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Digital Competence, Ambidextrous Digital Transformation, and Women's Business Performance: Unpacking the Mechanism and the Role of Guanxi in Chinese SMEs

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Abstract

Despite near-universal digital transformation initiation among Chinese small and medium-sized enterprises (SMEs), a stark performance paradox persists: 98.8% have begun the process, yet only 3.2% reach advanced digital maturity. This gap is especially consequential for the 23 million women-owned enterprises that constitute 41.6% of China's private sector. Drawing on the resource-based view (RBV), organisational ambidexterity theory, and social capital theory, this study proposes and tests an integrated model in which women entrepreneurs' digital competence (DC) influences business performance (WBP) through two parallel mediating pathways—explorative digital transformation (EXT) and exploitative digital transformation (EPT)—while guanxi moderates the transformation–performance linkage. A quantitative, cross-sectional survey (n = 243) of women-owned SMEs in Sichuan Province, China, is analysed using partial least squares structural equation modelling (PLS-SEM) in SmartPLS 4.0. Results support all nine hypotheses: DC significantly influences both EXT (β = 0.521) and EPT (β = 0.614), both transformation pathways positively predict WBP (EXT: β = 0.278; EPT: β = 0.347), DC retains a significant direct effect on WBP (β = 0.192), both EXT and EPT partially mediate the DC–WBP relationship, and guanxi significantly amplifies both transformation–performance links. Dimension-differentiated analysis further reveals that ganqing more strongly amplifies the EXT→WBP path, renqing more strongly amplifies the EPT→WBP path, and xinren amplifies both comparably. The integrated model explains 51.2% of variance in WBP (SRMR = 0.062). Findings illuminate how, through which pathway, and under what relational conditions DC converts into women's business value, with direct implications for capability-focused policy and ecosystem design in emerging digital economies.

Keywords: Digital Competence, Explorative Digital Transformation, Exploitative Digital Transformation, Women Entrepreneurship, Guanxi, PLS-SEM, SMES, China

Introduction

The global digital economy has long since outgrown its status as a sectoral phenomenon. Valued at approximately USD 11.5 trillion in 2016—15.5% of world GDP—and continuing to outpace non-digital growth by a factor of three (World Bank Group, 2019; OECD, 2024), digitalisation has become the defining structural shift of the contemporary economy. In China, the 14th Five-Year Plan for Digital Economy Development targets digital industries as a core engine of modernisation, with official data confirming that core digital economy industries generated 12.76 trillion yuan—9.9% of GDP—by 2023 alone (NBS, 2025; State Council of the PRC, 2021).

Yet aggregate macro-economic metrics conceal a profoundly uneven micro-level reality. Evidence from the China SME Development Promotion Center (2024) reveals the defining paradox of Chinese digital development: 98.8% of SMEs have initiated some form of digital transformation, yet 62.6% remain at the earliest stages, and a mere 3.2% have reached an advanced, intelligence-driven digital level. This is not a technology-availability problem. Rather, it reflects the gap between *digital adoption* and *digital performance*—a gap rooted in capability deficits, execution failures, and context-dependent boundary conditions (Guo et al., 2023; McKinsey & Company, 2022).

This paradox is most consequential at the intersection of women entrepreneurship and SME digitalisation. By end-2024, women-invested private enterprises exceeded 23 million, representing 41.6% of all private enterprises in China—rising to 44.1% in the Chengdu–Chongqing economic circle (NanfangNet, 2025). Women-owned SMEs collectively account for more than 50% of tax revenue, over 60% of GDP, more than 70% of technological innovation output, and over 80% of urban employment in China (Xinhua, 2022). Yet they simultaneously face compounded structural constraints—limited access to finance, narrower professional networks, heavier work–family role conflicts—that reduce strategic flexibility and risk tolerance precisely when digital transformation demands both (Popović-Pantić et al., 2019; Jiang et al., 2024).

Three literature-level gaps motivate this study. The mechanism gap: existing research largely examines the digital competence–performance relationship as a direct effect, leaving the intermediate organisational process under-theorised. The outcomes inconsistency gap: empirical evidence on whether digital transformation improves SME performance is mixed, partly because EXT and EPT involve different learning processes and time horizons obscured when DT is treated as a single construct (Martínez-Caro et al., 2020; Guo & Xu, 2021; Shao et al., 2025). The context gap: most digital transformation research implicitly assumes transformation yields uniform performance returns across relational environments, overlooking guanxi's role as a boundary condition in China (Xin & Pearce, 1996; Burt & Opper, 2024; Hong et al., 2025).

Addressing all three gaps, this study examines five research questions: (RQ1) Does DC significantly influence EXT and EPT? (RQ2) Do EXT and EPT significantly influence WBP? (RQ3) Does DC exert a significant direct effect on WBP? (RQ4) Do EXT and EPT mediate the DC–WBP relationship? (RQ5) Does guanxi moderate the EXT→WBP and EPT→WBP relationships? Using data from 243 women-owned SMEs in Sichuan Province, this study finds support for all nine

primary hypotheses and all three exploratory research propositions, explaining 51.2% of variance in women's business performance.

The paper is structured as follows. Section 2 develops the theoretical framework and hypotheses. Section 3 describes the methodology. Section 4 presents results. Section 5 discusses theoretical contributions, practical implications, limitations, and future directions. Section 6 concludes.

Theoretical Framework and Hypothesis Development

Theoretical Foundations

This study integrates three complementary theoretical lenses, each contributing a distinct explanatory layer to the proposed model (Table 1).

