ISSN 2409-2665
Journal of Logistics, Informatics and Service Science
Vol. 12 (2025) No. 9, pp. 86-104
DOI:10.33168/JLISS.2025.0906

From Path Dependence to Path Creation: A Mixed-Methods Analysis of Innovation Strategy and Capability Building in Wenzhou's Footwear Cluster

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Abstract. To explore the transformation mechanism of traditional industrial clusters in overcoming path dependence, this study takes the Wenzhou footwear industry as a sample and, based on the "cluster embedded innovation" framework, employs a hybrid approach combining qualitative and quantitative methods (including semantic network analysis and interruption time series analysis). The results show that innovation strategies improve performance through a dual-mediating effect of enterprise innovation capability (path coefficient 0.711, $p<0.001$) and technological R&D capability (0.271, $p<0.001$), and this transformation process is significantly moderated by income level and market competition. Theoretically, this study reconstructs the explanatory framework of the Wenzhou model, revealing the realization mechanism of cluster path creation under embedded constraints; practically, it provides empirical evidence for enterprise R&D investment decisions and policy ecosystem optimization.

Keywords: Wenzhou model; industrial clusters; cluster embedded innovation; path dependence; hybrid approach

1. Introduction

The rise of Wenzhou's footwear industry epitomizes the transformation of Chinese regional clusters from peripheral embedding to value upgrading after the Reform and Opening-Up. Its evolution intertwines institutional change, global division of labor, and technological progress, illustrating both the challenges and opportunities of late-developing economies in the restructuring of global value chains. The key question remains how developing countries can upgrade from OEM (Original Equipment Manufacturer) to OBM (Original Brand Manufacturer). Existing studies often separate external shocks from internal capabilities (Gereffi, 2019), making it difficult to explain why firms within the same cluster display divergent paths.

Since the 1980s, Wenzhou has built a networked private economy characterized by flexible specialization and trust-based collaboration (Huang et al., 2007). This enabled rapid integration into global value chains, but as competition intensified and labor costs rose, differentiation emerged: some firms advanced through technological and design innovation, while others became locked in low-end operations (Luo, 2016). The dual nature of cluster networks—facilitating knowledge diffusion yet reinforcing path dependence deepens this divergence (Huang & Zhang, 2008). Government intervention, such as the "brand-driven city" policy, further reshaped upgrading incentives and revealed asymmetrical effects across firm sizes (Jin Hua, 2023).

Overall, the industry's shift from OEM to OBM is driven by the combined effects of external markets, technology, and policy. Yet this process is dynamic and nonlinear, influenced by crises, institutional shifts, and firm heterogeneity.

Since 2020, digitalization and green transformation have imposed dual pressures on the industry, exposing new theoretical and practical challenges. In the digital sphere, technologies such as AI, 3D design, and industrial internet are transforming supply chains (Oliveira et al., 2021), yet SMEs face the "Matthew effect" due to resource and capability gaps (Ni, 2020; Teng et al., 2024). In the green dimension, carbon-reduction and sustainability demands compel firms to balance cost control and environmental governance. While bio-based materials and circular design offer new solutions (García & Prieto, 2018), most SMEs remain at the end-of-pipe stage, and only leading firms achieve green upgrading through global collaboration (Song et al., 2022).

The interaction between digital and green transitions is neither purely synergistic nor purely competitive; it often oscillates between complementarity and resource conflict (Teng et al., 2024). Within clusters, this duality is magnified by firm heterogeneity—large firms integrate green innovation from the source, whereas SMEs are constrained by limited resources and technical capabilities.

2. Literature Review and Research Hypotheses

2.1 Innovation Strategy and Performance Path of Wenzhou Footwear Industry

The innovation trajectory of Wenzhou's footwear industry reflects the joint influence of external institutional change, internal capability evolution, and cluster network embedding. Prior studies emphasize three perspectives: (1) external shocks such as policy, market, and trade pressures that reshape innovation (Gereffi, 2019; Wei, 2009); (2) internal capabilities including organizational learning and dynamic capabilities for responding to uncertainty (Teece, 2007; Ghinoi et al., 2024); and (3) cluster effects derived from social capital and knowledge spillovers (Bathelt et al., 2004; Jin Hua, 2023).

However, these perspectives are often fragmented. The evolution of Wenzhou's footwear industry reveals a dynamic mechanism of external pressure—capability adjustment—cluster support, where institutional reforms and trade barriers stimulate strategic responses (Wang, 2011), internal learning provides the foundation for adaptation (De Massis et al., 2016), and cluster networks facilitate resource sharing and diffusion (Raimbault, 2022). The innovation process is thus a dynamic, interactive system shaped by environmental triggers, internal responses, and cluster-based diffusion.

Within clusters, enterprises first benefit from spatial proximity and trust that encourage incremental innovation (Jin Hua, 2023; Bathelt et al., 2004). As the cluster expands, however, a center–periphery structure emerges: leading firms globalize while smaller firms remain locked in low-end competition (Gereffi et al., 2021). Excessive local embeddedness can also cause path dependence and innovation inertia (Zheng & Li, 2019). Hence, cluster networks serve as both the incubator and the constraint of innovation. Understanding how firms "unlock" from such dependence through cross-level restructuring remains an important research direction.

The dual transformation of digitalization and greening adds new complexity. Digital technologies enable efficiency gains (Teng et al., 2024), while green innovation responds to sustainability and carbon reduction pressures (García & Prieto, 2018). Yet most SMEs lack sufficient resources, facing a "digital–green trade-off" (Jin Hua, 2023). The synergy between digital and green innovation depends on firm size and capability: large firms integrate both through resource redundancy, whereas SMEs must prioritize one dimension (Song et al., 2022). In essence, dual transformation reflects the dynamic balance between external pressures, internal capabilities, and cluster support rather than a linear process of simultaneous advancement.

