPF on innovation outcomes? One interpretation is that in contexts where digital disparities remain high, the ability to digitally connect, share information, and orchestrate resources is immediately performance-relevant, whereas structural productivity gains may be slower to materialize. This finding adds to theoretical debates by suggesting that digital capability, rather than structural modernization, is the proximate enabler of collaboration.

Finally, the mediating effect of DT (H4) is significant ($\beta = 0.269$, $t = 12.676$, $p < 0.001$), highlighting that while NQPF provides strategic potential, it is DT that operationalizes this into collaborative outcomes. This layered mechanism confirms that productivity upgrades must be complemented by digital integration to yield tangible benefits (Merín-Rodríguez et al., 2024). The predictive relevance ($Q^2 = 0.340$ for CIP; $Q^2 = 0.187$ for DT) and explanatory power ($R^2 = 0.650$ for CIP; $R^2 = 0.191$ for DT) further support the robustness of the model.

Beyond the Chinese context, these findings also carry implications for international audiences. In emerging economies, similar dynamics may apply where structural reforms create conditions for DT, but digital maturity ultimately determines collaborative success. By contrast, in advanced economies with already high digital penetration, the marginal impact of DT may be weaker, and NQPF investments may play a stronger role in sustaining competitiveness. This comparative perspective highlights the transferability of our framework while acknowledging contextual variations.

6.0 Conclusion& Recommendations

6.1 Theoretical Implications

This study extends the application of DCT and CIT by unpacking how NQPF influence CIP through the mediating role of DT in SMEs within the CCEC. Beyond confirming direct and mediating effects, our findings reveal a theoretical tension: while NQPF provide the structural foundation for innovation, DT exerts a comparatively stronger effect on CIP, suggesting that latent productivity gains are insufficient without digital operationalization. This finding enriches DCT by highlighting digital capability as a necessary condition for resource reconfiguration to yield collaborative outcomes (Merin-Rodríguez et al., 2024). It also sharpens CIT by showing that digital ecosystems act as enabling infrastructures where structural productivity is translated into innovation synergies. Theoretically, this work contributes to debates on capability recombination by illustrating that NQPF alone cannot explain firm-level collaborative advantages; rather, the interplay with DT determines the extent of innovation performance in policy-driven regional clusters (Gao, 2024).

6.2 Policy and Managerial Implications

From a policy perspective, the results point to the need for more targeted interventions beyond general support for innovation. First, regional governments should launch SME digital literacy programs to reduce uneven capabilities across firms, ensuring that even traditional SMEs can integrate digital tools into collaborative projects (Gao et al., 2023). Second, differentiated strategies should be designed: traditional SMEs may require subsidies for basic digital infrastructure and training, while high-tech SMEs should receive incentives for advanced applications such as AI-driven manufacturing or green technologies (Cappa et al., 2021; Al-Omouh et al., 2022). Third, policies should encourage cross-regional digital collaboration frameworks, enabling SMEs in different provinces or industries to co-develop standards, share data securely, and reduce interoperability barriers.

For managers, actionable strategies emerge from the results. SMEs should establish internal digital readiness roadmaps, aligning NQPF adoption (e.g., robotics, cloud computing, renewable energy technologies) with organizational restructuring and talent reskilling. Managers of traditional SMEs can prioritize cost-effective digital solutions such as cloud-based collaboration, while high-tech SMEs should leverage advanced analytics and platform-based ecosystems to maximize innovation efficiency (Gao et al., 2024). Furthermore, SMEs should actively join platform-based innovation alliances where they can co-create and exchange knowledge, thereby reducing transaction inefficiencies and accelerating innovation cycles. These recommendations provide concrete pathways for aligning firm-level practices and regional policy with China's NQPF agenda.

6.3 Limitations and Future Research Avenues

This study is subject to several limitations. First, the use of a cross-sectional design limits the ability to infer causality. Longitudinal or panel studies are recommended to capture the dynamic evolution of NQPF and DT over time. Second, the study relied on self-reported data, which may be influenced by perceptual bias despite statistical checks for common method variance.

Future research could explore sectoral differences in the impact of NQPF, particularly between high-tech and traditional manufacturing industries. Additionally, examining the moderating role of organizational culture or absorptive capacity may offer deeper insights into the NQPF–DT–CIP pathway. Lastly, extending the research to other national innovation clusters or comparative studies between regions would enhance generalizability and policy relevance.

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Paper Contribution to Related Field of Study

This study constructs and validates the "NQPF–DT–CIP" model, enriching the theoretical framework of enterprise innovation and extending the application of new quality productive forces in the development of SMEs.

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