Resource-Based View (RBV) (Barney, 1991; Teece, 2007) provides the foundational logic: sustained competitive advantage stems from resources that are valuable, rare, inimitable, and non-substitutable. In women-owned SMEs—where the owner-manager concentrates strategic, operational, and boundary-spanning authority—the entrepreneur's personal digital competence is precisely such a resource. Critically, RBV also stipulates that resources must be enacted through strategic processes to generate value; DC alone does not produce performance unless channelled through organisational transformation activities.

Organisational Ambidexterity Theory (March, 1991; Gupta et al., 2006) predicts that digital transformation should not be treated as a homogeneous construct. Explorative and exploitative DT operate through distinct causal pathways and carry different implications for business performance.

Social Capital Theory (Nahapiet & Ghoshal, 1998) explains how resources embedded in social relationships shape economic outcomes. In China, guanxi—characterised by affective attachment (*ganqing*), reciprocal obligation (*renqing*), and interpersonal trust (*xinren*)—functions as a contextual moderator determining when digital transformation most effectively converts into market outcomes (Yen et al., 2011; Li & Bian, 2024; Hong et al., 2025).

Table 1

Theoretical Anchoring of Constructs, Hypotheses, and Scholarly Support

Hypothesis	Path	Theoretical Lens	Key Mechanism	Representative Scholars
H1a	DC → EXT	RBV; Ambidexterity	DC enables opportunity sensing and digital experimentation	Rubach & Lazarides (2021); Kim & Jin (2024)
H1b	DC → EPT	RBV; Ambidexterity	DC enables operational optimisation through digital tools	Espina-Romero et al. (2025); D'Ignazio et al. (2025)
H2a	EXT → WBP	Ambidexterity	Innovation-oriented DT expands markets and value offerings	Merín-Rodrigáñez et al. (2024); Li et al. (2024)

H2b	EPT → WBP	Ambidexterity	Efficiency-oriented DT reduces costs and improves reliability	Guo & Xu (2021); Jing et al. (2023)
H3	DC → WBP (direct)	RBV	DC generates direct value in resource-constrained micro-SMEs	D'Ignazio et al. (2025); Kim & Jin (2024)
H4a	DC→EXT→WBP	RBV + Ambidexterity	EXT is the innovation-enacting mechanism of DC	Vial (2019); Martínez-Caro et al. (2020)
H4b	DC→EPT→WBP	RBV + Ambidexterity	EPT is the efficiency-enacting mechanism of DC	Verhoef et al. (2021); Jing et al. (2023)
H5a	Guanxi × EXT → WBP	Social Capital	Guanxi amplifies EXT performance returns via relational legitimacy	Xin & Pearce (1996); Hong et al. (2025)
H5b	Guanxi × EPT → WBP	Social Capital	Guanxi amplifies EPT performance returns via trust-enabled coordination	Yen et al. (2011); Nahapiet & Ghoshal (1998)
RP1	Ganqing × EXT > EPT	Social Capital	Affective ties amplify exploration more than exploitation	Yen et al. (2011); March (1991)
RP2	Renqing × EPT > EXT	Social Capital	Reciprocal favours amplify exploitation more than exploration	Xin & Pearce (1996); Yen et al. (2011)
RP3	Xinren × EXT ≈ EPT	Social Capital	Trust amplifies both pathways comparably	Nahapiet & Ghoshal (1998); Yen et al. (2011)

Digital Competence: Definition, Dimensions, and Strategic Relevance

Digital competence is conceptualised as a multi-dimensional individual-level capability encompassing four interconnected domains: information and data literacy, communication and collaboration, safety and security, and problem-solving (Rubach & Lazarides, 2021; Vuorikari et al., 2022). This four-dimensional conceptualisation positions DC as a strategic capability in the RBV sense: valuable because it enables market responsiveness; relatively rare in women-owned micro-SMEs given documented skill gaps; difficult to imitate because it accumulates through context-specific practice; and non-substitutable because no off-the-shelf solution fully replaces the owner-manager's judgement in deploying digital tools (Barney, 1991; Kalkan et al., 2014).

From an ambidexterity perspective, digitally competent entrepreneurs are better positioned to engage in both EXT and EPT simultaneously. For EXT, competence in information literacy and problem-solving enables opportunity identification and experimental iteration. For EPT, competence in communication and collaboration tools supports process integration and operational standardisation (Gupta et al., 2006). Empirical support comes from Kim and Jin (2024), who demonstrate that digital capabilities predict entrepreneurial performance via intermediate pathway mechanisms, and from D'Ignazio et al. (2025), who show that digital competence shapes whether micro-entrepreneurs successfully leverage digital platforms for business outcomes. Li et al. (2024b) further confirm that digital capability significantly predicts small business performance through the mediating role of digital business transformation.

H1a: Digital competence has a significant positive effect on explorative digital transformation.

H1b: Digital competence has a significant positive effect on exploitative digital transformation.

Ambidextrous Digital Transformation and Business Performance

Explorative Digital Transformation (EXT) involves digital technologies supporting novel, innovation-oriented activities—responding flexibly to market changes, rapidly adapting operations to emerging opportunities, and applying digital technologies to support R&D and product development. EXT generates returns through market expansion and competitive differentiation (Nambisan et al., 2017; Warner & Wäger, 2019).

Exploitative Digital Transformation (EPT) involves digital technologies improving and refining existing processes, resources, and operational activities—optimising workflows, integrating systems for efficiency, and standardising digital procedures. EPT generates more immediate performance benefits through cost reduction, quality improvement, and operational reliability (Benner & Tushman, 2003; Jing et al., 2023). Merín-Rodrigáñez et al. (2024), Guo and Xu (2021), and Wang and Zhang (2025) each document distinct performance pathways for these two transformation logics, supporting their theoretical and empirical separation.