In summary, innovation in Wenzhou's footwear industry forms a multi-dimensional interactive system. External shocks act as triggers, internal capabilities as transformation mechanisms, and cluster embedding as diffusion mechanisms. The main limitation of existing studies lies in their failure to reveal the coupling logic among these three forces.

2.2 Research Gaps and Analytical Framework

Although previous research provides valuable insights into the evolution and drivers of Wenzhou's footwear industry, three gaps remain. First, integration across perspectives is insufficient—external shocks and internal capabilities are often examined separately, lacking a unified analytical framework that reveals their dynamic interaction. Second, micro-level heterogeneity within clusters remains underexplored, and little empirical work explains why firms adopt divergent strategies under similar environments. Third, the literature on digital and green transformation focuses mainly on macro-level synergy, neglecting enterprise-level constraints and trade-offs (Teng et al., 2024).

To address these gaps, this study develops an integrated Strategy–Capability–Environment (SCE) Framework. It conceptualizes innovation as a dynamic linkage: environmental changes trigger strategic responses, which are executed through firm capabilities within a cluster-supported context. Innovation strategy represents the firm's core action choice and includes three types: (1) outsourcing collaboration through global digital platforms; (2) independent breakthrough via internal R&D and branding; and (3) network cooperation leveraging cluster partnerships. These strategies may coexist and evolve dynamically. Dynamic capabilities serve as the mediating mechanism that transforms strategy into performance, encompassing opportunity sensing, resource acquisition, and reconfiguration (Teece, 2007). The market and institutional environment form the external boundary, including global value chain governance, industrial policy, competition intensity, and green trade barriers. These contextual factors both constrain and enable firms' innovation choices.

This framework posits that innovation performance results from an interactive process where firms perceive environmental changes, select appropriate strategies, and realize performance outcomes through capability execution. It links the macro context (environment), meso mechanism (strategy), and micro foundation (capability).

The theoretical contribution of this framework lies in three aspects. First, it integrates global value chain, dynamic capability, and embeddedness theories, providing a more comprehensive analytical lens than single-perspective studies. Second, it clarifies the mechanism linking strategy, capability, and performance, highlighting the mediating role of firm capabilities and the moderating role of the market environment. Third, it offers practical value by identifying differentiated transformation paths for enterprises of varying sizes and resources, thereby informing both enterprise strategy and policy design.

3. Theoretical Model and Research Hypotheses

3.1 Theoretical Construction of Cluster Embedded Innovation Framework

Under intensified market competition and industrial upgrading, the effectiveness of enterprise innovation strategies is deeply shaped by their cluster environment (Porter, 1990). Existing theories such as the resource-based view and dynamic capability theory (Wang & Ahmed, 2007) explain firms' internal advantages but overlook the social and institutional contexts in which cluster members operate (Huang & Zhang, 2008). Porter's cluster theory emphasizes geographical advantages but fails to account for firm-level heterogeneity, while the "local buzz and global pipeline" model (Bathelt et al., 2004) lacks a systematic explanation of firm-specific innovation paths.

Drawing on global value chain theory (Gereffi, 1999) and studies on Wenzhou's clusters (Huang et al., 2007), this paper proposes a cluster-embedded innovation framework. It argues that firm innovation performance depends on how enterprises construct and apply innovation strategies within contexts shaped by family governance, informal institutions, and path dependence (De Massis et al., 2016; Liu, 2009; Gereffi et al., 2021). The framework emphasizes two core ideas: first, that dynamic capabilities are constrained and shaped by local relational networks and imitation patterns; and second, that firms can overcome lock-in effects and achieve path creation through differentiated embedding and disembedding strategies. This provides a contextual foundation for the hypotheses that follow and explains the distinct innovation mechanisms within Wenzhou's footwear industry.

3.2 Formulation of Research Hypotheses

Innovation strategy refers to an enterprise's systematic planning to obtain sustainable competitive advantages (Gatignon & Xuereb, 1997). In the Wenzhou footwear cluster, strategic effectiveness depends on internal capability restructuring and contextual influences such as family governance, institutional support, and cluster density. Following the resource-based view and dynamic capability theory (Teece, 2007), this study posits that innovation strategies enhance performance through capability transformation, moderated by family control and cluster environment.

H1: Within the Wenzhou footwear industry cluster, a firm's innovation strategy has a direct effect on its innovation performance.

H2: A firm's innovation strategy positively influences innovation performance indirectly through the enhancement of its innovation capability.

H3: A firm's innovation strategy positively influences innovation performance indirectly through the improvement of its technological R&D capability.

Family governance, a defining feature of Wenzhou firms, shapes strategic orientation and resource allocation. While long-term commitment strengthens cohesion, it can restrict external knowledge integration. Considering the joint influence of governance, income, and institutional context, the following hypothesis is proposed:

H4: Income level and the strength of family governance jointly and positively moderate the relationship between innovation strategy and technological R&D capability.

Dense cluster networks in Wenzhou encourage knowledge diffusion but may also create rigidity and path dependence (Zheng & Li, 2019). Under strong competition and network embeddedness, firms must rely on internal innovation capacity to achieve differentiation and escape structural constraints. This leads to:

H5: Market competition intensity and cluster density jointly and positively moderate the relationship between firm innovation capability and innovation performance.

Based on the above, innovation strategy influences performance through a dual-mediation mechanism involving innovation and R&D capabilities, under multiple contextual moderators. Hence:

H6: Within the Wenzhou footwear industry cluster, a firm's innovation strategy influences

innovation performance through the dual mediating effects of innovation capability and technological R&D capability.

