

Mediating Role of Digital Technology and Innovation Inputs, Organizational Culture, Affecting Intellectual Property of Innovative Capability Enterprises in Chongqing, China

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Abstract

The rapid transformation of China's innovation-driven economy has placed increasing emphasis on the role of intellectual property (IP) in strengthening the competitiveness of enterprises. In this context, enterprises in Chongqing face both opportunities and challenges in leveraging digital technology, innovation inputs, and organizational culture to enhance their innovative capability. The objective of this study is to examine how digital technology and innovation inputs, together with organizational culture, influence intellectual property practices and, in turn, affect the innovative capability of enterprises.

A mixed-methods approach was employed. Quantitative data were collected through a structured questionnaire administered to innovative enterprises in Chongqing, and the data were analyzed using Structural Equation Modeling (SEM) to test the hypothesized relationships. To complement these findings, semi-structured interviews with 20 enterprise managers and policy experts were conducted, and thematic analysis was applied to capture contextual insights and validate the statistical results.

The results indicate that digital technology and innovation inputs significantly enhance the innovative capability of enterprises, with intellectual property serving as a mediating mechanism. Furthermore, organizational culture was found to play a moderating role, shaping how knowledge and technological resources are integrated into innovation outcomes. Qualitative evidence reinforced these findings by illustrating how firms in Chongqing strategically balance technological investment, IP protection, and cultural values in their pursuit of innovation.

This study contributes by advancing theoretical understanding of the mediating role of intellectual property in innovation research, while also providing practical guidance for enterprises and policymakers in Chongqing. The findings suggest that effective integration of digital technology, innovation inputs, and supportive organizational culture can significantly strengthen enterprise innovation capability and long-term competitiveness.

Keywords: Organizational Culture; Innovation Inputs; Digital Technology; Intellectual Property
Innovation Capability; Digital Technology

Introduction

Innovation is widely recognized as a key driver of sustainable economic development and a foundation of enterprise competitiveness (Yao & Li, 2023). With China transitioning toward high-quality development, the ability of firms to leverage intellectual property (IP) has become increasingly important for enhancing innovative capability. In particular, small and medium-sized enterprises (SMEs)—which account for the majority of enterprises in China—play a vital role in technological progress, employment, and GDP contribution. However, as SMEs face both opportunities and challenges in the era of rapid digital transformation, their capacity to integrate digital technology, innovation inputs, and organizational culture with IP protection has emerged as a decisive factor in sustaining competitiveness (Wang, 2004; Cheng & Wang, 2024).

Government initiatives underscore this urgency. The 2021 State Council's measures and the 2023 Government Work Report both emphasize strengthening IP protection and innovation capacity as strategic priorities (WIPO, 2023). Policies supporting IP rights, financial incentives, and certification standards have been implemented to encourage SMEs to build innovation-driven development. Yet, in practice, many enterprises—particularly in Chongqing, a rising innovation hub—still encounter difficulties such as inadequate investment in digital technologies, weak organizational cultures, and ineffective innovation inputs (National Innovation Index Report, 2020).

Problem Statement: Despite rising R&D investments and government support, many SMEs in Chongqing fail to fully integrate organizational culture, digital technology, and innovation inputs into their intellectual property strategies, thereby limiting their overall innovative capability (Chen, 2022). Previous

empirical studies confirm that organizational culture and innovation investment can improve enterprise innovation performance (Ahmed, 1998; Aksoy, 2017), but gaps remain in understanding how these factors interact with IP in the Chinese context.

Purpose of the Study: This study addresses these gaps by analyzing the influence of organizational culture, innovation inputs, and digital technology on the intellectual property practices of SMEs in Chongqing, and how these collectively shape their innovative capability. By applying a mixed-methods approach, the research aims to provide both theoretical insights and practical guidance for enterprises and policymakers seeking to enhance IP-based innovation strategies.

Research Objective

1.To determine the influence paths of organizational culture, innovation input and digital technology on the intellectual property innovation capacity of Chongqing SMEs.

2.To propose the model structure of Chongqing SMEs' intellectual property innovation capacity based on organizational culture, innovation inputs and digital technology.

3.To analyses the interaction mechanism of Chongqing SMEs' intellectual property innovation capacity based on organizational culture, innovation inputs and digital technology.

Hypothesis

H1 Innovative organizational culture has a positive impact on SMEs' intellectual property innovation ability.

H2 The degree of innovation inputs is positively related to SMEs' IP innovation capability.

H3 The degree of digital technology application is positively related to SMEs' intellectual property innovation ability.

H4 There is a mediating effect between organizational culture and innovation inputs.

H5 innovation inputs and digital technology plays the mediating role effect between organizational culture and digital technology

H6 Innovation inputs have a positive impact on digital technology

Literature Review

Policies Related to the Knowledge Innovation Capacity of SMEs

Effectively utilizing intellectual property policies is a key factor in enhancing a country's innovation capacity. (Lim, Zhang, & Lee, 2023) This section focuses on introducing the intellectual property innovation policies of the World Intellectual Property Organization (WIPO), the United States, the United Kingdom, Germany, Japan, and other countries. It also introduces the policy formulation of intellectual property innovation at the national level in China, Chongqing Province, and the work carried out at the policy level of intellectual property innovation in Chongqing City.