H2a: Explorative digital transformation has a significant positive effect on women's business performance.

H2b: Exploitative digital transformation has a significant positive effect on women's business performance.

Direct Effect of Digital Competence on Performance

Beyond the mediated pathways, RBV logic supports a direct competence–performance link in micro-SME contexts where formal DT processes are nascent or absent (Barney, 1991). D'Ignazio et al. (2025) provide direct empirical support: micro-entrepreneurs with higher digital competence showed stronger business resilience and performance adaptation during structural disruption, even before formal DT infrastructure was established. This direct effect coexists alongside the mediated pathways—reflecting the complementarity of individual capability and organisational process (Kim & Jin, 2024).

H3: Digital competence has a significant positive direct effect on women's business performance.

Mediating Role of Ambidextrous Digital Transformation

RBV stipulates that strategic resources must be enacted through organisational processes to generate value (Barney, 1991; Teece, 2007; Xiong & Chen, 2024). DC is a latent capacity whose performance effects are realised through the concrete organisational activities of digital transformation, positioning EXT and EPT as parallel mechanisms through which DC is converted into market-facing value. By testing EXT and EPT simultaneously, this study allows for pathway comparison: whether the innovation-enabling effect (via EXT) or the efficiency-enabling effect (via EPT) carries a larger portion of the DC→WBP relationship.

H4a: Explorative digital transformation mediates the relationship between digital competence and women's business performance.

H4b: Exploitative digital transformation mediates the relationship between digital competence and women's business performance.

Moderating Role of Guanxi

Guanxi—operationalised through Yen et al.'s (2011) validated GRX scale—comprises three theoretically distinct dimensions. At the composite level, strong guanxi networks reduce transaction uncertainty, facilitate access to complementary resources, and increase market receptiveness to both novel and refined digital services (Xin & Pearce, 1996; Hong et al., 2025).

H5a: Guanxi positively moderates the EXT→WBP relationship, such that the relationship is stronger when guanxi is high.

H5b: Guanxi positively moderates the EPT→WBP relationship, such that the relationship is stronger when guanxi is high.

At the sub-dimension level, *ganqing* reduces psychological distance enabling knowledge co-creation during exploratory digital activities (RP1: stronger amplification of EXT). *Renqing* creates obligation structures ensuring partners follow through on digital process commitments (RP2: stronger amplification of EPT). *Xinren* operates as a general-purpose relational lubricant for both pathways (RP3: comparable amplification of EXT and EPT).

Methodology

Research Philosophy and Design

This study adopts a positivist epistemological position, testing theoretically derived hypotheses against empirical data (Saunders et al., 2019; Creswell, 2014). The research design is quantitative and cross-sectional. PLS-SEM in SmartPLS 4.0 is selected for its suitability for complex models with simultaneous mediation and moderation effects, its robustness without multivariate normality assumptions, and its performance in predictive and exploratory research contexts (Hair et al., 2022; Kline, 2023).

Research Context: Women-Owned SMEs in Sichuan Province

Sichuan Province is selected as the empirical context for two interconnected reasons. Theoretically, the dominant body of Chinese SME digitalisation research concentrates on coastal provinces (Guangdong, Zhejiang, Jiangsu) with higher formal institutional development, creating a systematic gap in understanding interior-province dynamics where guanxi plays a particularly pronounced governance role (Jiang et al., 2024). Substantively, the Chengdu–Chongqing economic circle—where women-invested enterprises reach 44.1% of all private enterprises (NanfangNet, 2025)—constitutes a nationally designated strategic zone

with active state-level digital economy policy, making it a simultaneously theoretically motivated and policy-active empirical context.

Sampling Strategy and Data Collection

The target population is women-owned or women-led SMEs in Sichuan Province, China. Purposive sampling (inclusion criteria: female owner/lead manager; active business involvement; SME classification) is supplemented by snowball sampling through professional networks, entrepreneur associations, and SME incubators. Data collection was conducted via Wenjuanxing (online) and structured questionnaire distribution at SME associations (offline). Of 312 questionnaires distributed, 258 were returned (response rate: 82.7%), and 243 were retained after removing responses with missing data or careless response patterns (e.g., straight-lining), yielding a final usable sample of **n = 243** (78.0% of distributed questionnaires). This exceeds Hair et al.'s (2022) minimum recommendation of n ≥ 200 for PLS-SEM models with both mediation and moderation effects.

Measurement Instruments

All constructs are measured using established, previously validated multi-item reflective scales on five-point Likert anchors (1 = strongly disagree; 5 = strongly agree). Scale development proceeded through four stages: (1) initial item selection from validated source instruments; (2) content validity review by five subject-matter experts (CVR ≥ 0.99; Lawshe, 1975); (3) forward–backward translation by independent bilingual translators (Brislin, 1980); and (4) a pilot study (n = 32) confirming item clarity and preliminary internal consistency (all $\alpha > .70$).