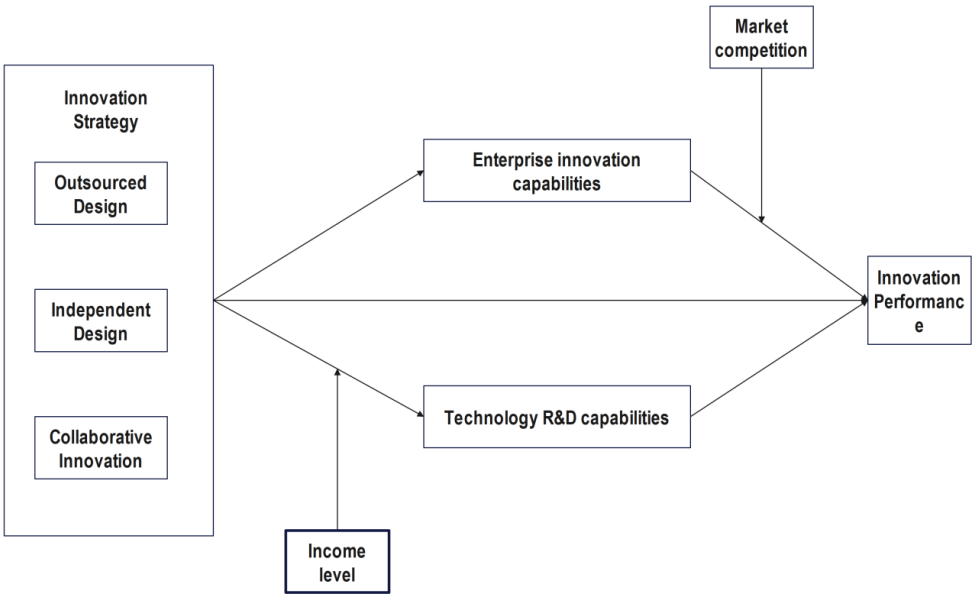

Fig.1: Hypothesis Model Diagram

The theoretical model integrates the resource–capability–performance path with dynamic capability theory, contextualized within Wenzhou's institutional and governance setting. Innovation strategy, as the independent variable, is measured through continuous investment, structured innovation, and external R&D cooperation using a 5-point Likert scale (Gunday et al., 2011; Calantone et al., 2002). The mediating variables, innovation capability and technological R&D capability, represent an enterprise's organizational and technical competence for innovation (Lawson & Samson, 2001; Cohen & Levinthal, 1990; Saunila, 2014). Innovation performance, as the dependent variable, captures product outcomes, process improvement, and market expansion, following the Oslo Manual (OECD, 2005) and Subramanian & Nilakanta (1996). Moderating variables include income level (Chen & Liu, 2022) and market competition intensity (Porter, 1990; Zahra & Covin, 1993). All measurement scales were adapted to the Wenzhou context and pre-tested to ensure validity, while firm size and product type were controlled to enhance model robustness. Overall, this framework captures the dynamic linkage among strategy, capability, and performance under the unique Wenzhou model, combining theoretical rigor with contextual applicability. Subsequent sections elaborate on data collection, sample characteristics, and empirical validation of the proposed hypotheses.

4. Exploration and Analysis

4.1 Interview Analysis

A systematic qualitative analysis was conducted on interview data from Wenzhou footwear enterprises using grounded theory. Through three levels of coding with Nvivo, 60 open codes were refined into 14 axial categories and ultimately condensed into three core dimensions: enterprise capability building, innovation strategy paths, and market–institutional environment. These categories form an integrated framework explaining the transformation of cluster firms from imitation to innovation.

Capability building is central to this transformation. Interviews indicate that firms flexibly adjust R&D spending with revenue changes, revealing dynamic resource allocation abilities. Leading companies maintain long-term R&D during downturns, while smaller firms cut expenditures when profits fall. This adaptability reflects the moderating role of income in innovation. Firms also display strong responsiveness by using digital tools for product testing and customer segmentation, accelerating

market feedback and product iteration. Cross-sector collaboration with universities and global suppliers enhances technological diversity and breaks the homogeneity of local networks. Governance reform, such as adopting professional management during generational transitions, strengthens organizational capacity and risk resilience. Crises like the 2008 recession and the COVID-19 pandemic further stimulated internal capability reconstruction, confirming resilience as a key element of sustained innovation.

Innovation strategy choices reflect how enterprises align internal capabilities with market dynamics. Three paths dominate: supply chain and channel innovation, strategic repositioning, and digital–green transformation. Many firms leverage cluster-based collaboration to shorten delivery times and enhance e-commerce conversion, while others pursue branding and niche markets to upgrade from OEM to OBM. Digital and green initiatives, including ERP integration and eco-material R&D, have improved efficiency and fostered sustainable competitiveness. User-oriented innovation underpins all paths, with firms tailoring products to different income groups through scenario design and emotional value creation, reflecting how market competition shapes the innovation–performance relationship.

The external environment acts both as constraint and catalyst. Globalization compels firms to pursue high- and low-end markets simultaneously, while local government policies—such as financial support for "benchmark" exporters—help ease resource shortages. The tension between imitation culture and intellectual property enforcement now pushes firms toward genuine innovation. Executives note that competition with global brands increases R&D commitment and cost efficiency. Despite resource pressures, most firms follow a principle of cost-controllable innovation, ensuring profitability alongside transformation.

Synthesizing the three core categories yields a dynamic "environment–capability–strategy" framework: external pressures such as competition and regulation drive firms to reconfigure resources and networks, leading to strategic transformations in supply chains, digitalization, and sustainability. This framework explains how Wenzhou footwear enterprises evolve from path dependence to path creation, providing qualitative evidence for the mediation and moderation mechanisms later tested in the quantitative model.