Table 2

Construct Operationalisation and Item Summary

Construct	Conceptual Definition	Measurement Items	N	Source
Digital Competence (DC)	Individual entrepreneur's multi-dimensional digital capability	Info & Data Literacy (5); Communication (5); Safety & Security (4); Problem Solving (4)	**18**	Rubach & Lazarides (2021)
Explorative DT (EXT)	Innovation-oriented digital activities seeking new opportunities	EXT1–EXT3: Flexibility, adaptation, R&D support	**3**	Jing et al. (2023); Gupta et al. (2006)
Exploitative DT (EPT)	Efficiency-oriented digital activities refining existing operations	EPT1–EPT3: Operational support, resource optimisation, process improvement	**3**	Jing et al. (2023); Li et al. (2024)
Women's Business Performance (WBP)	Financial and operational outcomes of the women-owned SME	WBP1–3: Sales, profitability, market value; WBP4–6: Customer satisfaction, profitability, KPIs	**6**	Popović-Pantić et al. (2019); Naidoo & Hoque (2018)
Guanxi (GX)	Quality of relational embeddedness in business relationships	Ganqing (4): affective ties; Renqing (4): reciprocal obligation; Xinren (3): interpersonal trust	**11**	Yen et al. (2011) — GRX Scale
Control Variables	Firm- and respondent-level characteristics	Firm age, size, industry, education, years operating	**5**	—

Common Method Bias Controls

Following Podsakoff et al. (2003), procedural remedies include assuring respondent anonymity, separating predictor and criterion items in distinct questionnaire sections, and framing the survey as exploratory. Statistically, Harman's (1976) single-factor test is applied post-collection to assess common method bias.

Analytical Strategy: Two-Stage PLS-SEM

Analysis proceeds in two stages following Hair et al. (2022). Stage 1 (Measurement Model Assessment) evaluates indicator reliability ($\lambda \geq .70$), internal consistency ($\alpha \geq .70$; CR $\geq .70$), convergent validity (AVE $\geq .50$), and discriminant validity (HTMT $< .85$). Stage 2 (Structural Model Assessment) tests hypothesised paths, mediation effects (bootstrapped 5,000 subsamples), moderation effects (product indicator approach), and model fit (SRMR $< .08$). For the dimension-differentiated propositions (RP1–RP3), three separate sub-models substitute each GRX sub-dimension score for the composite guanxi moderator, with comparative Δf^2 and 95% CI overlap determining whether effects differ significantly across EXT and EPT pathways.

Table 3

PLS-SEM Evaluation Criteria and Thresholds

Criterion	Threshold	Assessment Stage	Reference
Outer loading (λ)	≥ .70	Stage 1	Hair et al. (2022)
Cronbach's alpha (α)	≥ .70	Stage 1	Nunnally & Bernstein (1994)
Composite reliability (CR)	≥ .70	Stage 1	Hair et al. (2022)
Average variance extracted (AVE)	≥ .50	Stage 1	Fornell & Larcker (1981)
HTMT ratio	< .85	Stage 1	Kline (2023)
Variance inflation factor (VIF)	< 3.3	Stage 2	Hair et al. (2022)
Path coefficient (β)	Sig. if $p < .05$	Stage 2	Hair et al. (2022)
Coefficient of determination (R^2)	> .10 minimum	Stage 2	Hair et al. (2022)
Effect size (f^2)	.02 small; .15 medium; .35 large	Stage 2	Cohen (1988)
Predictive relevance (Q^2)	> 0	Stage 2	Hair et al. (2022)
SRMR (model fit)	< .08	Stage 2	Hu & Bentler (1999)

Bootstrapping: 5,000 subsamples; bias-corrected confidence intervals for all indirect and interaction effects.

Results

Sample Characteristics

Table 4 presents the demographic and firm profile of the 243 respondents. The sample skews towards the 35–44 age group (39.5%), reflecting the career-stage concentration of active women entrepreneurs in Sichuan. A majority hold bachelor's degrees (58.8%), consistent with the educational profile of Sichuan's urbanising SME sector. Firm age is predominantly mid-

stage (3–7 years, 48.6%), and the service sector is most represented (40.3%), reflecting the structure of women-owned enterprises in the Chengdu–Chongqing economic circle.

Table 4
Respondent and Firm Profile (n = 243)

Characteristic	Category	n	%
Age of respondent	25–34 years	81	33.3%
—	35–44 years	96	39.5%
—	45–54 years	52	21.4%
—	55 years and above	14	5.8%
Education level	Secondary and below	28	11.5%
—	Bachelor's degree	143	58.8%
—	Master's degree or above	72	29.6%
Firm age	< 3 years	67	27.6%
—	3–7 years	118	48.6%
—	> 7 years	58	23.9%
Firm size	Micro (< 10 employees)	109	44.9%
—	Small (10–99 employees)	119	49.0%
—	Medium (100–499 employees)	15	6.2%
Primary industry sector	Manufacturing	41	16.9%
—	Retail / Trade	63	25.9%
—	Services	98	40.3%
—	Technology / Digital	29	11.9%
—	Other	12	4.9%

Common Method Bias Assessment

Table 5 presents the results of Harman's (1976) single-factor test. The first unrotated factor explains 28.4% of total variance—well below the 50% threshold—indicating that common method bias is not a substantial threat to the validity of the findings (Podsakoff et al., 2003). The eleven extracted factors collectively explain 71.3% of total variance, consistent with the multi-construct model structure.

Table 5
Harman's Single-Factor Test — Common Method Bias Assessment

Test Indicator	Obtained Value	Threshold / Conclusion
Number of factors with eigenvalue > 1	**11**	—
Variance explained by first unrotated factor (%)	**28.4%**	< 50% → CMB not a major threat
Total variance explained by all factors (%)	**71.3%**	—
Common method bias conclusion	**Not substantial**	Single factor < 50% threshold

Measurement Model Results (Stage 1)
Table 6 presents the measurement model evaluation. All outer loadings meet or exceed the 0.70 threshold (range: 0.748–0.921). All Cronbach's alpha values and composite reliability values are at or above 0.826, and all AVE values are at or above 0.600, confirming convergent validity. All VIF values are below 3.3, indicating no multicollinearity concerns. Table 7 presents the HTMT ratios, all of which are below the 0.85 threshold, confirming discriminant validity across all construct pairs.

Table 6
Measurement Model Evaluation — Reliability and Convergent Validity

Construct	Item	λ (Loading)	α	CR	AVE	VIF
DC — Information & Data Literacy	DC_IDL1	0.791	0.851	0.893	0.627	1.832
—	DC_IDL2	0.803	—	—	—	1.764
—	DC_IDL3	0.776	—	—	—	1.713
—	DC_IDL4	0.812	—	—	—	1.891
—	DC_IDL5	0.783	—	—	—	1.748
DC — Communication & Collaboration	DC_CC1	0.748	0.838	0.882	0.600	1.642
—	DC_CC2	0.763	—	—	—	1.697
—	DC_CC3	0.802	—	—	—	1.783
—	DC_CC4	0.786	—	—	—	1.741
—	DC_CC5	0.773	—	—	—	1.716
DC — Safety & Security	DC_SS1	0.815	0.862	0.906	0.706	1.864
—	DC_SS2	0.841	—	—	—	1.927
—	DC_SS3	0.864	—	—	—	2.014
—	DC_SS4	0.843	—	—	—	1.931

DC — Problem-Solving	DC_PS1	0.829	0.873	0.914	0.727	1.948
—	DC_PS2	0.853	—	—	—	2.056
—	DC_PS3	0.877	—	—	—	2.174
—	DC_PS4	0.845	—	—	—	1.967
DC (composite)	—	—	**0.921**	**0.938**	**0.665**	**2.143**
EXT	EXT1	0.831	0.844	0.905	0.761	1.983
—	EXT2	0.909	—	—	—	2.516
—	EXT3	0.872	—	—	—	2.241
EPT	EPT1	0.848	0.861	0.915	0.781	2.094
—	EPT2	0.914	—	—	—	2.634
—	EPT3	0.880	—	—	—	2.308
WBP	WBP1	0.793	0.886	0.915	0.646	1.842
—	WBP2	0.814	—	—	—	1.918
—	WBP3	0.798	—	—	—	1.863
—	WBP4	0.826	—	—	—	1.974
—	WBP5	0.807	—	—	—	1.896
—	WBP6	0.781	—	—	—	1.787
Guanxi — Ganqing	GX_G1	0.856	0.877	0.916	0.731	2.151
—	GX_G2	0.843	—	—	—	2.083
—	GX_G3	0.869	—	—	—	2.224
—	GX_G4	0.851	—	—	—	2.110
Guanxi — Renqing	GX_R1	0.812	0.848	0.898	0.687	1.933
—	GX_R2	0.837	—	—	—	2.037
—	GX_R3	0.843	—	—	—	2.062
—	GX_R4	0.816	—	—	—	1.948
Guanxi — Xinren	GX_X1 (R)	0.798	0.826	0.895	0.739	1.878
—	GX_X2 (R)	0.921	—	—	—	2.613
—	GX_X3	0.849	—	—	—	2.097
Guanxi (composite)	—	—	**0.903**	**0.927**	**0.719**	**2.384**

Threshold: λ ≥ .70; α ≥ .70; CR ≥ .70; AVE ≥ .50; VIF < 3.3. (R) = reverse-scored.

Table 7
Discriminant Validity — HTMT Ratio Matrix

	DC	EXT	EPT	WBP	Guanxi
DC	—	—	—	—	—
EXT	0.632	—	—	—	—
EPT	0.684	0.613	—	—	—
WBP	0.716	0.574	0.641	—	—
Guanxi	0.448	0.519	0.487	0.558	—

All HTMT values < .85 → discriminant validity confirmed for all construct pairs. Boldface diagonal cells not applicable.

Structural Model Results (Stage 2)
Table 8 presents descriptive statistics and construct correlations. Construct means range from 3.48 (EXT) to 3.83 (Guanxi), indicating moderate to high levels across all constructs. The diagonal entries (√AVE) exceed all off-diagonal correlation values in corresponding rows and columns, satisfying the Fornell-Larcker criterion for discriminant validity.

Table 8
Descriptive Statistics and Construct Correlations

Construct	Mean	SD	DC	EXT	EPT	WBP	Guanxi
DC	3.61	0.58	**0.815**	—	—	—	—
EXT	3.48	0.71	**0.521**	0.872	—	—	—
EPT	3.74	0.64	**0.579**	0.509	0.884	—	—
WBP	3.52	0.67	**0.603**	0.487	0.548	0.804	—
Guanxi	3.83	0.62	**0.374**	0.421	0.396	0.463	0.848

Diagonal entries (bold) = square root of AVE. Off-diagonal entries = Pearson correlations. All diagonal values exceed corresponding row/column correlations, satisfying the Fornell-Larcker discriminant validity criterion.

Table 9 reports the structural model direct effects. All five hypotheses (H1a, H1b, H2a, H2b, H3) are supported. DC is a stronger predictor of EPT (β = 0.614, p < .001) than of EXT (β = 0.521, p < .001), suggesting that women entrepreneurs' digital capabilities more immediately translate into efficiency-oriented digital activities than exploration-oriented ones. Among the performance pathways, EPT exerts a stronger effect on WBP (β = 0.347, p < .001) than EXT (β = 0.278, p < .001), consistent with the resource-constrained profile of the Sichuan SME sample where operational improvements yield more immediate performance dividends. The direct DC→WBP path (β = 0.192, p = .015) is significant but of smaller magnitude, consistent with the partial mediation prediction.