4.2 Interruption Time Series Analysis

To evaluate the impact of the COVID-19 shock on Wenzhou footwear enterprises, the pandemic of 2020 was treated as an exogenous event and analyzed using an interrupted time series regression. The model examined financial indicators including net profit margin to gross profit margin, operating cash flow to revenue, and R&D expenditure. Firm fixed effects and enterprise-specific trends were incorporated to control heterogeneity. This approach allowed comparison of pre- and post-pandemic patterns and revealed how firms adjusted profitability, liquidity, and innovation under external shocks.

Table 1. Quasi-natural experiment results of the impact of the epidemic on the operating performance of listed footwear companies in Wenzhou.

Indicator	Overall Trend	Pandemic-Year Effect	Long-Term Trend	Main Findings
Net profit margin / gross profit margin	-0.031***	+0.075 (ns)	−0.013 (ns)	Overall decline; heterogeneity across firms.
Operating cash flow / revenue	Stable	+0.067**	−0.077***	Short-term recovery, long-term deterioration.
R&D expenses	Stable	−40.6 (ns)	−13.3 (ns)	Limited impact; firm C increased +29.6***.
R&D investment → revenue	—	—	−114.3***	R&D drives growth (+41.8 per 1M RMB invested).

Wenzhou. The net profit margin ratio declined significantly before the pandemic (− 0.031, $p < 0.001$), rose insignificantly during it (+0.075), and remained weak thereafter (− 0.013). Companies A, B, and C recorded further declines, company D was stable, and company E showed mild improvement, indicating differentiated cost-control responses.

The operating cash-flow ratio was stable before the pandemic, improved temporarily during it (+0.067, $p = 0.015$), but dropped afterward (− 0.077, $p < 0.001$), reflecting a short-term boost followed by persistent weakening. Firms A and E continued to deteriorate, while B, C, and D remained unchanged.

R&D expenditure showed no significant overall variation: stable before the shock, a non-significant decline during the pandemic, and limited recovery afterward. Only company C increased R&D substantially (+29.6, $p < 0.001$), confirming that strategic heterogeneity, rather than the pandemic itself, explained investment differences. Regression results further demonstrated that every additional RMB 1 million in R&D corresponded to roughly RMB 41.8 million in revenue ($p < 0.001$). Although the pandemic had no significant contemporaneous effect on revenue, it weakened long-term growth (− 114.3, $p = 0.002$), implying that external shocks reduce future expansion rather than current profits.

Overall, the industry displayed a mix of short-term resilience and long-term decline. Profitability and cash-flow quality weakened across most firms, while R&D investment remained uneven but crucial to sustaining growth. The evidence suggests that stable innovation spending serves as an effective buffer against external shocks, enabling firms to preserve competitiveness despite revenue volatility.

4.3 Enterprise Semantic Social Network Analysis

A semantic social network of innovation in Wenzhou's footwear industry was constructed through a high-frequency co-occurrence analysis of interview texts. Paragraph-level co-occurrence was defined as the criterion for association: when two codes appeared in the same paragraph, they were considered linked, and the co-occurrence frequency served as the edge weight. Node attributes were aligned to their main and subcategories to ensure consistency between network structure and theoretical logic. Semantic units were standardized through synonym unification and contextual validation to maintain conceptual clarity and eliminate random co-occurrences, ensuring theoretical reliability.

To retain the completeness of the corpus, all co-occurrence relationships were preserved, and their frequencies were used to indicate connection strength. Node word frequency served as its weight to highlight the relative importance of concepts in visualization. Three indicators were used to characterize the network: density, reflecting the overall connectedness of concepts; modularity, describing topic differentiation; and the average clustering coefficient, indicating local cohesion among related concepts. These indicators together reveal the general semantic topology of innovation cognition in Wenzhou footwear enterprises.

Table 2. Degree centrality and betweenness centrality of the social network in Wenzhou's footwear industry

Category	Node	Freq.	Degree	Betweenness	Interpretation
Innovation	Supply Chain	385	1	0.255	Central hub of innovation network.
Product	Footwear Products	170	0.818	0.291	Bridge between technology and market.
Management	Business Model	114	0.636	0.109	Connects R&D, marketing, and performance.
Technology	Technological Innovation	159	0.455	0.000	Internal driver, low bridging effect.
Material	Material Tech / Quality / Manufacturing	—	Low	0.000	Peripheral, execution-level nodes.