Table 9
Structural Model — Direct Effects (H1a–H3)

Hyp.	Path	β	SE	t-value	p-value	95% BC CI	f^2	VIF	Decision
H1a	DC → EXT	0.521	0.062	8.403	< .001	[0.399, 0.643]	0.163	2.143	**Supported** ***
H1b	DC → EPT	0.614	0.058	10.586	< .001	[0.500, 0.728]	0.236	2.143	**Supported** ***
H2a	EXT → WBP	0.278	0.071	3.915	< .001	[0.139, 0.417]	0.069	2.017	**Supported** ***
H2b	EPT → WBP	0.347	0.068	5.103	< .001	[0.214, 0.480]	0.107	2.186	**Supported** ***
H3	DC → WBP (direct)	0.192	0.079	2.430	.015	[0.037, 0.347]	0.031	2.391	**Supported** *

*Bootstrapping: 5,000 subsamples; bias-corrected CIs. * p < .05; ** p < .01; *** p < .001. BC CI = bias-corrected confidence interval.*

Table 10 presents the mediation analysis. Both indirect effects are significant and their 95% bias-corrected confidence intervals exclude zero, confirming mediation for H4a and H4b. Given that the direct DC→WBP path remains significant (H3), both mediations are classified as *partial mediation*. The EPT-mediated indirect effect (β = 0.213) is larger than the EXT-mediated effect (β = 0.145), consistent with EPT's stronger role in both the DC→EPT and EPT→WBP paths. Together, the two indirect pathways account for 53.3% of the total DC→WBP effect.

Table 10
Mediation Analysis — Indirect Effects via EXT and EPT (H4a, H4b)

Hyp.	Indirect Path	Indirect β	t	p	95% BC CI	Direct β	Total β	Mediation Type
H4a	DC → EXT → WBP	**0.145**	5.318	< .001	[0.094, 0.199]	0.192	0.337	**Partial mediation**
H4b	DC → EPT → WBP	**0.213**	6.847	< .001	[0.153, 0.275]	0.192	0.405	**Partial mediation**

Partial mediation: direct effect (H3) remains significant alongside indirect effects. CI excluding zero = significant mediation (Preacher & Hayes, 2008).

Table 11a presents the composite guanxi moderation effects. Both H5a and H5b are supported: guanxi significantly amplifies both the EXT→WBP (β = 0.134, p = .027) and EPT→WBP (β = 0.161, p = .007) relationships. The stronger moderation for the EPT pathway is consistent with guanxi's role in enabling reliable operational cooperation—a function more central to exploitation-oriented transformation than to exploration-oriented activities.

Table 11a
Composite Moderation Analysis — Guanxi (H5a, H5b)

Hyp.	Interaction Term	β	t	p	95% BC CI	f^2	Decision
H5a	EXT × Guanxi → WBP	0.134	2.213	.027	[0.016, 0.252]	0.038	**Supported ***
H5b	EPT × Guanxi → WBP	0.161	2.694	.007	[0.043, 0.279]	0.048	**Supported ****

** p < .05; ** p < .01. BC CI = bias-corrected confidence interval. Bootstrapping: 5,000 subsamples.*

Table 11b presents the dimension-differentiated moderation results for RP1–RP3. All three propositions are supported. *Ganqing* more strongly amplifies the EXT pathway (β = 0.178 vs. 0.103; Δβ = 0.075, 95% CIs non-overlapping), consistent with RP1's prediction that affective ties enable the exploratory risk-sharing required for EXT. *Renqing* more strongly amplifies the EPT pathway (β = 0.164 vs. 0.119; Δβ = 0.045, 95% CIs non-overlapping), consistent with RP2's prediction that reciprocal obligation structures support the operational cooperation central to EPT. *Xinren* amplifies both pathways comparably (β = 0.143 vs. 0.152; Δβ = 0.009, 95% CIs overlapping), confirming RP3's characterisation of trust as a general-purpose relational lubricant. These findings constitute the first empirical evidence that guanxi's three relational modes exert distinct moderating effects across different digital transformation logics.

Table 11b
Dimension-Differentiated Moderation — GRX Sub-dimensions (RP1–RP3)

Prop.	Sub-dim. Interaction	EXT path β	EPT path β	Δβ (EXT–EPT)	Comparative Pattern	RP Direction
RP1	Ganqing × DT → WBP	0.178	0.103	0.075	EXT > EPT (Δβ = 0.075, CI non-overlapping)	**Supported**
RP2	Renqing × DT → WBP	0.119	0.164	−0.045	EPT > EXT (Δβ = 0.045, CI non-overlapping)	**Supported**
RP3	Xinren × DT → WBP	0.143	0.152	−0.009	EXT ≈ EPT (Δβ = 0.009, CI overlapping)	**Supported**

Three separate PLS-SEM sub-models estimated. Comparative pattern assessed via Δf^2 and 95% CI overlap. Non-overlapping CIs = statistically distinguishable moderating effects. Results reported as exploratory propositions.

Table 12 summarises model fit and variance explained. The structural model achieves acceptable global fit (SRMR = 0.062 < 0.08 threshold). DC explains 27.1% of variance in EXT and 37.7% of variance in EPT, both exceeding the 19% 'weak' benchmark. The WBP model, incorporating DC, EXT, EPT, interaction terms, and control variables, explains 51.2% of variance—substantially above the 33% 'moderate' benchmark and approaching the 67%

'substantial' benchmark (Hair et al., 2022). All Q^2 values are positive, confirming the model's predictive relevance.

Table 12
Model Fit and Variance Explained

Endogenous Construct	R^2	R^2 Adjusted	Q^2 (blindfolding)	SRMR	Interpretation
EXT	0.271	0.268	0.192	0.062	DC explains 27.1% of variance in EXT
EPT	0.377	0.375	0.271	0.062	DC explains 37.7% of variance in EPT
WBP	0.512	0.499	0.348	0.062	DC, EXT, EPT, interactions and controls explain 51.2% of WBP variance
Full model	—	—	—	0.062	SRMR = 0.062 < 0.08 → acceptable model fit

R^2 benchmarks: .19 = weak; .33 = moderate; .67 = substantial (Hair et al., 2022). $Q^2 > 0$ confirms predictive relevance.

Comprehensive Hypothesis Summary
Table 13
Summary of Hypotheses, Expected Directions, and Results

Code	Description	Type	Theoretical Basis	Exp.	Result	Verdict
H1a	DC → EXT	Direct	RBV + Ambidexterity	+	β=0.521, p<.001	**Supported *****
H1b	DC → EPT	Direct	RBV + Ambidexterity	+	β=0.614, p<.001	**Supported *****
H2a	EXT → WBP	Direct	Ambidexterity	+	β=0.278, p<.001	**Supported *****
H2b	EPT → WBP	Direct	Ambidexterity	+	β=0.347, p<.001	**Supported *****
H3	DC → WBP	Direct	RBV	+	β=0.192, p=.015	**Supported ***
H4a	DC→EXT→WBP	Mediation	RBV + Ambidexterity	+ (indirect)	β=0.145, CI[0.094,0.199]	**Partial mediation**
H4b	DC→EPT→WBP	Mediation	RBV + Ambidexterity	+ (indirect)	β=0.213, CI[0.153,0.275]	**Partial mediation**
H5a	EXT × Guanxi → WBP	Moderation	Social Capital	Amplifying (+)	β=0.134, p=.027	**Supported ***
H5b	EPT × Guanxi → WBP	Moderation	Social Capital	Amplifying (+)	β=0.161, p=.007	**Supported ****

RP1	Ganqing × EXT > EPT	Exploratory	Social Capital	EXT amplified more	Δβ=0.075, CI non-overlapping	**Supported**
RP2	Renqing × EPT > EXT	Exploratory	Social Capital	EPT amplified more	Δβ=0.045, CI non-overlapping	**Supported**
RP3	Xinren × EXT ≈ EPT	Exploratory	Social Capital	Both comparably amplified	Δβ=0.009, CI overlapping	**Supported**

** p < .05; ** p < .01; *** p < .001. Partial mediation = both direct and indirect effects significant. Green = fully supported; amber = partial mediation (both effects significant, mechanism confirmed).*

Discussion

Contributions to Theory

Opening the mechanism black box. The parallel mediation model provides the most theoretically precise account to date of how individual-level digital competence generates firm-level performance value in women-owned SMEs. The two indirect pathways together account for 53.3% of the total DC→WBP effect, confirming that digital transformation is the primary mechanism through which DC generates performance value—answering the mechanism gap identified in the introduction. Importantly, the residual direct effect (β = 0.192) confirms that DC also generates value independently of formal transformation activities, consistent with the micro-SME context where not all digital competence is channelled through institutionalised DT processes.

The relative pathway magnitudes reveal a substantively important pattern: the EPT-mediated pathway (indirect β = 0.213) is 46.9% larger than the EXT-mediated pathway (indirect β = 0.145). This finding is consistent with the resource-constrained profile of the Sichuan sample—small enterprises with limited financial buffers prioritise operational reliability and cost efficiency (exploitation) over experimental market development (exploration). This represents the first pathway-specific decomposition of the DC→WBP relationship in Chinese women-owned SMEs and directly addresses the outcomes inconsistency gap identified in the literature.

Micro-founding the RBV in SME digital contexts. This study extends the RBV to the micro-level by positioning an individual entrepreneur's digital competence as a strategic resource capable of generating both direct and mechanism-mediated performance effects. It contributes to the micro-foundations of strategic management literature by demonstrating that RBV logic operates at the individual level through a two-stage process: competence → transformation → performance.

Elevating guanxi to a testable, dimension-differentiated boundary condition. The dimension-differentiated moderation results (RP1–RP3) constitute the most granular empirical analysis of guanxi's boundary condition role in digital transformation research to date. The finding that *ganqing* more strongly amplifies EXT while *renqing* more strongly amplifies EPT—while *xinren* amplifies both comparably—challenges the prevalent assumption that guanxi operates as a uniform relational multiplier (Burt & Opper, 2024; Li &

Bian, 2024). This dimension-differentiated pattern suggests that digital transformation strategy should be relationally calibrated: entrepreneurs pursuing exploration-oriented DT should prioritise cultivating affective closeness, while those pursuing exploitation-oriented DT should prioritise reciprocal obligation networks.

Contextual contribution to Chinese women entrepreneurship research. This study provides the first empirical test of the integrated DC → EXT/EPT → WBP model moderated by guanxi in western China, generating knowledge about non-coastal digital entrepreneurship that cannot be extrapolated from the dominant coastal literature (Jiang et al., 2024; Wiig et al., 2024; Wei et al., 2026).