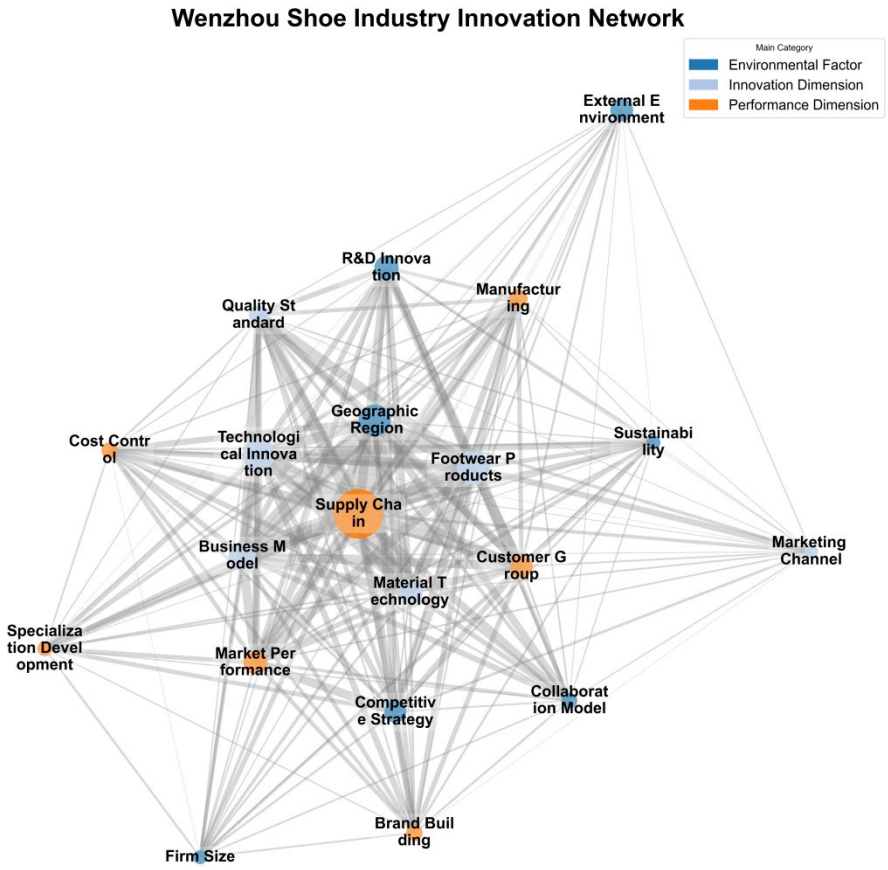

Fig.2: Wenzhou Shoe Industry Innovation Network

The supply chain appears as the most influential node, with the highest frequency (385), degree centrality (1.000), and a betweenness centrality of 0.255. It functions as a hub linking innovation, performance, and management elements, showing that cluster-based supply chain systems remain the foundation of innovation activities. The footwear product node (degree 0.818; betweenness 0.291) plays a strong bridging role between technical innovation and market performance, demonstrating that product-centered innovation is the core link between upstream technology and downstream demand. Business model innovation also exhibits high centrality (0.636) and moderate betweenness (0.109), reflecting its mediating role in coordinating R&D, marketing, and performance. In contrast, technological innovation and material technology have moderate degrees (0.455) but near-zero betweenness, suggesting limited cross-domain integration. Other nodes, such as quality standards and manufacturing, remain peripheral and operational in nature.

In the performance dimension, market performance (degree 0.364) connects both financial and market subcategories, serving as a key indicator of innovation outcomes. The customer group node, though frequent, lacks bridging power, and R&D innovation, while mentioned across categories, remains a specialized rather than integrative concept. Within environmental factors, geographic region has moderate importance (degree 0.455) but minimal bridging function, while competitive strategy remains marginal, reflecting fragmented attention to competitive positioning.

The network density reaches 0.979, indicating an almost fully connected structure; modularity is extremely low (0.023), showing limited thematic differentiation; and the average clustering coefficient is 0.164, suggesting weak local loops. Overall, the network displays a structure of high density, low modularity, and low clustering. This indicates that while Wenzhou's footwear enterprises share a unified understanding of innovation issues, thematic boundaries remain blurred, and cognitive differentiation is still developing. The core innovation cognition centers on the interaction of supply chain, product,

and business model, whereas technological R&D and strategic upgrading have not yet become central integrating forces. These findings highlight that the industry's transformation continues to rely on supply chain strengths and product-driven growth, with the need to reinforce R&D capabilities to achieve true innovation-led upgrading.

4.4 Joint Display Table Analysis

This study integrates qualitative and quantitative results through a "joint display" to connect why/how explanations with what/how much effects. The integration highlights four dimensions—drivers, mechanisms, strategy, and heterogeneity—showing how qualitative interpretation and quantitative validation jointly explain the transformation of Wenzhou's footwear cluster.

Table 3. Qualitative and Quantitative Meta-Inferences

Dimension	Qualitative Insight	Quantitative Evidence	Integrated Interpretation
1.Drivers of Transformation	Firms faced survival pressure from competition, imitation fatigue, and policy reform.	Profitability declined before COVID-19 (− 0.031***); no post-pandemic recovery.	Transformation was reactive, driven by external pressure rather than voluntary innovation.
2.Capability Mechanism	Firms developed dynamic resource-integration abilities, reallocating R&D during crises.	Dual mediation: innovation capability (0.711) and R&D capability (0.271); direct path negative (− 0.112).	The negative direct effect reflects resource reallocation during capability building; capability is the bridge from strategy to performance.
3.Strategic Paths	Pragmatic tactics like flexible supply chains and omnichannel sales improved short-term liquidity.	Cash-flow ratio rose temporarily (+0.067**) but declined later (− 0.077***).	Tactical innovation buffers shocks briefly; sustainable growth requires strategic digital-green upgrading.
4.Heterogeneity of Outcomes	Success depends on capability base and strategic alignment.	Company C increased R&D (+29.6***); SMEs showed weaker innovation – performance links.	Divergent outcomes stem from firms' ability to convert external pressure into differentiated strategies.

The joint display framework links qualitative mechanisms with statistical patterns through a cross-method inference loop. Qualitative findings generate theoretical assumptions and explain anomalies, while quantitative analysis verifies relationships and measures their strength. This interaction achieves explanatory integration rather than simple juxtaposition, addressing the gap between theoretical reasoning and empirical validation.

Through this meta-inference approach, a dynamic chain emerges: external pressure → capability restructuring → strategic adaptation → differentiated performance. Qualitative analysis reveals behavioral logic under crisis, whereas quantitative models such as structural equation and interruption time series confirm these mechanisms statistically. Together they form a cross-level explanatory system that connects micro-level firm behavior with macro-level industry evolution.

The framework thus demonstrates that Wenzhou's cluster transformation evolved from passive response to proactive innovation through capability renewal. It represents not only methodological innovation in mixed-methods research but also a theoretical contribution—showing how integration of qualitative interpretation and quantitative validation can reveal the mechanisms by which traditional manufacturing clusters achieve sustainable upgrading.

5.Data Analysis

5.1 Questionnaire Design

The questionnaire design in this study followed a structured path of qualitative exploration → theoretical abstraction → quantitative modeling. Using the Wenzhou footwear industry as a typical case, in-depth interviews with 15 firms of varying sizes were conducted. Through grounded-theory coding, key concepts were extracted to form measurable constructs. By comparing interview themes with theoretical frameworks, the study established a mapping relationship between qualitative findings and quantitative variables, as summarized in Table 4.

Table 4. Transformation of Interview Findings into Theoretical Concepts

Key points of qualitative discovery	Theoretical constructs (questionnaire dimension)
Enterprises at different stages adopt diverse approaches such as imitation and improvement, outsourcing design, independent design, or collaborative innovation.	Innovation Strategy
Many small and medium-sized enterprises (SMEs) tend to outsource design tasks to external studios or suppliers to reduce risk and cost.	Outsourced design
Mature companies tend to establish in-house design teams to develop their own brands and design systems.	Independent design
Enterprises form open innovation networks by collaborating with universities, research institutions, or upstream and downstream partners in research and development.	Collaborative Innovation
The level of development of the R&D department, the investment of innovation resources, and the innovative atmosphere among employees collectively determine the overall innovation potential of an enterprise.	Enterprise innovation capability
Enterprises show differences in R&D investment, patent output, and frequency of technological improvement.	Technology research and development capabilities
Intense market competition and widespread imitation have driven companies to accelerate innovation.	Market competition
Income level directly affects innovation budgets and R&D decisions; high-income enterprises have greater motivation for sustained innovation.	Income level
Innovation results have led to brand enhancement, market share growth, and improved profitability.	Innovation Performance

This transformation process ensured that each questionnaire item maintained both empirical grounding and theoretical consistency. The design logic is illustrated in Figure 3, demonstrating the systematic link from qualitative insight to quantitative operationalization.

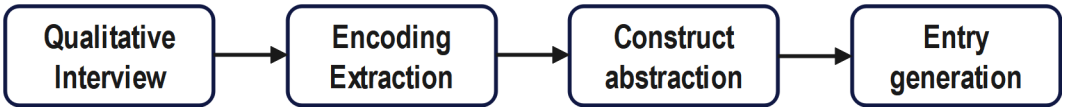

Fig.3: Flowchart

For statistical analysis, Structural Equation Modeling (SEM) was employed for three reasons.

First, the study's core variables—innovation strategy, capability, and performance—include both observed indicators and latent constructs, which SEM can model simultaneously.

Second, SEM allows joint testing of measurement and structural models, ensuring reliability, validity, and causal inference within one framework.

Third, the model involves multiple mediating and interaction effects, for which SEM provides higher

explanatory accuracy and robust parameter estimation.

Thus, SEM not only meets the theoretical and empirical demands of this study but also strengthens the scientific rigor and interpretability of the quantitative results, completing the closed loop from qualitative foundation to quantitative verification.

5.2 Data Quality Inspection

To ensure that the reliability and validity of the measurement model met the requirements of structural equation modeling (SEM), this study conducted a series of standardized tests, including Cronbach's α for internal consistency, Composite Reliability (CR) for stability, and Average Variance Extracted (AVE) for convergent validity.

The results showed that all constructs had Cronbach's α values above 0.7, most exceeding 0.92, indicating high internal consistency. Composite reliability (CR) values were all above 0.90, demonstrating excellent construct reliability and stability. AVE values were generally greater than 0.50, confirming convergent validity; only innovation strategy recorded a slightly lower value (0.488), which remained acceptable per Fornell & Larcker (1981) given its high α (0.941) and CR (0.947).

These findings verify that the measurement items within each latent construct are coherent, reliable, and theoretically consistent, ensuring that the dataset meets the criteria for subsequent SEM estimation.

5.3 Sample Description Analysis

To test for potential common method bias, Harman's single-factor test was applied to all items. Five factors with eigenvalues greater than 1 were extracted, and the first factor explained 34.39% of the variance—below the 40% threshold—indicating no serious common method bias.

A total of 517 valid questionnaires were collected from footwear enterprises in Wenzhou, obtained through a combination of stratified random sampling and snowballing. The sampling ensured balanced coverage across firm size, product type, and performance level, reducing survivorship and selection bias. Respondents were primarily owners and core managers, ensuring data validity and representativeness.

Table 5. Basic Statistics of the Sample

item	category	Frequency	percentage
gender	male	299	57.83%
	female	218	42.17%
age group	Under 18 years old	19	3.68%
	18~25	113	21.86%
	26~30	133	25.73%
	31~40	147	28.43%
	41~50	56	10.83%
	51~60	30	5.80%
	60 and above	19	3.68%
Education	Junior high school and below	41	7.93%
	High school/vocational school	131	25.34%
	College	138	26.69%
	undergraduate	175	33.85%
	Postgraduate and above	32	6.19%
Enterprise size	Small businesses (fewer than 50 employees)	142	27.47%
	Medium-sized enterprises (50-500 employees)	207	40.04%
	Large enterprises (500 or more employees)	168	32.50%
Position	skilled workers	108	20.89%

	ordinary employees	177	34.24%
	Middle Management	156	30.17%
	Senior Management	60	11.61%
	other	16	3.09%
	less than 1 year	68	13.15%
	1-3 years	143	27.66%
	3-5 years	126	24.37%
	5-10 years	124	23.98%
Years of service	10 years or more	56	10.83%
	Under 3000 yuan	64	12.38%
	3000-5000 yuan	134	25.92%
	5000-8000 yuan	118	22.82%
Monthly income range	8000-12000 yuan	115	22.24%
	More than 12,000 yuan	86	16.63%
	leather shoes	115	22.24%
	Casual shoes	143	27.66%
	sneakers	162	31.33%
Main product types	Children's shoes	40	7.74%
	other	57	11.03%
	Less than 5 million yuan	75	14.51%
	5-10 million yuan	160	30.95%
	10-50 million yuan	147	28.43%
	50 million to 100 million yuan	72	13.93%
Annual turnover	More than 100 million yuan	63	12.19%

The sample thus reflects the structural composition of the Wenzhou footwear cluster, dominated by medium-sized manufacturing firms with stable income and moderate educational levels among employees. The diverse firm types and respondent roles provide a balanced representation of the industry, ensuring that subsequent analyses of innovation strategies and performance have empirical robustness.