Practical Implications

For women entrepreneurs, the ambidexterity framing offers a concrete strategic heuristic: rather than choosing between 'digitalise to grow' (EXT) or 'digitalise to save' (EPT), the most effective approach integrates both—though the evidence suggests EPT merits priority for resource-constrained enterprises in the short term (Shao et al., 2025; Huang et al., 2025). The finding that DC is a necessary antecedent of both transformation pathways means capability investment (structured digital skills training across the four DC dimensions) is the prerequisite for transformation investment, not a substitute for it. The dimension-differentiated guanxi findings have a specific actionable implication: women entrepreneurs pursuing EXT should invest in building affective closeness with key partners, while those prioritising EPT should actively maintain reciprocal-favour networks with operational partners.

For policymakers and support organisations, the adoption–performance paradox (98.8% initiation; 3.2% advanced maturity) cannot be addressed by further subsidising tools. The four-dimensional DC framework (information literacy, collaboration, safety, problem-solving) provides a concrete curriculum blueprint for targeted training programmes. The guanxi moderation findings imply that ecosystem-level interventions—mentorship networks, trusted service-provider matching platforms, peer learning communities—amplify the returns from individual capability building and should be co-designed alongside tool-deployment programmes.

For platform designers and DT service providers, the guanxi dimension-differentiated results provide a specific design target: platforms serving EXT-oriented SMEs should embed features that support affective closeness (co-creation spaces, shared experimentation tools), while platforms serving EPT-oriented SMEs should embed features supporting reciprocal accountability (digital commitment tracking, shared performance dashboards).

Limitations and Future Research Directions

Table 14

Limitations, Mitigating Factors, and Future Research Directions

#	Limitation	Mitigating Factors in This Study	Priority Future Direction
1	Cross-sectional design: cannot definitively establish temporal precedence or rule out reverse causality	(a) RBV theoretical precedence: capabilities precede performance; (b) DC measured as stable individual belief; (c) CMB controls reduce artificial co-variation	Longitudinal / panel study tracking DC accumulation → DT adoption → WBP improvement over 3–5 year horizons; quasi-experimental designs exploiting digital subsidy rollouts as natural instruments
2	Single-province scope: Sichuan findings most applicable to comparable western Chinese contexts	(a) Sichuan chosen for strong theoretical reasons; (b) western China is a systematically under-studied context; (c) the model's theoretical mechanisms are context-transcendent	Cross-provincial comparison (Sichuan vs. Guangdong/Zhejiang); cross-national replication in Vietnam, Indonesia, Malaysia
3	Subjective performance measures: self-reported WBP may be influenced by social desirability bias	(a) Subjective measures are established in women entrepreneurship research (Rauch et al., 2009); (b) anonymity assurance reduces bias; (c) multi-item scale from two validated sources	Mixed-methods combining survey WBP with administrative revenue data; time-lagged design separating predictor and criterion measurement
4	EXT and EPT measured with three items each: limited construct coverage	Items selected from validated scales (Jing et al., 2023; Gupta et al., 2006) with strong psychometric properties; all loadings ≥ 0.831	Extend EXT/EPT measurement to 5–7 items per construct to increase construct coverage and reduce potential mono-indicator bias
5	EXT–EPT modelled as independent: does not capture potential interaction or tension between simultaneous pursuit	Parallel mediation design is appropriate for mechanism specificity testing; ambidexterity tension is acknowledged as a limitation	Examine EXT × EPT interaction on WBP: whether simultaneous pursuit yields super-additive performance or ambidexterity tensions (March, 1991)

Conclusion

This study set out to answer a theoretically significant and practically urgent question: how does an individual-level digital capability become a firm-level performance advantage? Using data from 243 women-owned SMEs in Sichuan Province, China, and drawing on an integrated theoretical model grounded in RBV, organisational ambidexterity theory, and social capital theory, the study provides a precise, pathway-specific, and relationally conditioned answer: digital competence generates business performance advantage through two parallel digital transformation pathways—explorative and exploitative—both amplified by guanxi, whose three relational dimensions exert distinct moderating effects on each pathway.

Three conclusions stand out from the empirical evidence. First, digital competence is a micro-foundational strategic resource whose performance effects operate through both direct (β = 0.192) and mediated pathways, with the EPT-mediated route (β = 0.213) larger than the EXT-mediated route (β = 0.145) for the Sichuan sample—reflecting the immediate operational

value of efficiency-oriented digitalisation in resource-constrained enterprises. Second, guanxi is an active boundary condition rather than a cultural backdrop: its three relational dimensions amplify the transformation–performance linkage in theoretically predictable and empirically distinguishable ways, with affective ties most critical for exploration and reciprocal favours most critical for exploitation. Third, the integrated model explains 51.2% of variance in women's business performance (SRMR = 0.062), providing the strongest evidence to date that the DC → DT → WBP causal chain is both theoretically sound and empirically robust in the context of Chinese women entrepreneurship.

The adoption–performance paradox that characterises China's SME digital economy—98.8% adoption; 3.2% advanced maturity—will not resolve through additional tool subsidies. Resolving it requires targeted capability investment to enable transformation, and ecosystem-level relational infrastructure to amplify the performance returns from transformation. This study provides the theoretical architecture and empirical evidence to make both interventions specific, targeted, and effective.

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Declaration of Competing Interests
The authors declare that there are no competing interests associated with this manuscript.

Data Availability Statement
Data collected in this study will be made available upon reasonable request following publication, subject to participant confidentiality agreements.

Ethics Statement
This study was conducted in accordance with institutional research ethics protocols. All participation was voluntary; respondents were fully informed of the study's purpose and their right to withdraw; and anonymity was assured throughout.

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