5.4 Model Path Analysis

Model evaluation results show that the R^2 of innovation performance is 0.748, indicating strong explanatory power. The mediating variables—enterprise innovation capability (R^2 = 0.443) and technological R&D capability (R^2 = 0.371)—also show moderate predictive strength. Among sub-dimensions, collaborative innovation (R^2 = 0.723) and independent design (R^2 = 0.630) have the highest explanatory power, confirming that the model effectively captures different innovation paths. The Q^2 values of all constructs are positive and consistent with R^2 trends, reflecting good predictive relevance. Although the Q^2 of innovation performance (0.292) is lower than its R^2, the model's SRMR = 0.124 remains within the acceptable range for complex PLS-SEM structures. Overall, the model demonstrates good explanatory and predictive validity.

Path estimates indicate that innovation strategy significantly drives both enterprise innovation capability ($\beta = 0.666$, $p < 0.001$) and technological R&D capability ($\beta = 0.580$, $p < 0.001$). Innovation capability exerts the strongest influence on innovation performance ($\beta = 0.711$, $p < 0.001$), while R&D capability also contributes positively ($\beta = 0.271$, $p < 0.001$). These results confirm a dual-mediation mechanism in which strategy promotes performance primarily through internal capability enhancement.

Table 6. Model Results

Path coefficient	Original sample (O)	T statistics (|O/STDEV|)	P values
Main product type: Casual shoes -> Innovation performance	0.043	0.477	0.633
Main Product Types_Other -> Innovation Performance	-0.087	0.841	0.40

Main Product Type - Leather Shoes -> Innovation Performance	0.073	0.779	0.436
Main Product Type: Sports Shoes -> Innovation Performance	0.014	0.147	0.883
Enterprise innovation capability -> Innovation performance	0.711	25.266	0.000
Innovation Strategy -> Corporate Innovation Capability	0.666	27.146	0.000
Innovation Strategy -> Innovation Performance	-0.112	3.650	0.000
Innovation Strategy -> Collaborative Innovation	0.850	71.670	0.000
Innovation Strategy -> Outsourced Design	0.720	25.095	0.000
Innovation Strategy -> Technology R&D Capability	0.580	20.278	0.000
Innovation Strategy -> Independent Design	0.794	42.416	0.000
Market competitiveness -> Innovation performance	0.037	1.730	0.084
Age Group -> Innovation Performance	0.056	2.444	0.015
Technology R&D capability -> Innovation performance	0.271	9.304	0.000
Income level -> Technological research and development capabilities	-0.153	3.815	0.000
Market competitiveness x Corporate innovation capability -> Innovation performance	0.069	3.324	0.001
Income level x Innovation strategy -> Technological R&D capability	0.177	3.619	0.000

Table 7 Results of Model Mediation and Moderating Effects

path	Indirect effect value	T-value	p-value
Innovation Strategy → Corporate Innovation Capability → Innovation Performance	0.473	19.256	0.000
Innovation Strategy → Technological R&D Capability → Innovation Performance	0.157	8.697	0.000
Income level → Technological R&D capability → Innovation performance	-0.041	3.458	0.001
Income level × Innovation strategy → Technology R&D capability → Innovation performance	0.048	3.418	0.001

The negative direct coefficient of innovation strategy on performance (β = –0.112) does not indicate inhibition but reflects resource reallocation effects: during early implementation, firms may prioritize R&D and internal capability building, temporarily reducing direct financial returns. Once mediating variables are included, the total effect of innovation strategy on performance becomes positive (β_total = 0.518, $p < 0.001$), with indirect effects through innovation capability (β = 0.473, $p < 0.001$) and R&D capability (β = 0.157, $p < 0.001$). This confirms that performance improvement occurs mainly through capability transformation rather than immediate market outcomes.

Moderating analysis shows that income level strengthens the "strategy → R&D capability" link (β = 0.177, $p < 0.001$), suggesting that firms with stronger financial bases can more effectively transform strategy into technological capability. Meanwhile, market competition amplifies the "innovation capability → performance" path (β = 0.069, p = 0.001), implying that capability-driven performance

gains are more evident under intense competition. Additionally, income exerts a double indirect effect (β = 0.048, p = 0.001) through its interaction with strategy, verifying the resource-based "amplifier" mechanism of contextual moderation.

Control variables show limited effects: age group of managers has a mild positive association with innovation performance (β = 0.056, p = 0.015), while product types (e.g., leather, casual, sports shoes) are not significant. Overall, the structural model confirms that innovation strategy enhances performance primarily via internal capability reconstruction, and that environmental and resource conditions amplify these mechanisms.

5.5 Results of Multi - Group Analysis

To test the robustness of the structural model across different firm sizes, this study used Permutation-based Multi-Group Analysis (MGA) with small- and medium-sized enterprises (SMEs) and large enterprises as grouping variables. The results show that most structural paths—such as innovation capability → innovation performance, R&D capability → innovation performance, and market competition → innovation performance—exhibit no significant differences (p > 0.05) between groups, indicating strong model stability and generalizability across different enterprise sizes.

However, several strategy-execution paths present significant heterogeneity. Specifically, the effects of innovation strategy → outsourced design (p = 0.005) and innovation strategy → independent design (p = 0.004) differ across firm sizes. Large enterprises tend to rely on internal R&D resources and brand-oriented design systems, while SMEs depend more on external outsourcing and cooperative innovation to mitigate costs and risks. This difference reflects executional diversity rather than structural instability, suggesting that firm size mainly influences how innovation strategies are implemented rather than whether they are effective.

In summary, while a few mediating paths vary significantly, the main capability-performance mechanism remains stable. The structural model retains strong explanatory validity across different firm sizes, demonstrating that the transformation logic of Wenzhou's footwear enterprises—strategy → capability → performance—is universal, though implementation patterns differ according to resource endowments and organizational maturity.

Table 8. Results of Multi-Group Analysis

	Original (medium-sized enterprise)	Original (Large Enterprise)	Original difference	Permutation means difference	2.50%	97.50%	Permutation p value
Main Product Type - Leather Shoes->Innovation Performance	0.470	0.067	0.403	0.003	-0.422	0.381	0.047
Innovation Strategy->Outsourced Design	0.793	0.593	0.200	-0.002	-0.154	0.154	0.005
Innovation Strategy->Independent Design	0.733	0.864	-0.131	0.002	-0.083	0.098	0.004
Income level-> Technological research and development capabilities	-0.260	-0.054	-0.207	0.001	-0.217	0.175	0.044

6. Conclusion and Discussion

6.1 Research Conclusions

This study systematically investigates the innovation strategy and transformation of Wenzhou's

footwear industry using a mixed-method design integrating interviews, historical tracking, social network analysis, and structural equation modeling.

The findings show that the transformation of Wenzhou's footwear industry is primarily driven by external pressures rather than proactive initiative. The long-standing family networks, imitation culture, and flexible private governance once enabled rapid expansion but later led to path dependence and capability stagnation. Profitability indicators such as net profit margin (Coef. = −0.031, $p < 0.01$) confirm a pre-pandemic decline, illustrating that transformation emerged as an inevitable response to survival pressures.

At the internal mechanism level, enterprise capability serves as the key bridge linking strategy and performance. While innovation capability ($\beta = 0.711$, $p < 0.001$) and R&D capability ($\beta = 0.271$, $p < 0.001$) significantly enhance performance, the direct effect of innovation strategy is negative ($\beta = -0.112$, $p < 0.001$), reflecting short-term resource transfer and lagged capability returns. This result suggests that strategy yields performance only through capability transformation. Moreover, income level strengthens the "strategy → R&D capability" path ($\beta = 0.177$, $p < 0.001$), while market competition amplifies the "capability → performance" effect ($\beta = 0.069$, $p = 0.001$), indicating the contextual importance of resource abundance and market intensity.

Transformation practices reveal three major paths: supply-chain and channel innovation, digital-green transformation, and user-oriented innovation. Supply-chain flexibility improved short-term cash flow during the pandemic (Coef. = 0.067, $p < 0.05$) but proved unsustainable (Coef. = −0.077, $p < 0.01$). Only firms that strengthened R&D and digital systems—such as Company C—achieved stable growth. Thus, the evolution from tactical to strategic innovation is essential for long-term competitiveness.

Heterogeneity among firms is evident: large enterprises favor in-house design, while SMEs rely on outsourcing; yet the overall "strategy → capability → performance" path remains stable. The general logic of transformation can be summarized as external pressure → capability building → strategic adaptation → performance differentiation, representing a shift from path dependence to path creation.

6.2 Theoretical Contributions

This study reinterprets the Wenzhou model through a dynamic and institutional lens. It reveals that informal institutions and imitation culture, while initially lowering transaction costs, later constrained innovation and intellectual-property development, turning early advantages into structural obstacles.

Second, it constructs and verifies a cluster-embedded innovation framework that links external pressures, capability formation, strategic choices, and performance differentiation. The results confirm that innovation strategy improves performance mainly through capability mediation, with income level and competition moderating these relationships. The finding of a negative direct effect challenges the conventional assumption that strategy automatically generates performance, highlighting the centrality of capability restructuring in industrial transformation.

Methodologically, the study demonstrates an exploratory sequential mixed-methods design combining qualitative coding, quasi-natural experiments, and PLS-SEM verification. The use of semantic social network analysis further visualizes the cluster's innovation structure, revealing weak R&D connectivity and supply-chain dominance, offering a new lens for analyzing innovation bottlenecks.

6.3 Research Limitations

Although the study includes 517 valid samples, potential survivor bias exists, as firms with stronger innovation awareness are more likely represented. The conclusions therefore mainly apply to active enterprises within the Wenzhou cluster.

Causality should also be interpreted cautiously. SEM reveals associations rather than strict causal effects; longitudinal or experimental data are required to confirm the dynamic mechanisms suggested.

Additionally, reliance on self-reported data without external validation limits objectivity. Future research should integrate multi-source data such as financial statements or industry reports to strengthen triangulation and external validity.

6.4 Practical Implications

For enterprises, transformation requires sustained R&D, enhanced dynamic capabilities, and digital-branding integration. SMEs should strengthen collaborative innovation platforms, while large firms can pursue international design alliances to accelerate strategic conversion.

For policymakers, maintaining targeted support mechanisms—including R&D subsidies, digital infrastructure, and intellectual-property protection—is essential. Industry associations can facilitate shared platforms for information and standardization to improve collective efficiency.

At the cluster level, the Wenzhou case demonstrates that transformation is a collective evolutionary process. Without simultaneous progress in R&D, branding, and sustainability, supply-chain advantages alone cannot prevent lock-in. Only through differentiated strategies and institutionalized capability restructuring can clusters evolve from imitation toward innovation leadership.

Acknowledgements

The author would like to express sincere gratitude to the supervisors and experts who provided valuable guidance and constructive suggestions throughout this research. Special thanks are extended to the Wenzhou Footwear Association and participating enterprises for their generous support and data assistance. Appreciation is also given to colleagues and friends whose encouragement and insightful discussions greatly contributed to the completion of this study.

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