Organizational culture

Only formalized in the 1980s (Schneider et al., 2017) and is defined as a shared pattern of basic assumptions that an organization acquires in solving its external adaptive problems as well as its internal integration problems, which proves to be effective in solving such problems, and therefore for new members of the organization this pattern of assumptions is the right way to perceive, think and feel when it comes to such problems. (Schein, 1985). Definitions of organizational culture are complex and focus on only one focus or level of organizational culture. Some of the widely accepted definitions are: a pattern of basic assumptions; invented, discovered or developed by a particular group of people; developed in the course of a particular group of people learning to cope with problems of external adaptation and internal integration; effective in its development; to be taught to new members as the right way to perceive, think and feel; the right way to perceive, think and feel in relation to these problems, etc. (Schein, 1990).

Innovation Inputs

Reviews the role of R&D investment, employee training, and infrastructure in fostering innovation . (Wei , 2020).

Explores empirical findings on how innovation inputs contribute to intellectual property development in SMEs.(Hanifah et al.,2020)

Digital Technology

Explores the impact of emerging digital technologies such as big data, cloud computing, blockchain, and AI on SMEs' innovation capabilities. (Razzaq et al., 2021)

Discusses the Digital Maturity Model (DMM) as a tool to assess the digital transformation level in SMEs. (Potts & Öberg, 2017).

Intellectual Property Innovation Capabilities of SMEs

Defines intellectual property innovation and its significance for SMEs. (Eppinger& Vladova, 2013)

Reviews previous studies on how SMEs leverage organizational culture, innovation inputs, and digital technology to enhance intellectual property creation and protection. (Wu & Lu,2023).

Conceptual Framework

This study takes SMEs' intellectual property innovation capacity as the dependent variable (i.e. the research object), organizational culture as the independent variable, and innovation inputs and digital technology as the moderating variables. The theoretical structural equation model is constructed based on an overview of previous opinions, research objectives, and the actual situation of SMEs' intellectual property innovation capacity.

The schematic diagram of the model is shown in Figure 1: Conceptual Framework.

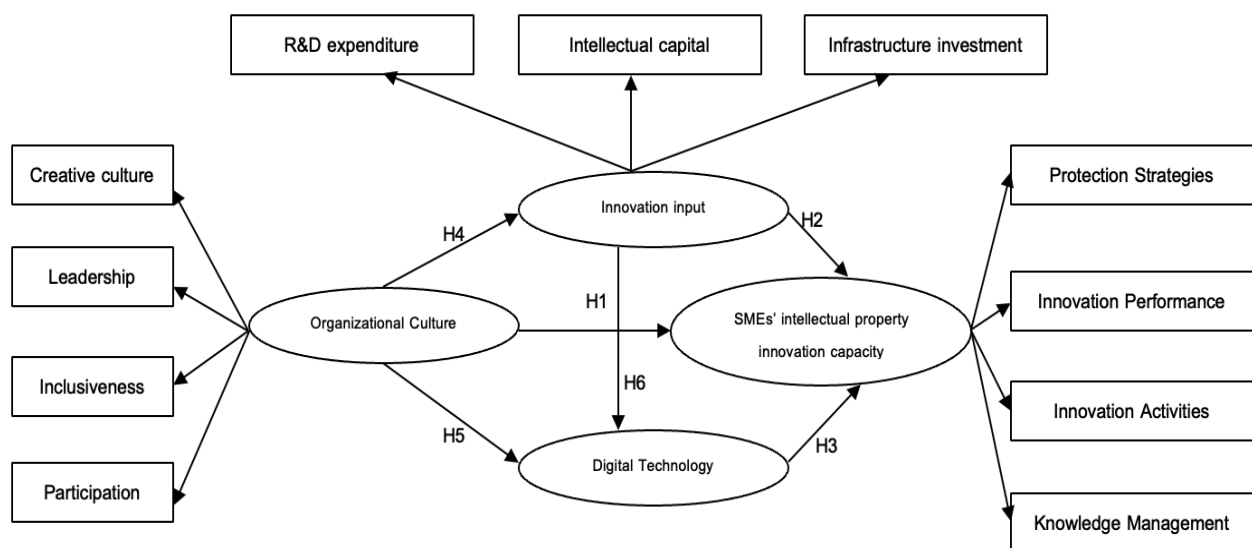


Figure 1 Conceptual Framework

This study takes Chongqing small and medium-sized enterprises as the research object, intellectual property innovation ability as the dependent variable, organizational culture as the independent variable, and innovation investment and digital technology as the moderating variable. In

this paper, we will form a special dimension based on the review of the previous viewpoints of each variable, combining the research question, the research goal, and the actual situation of the intellectual property innovation ability of SMEs, conducting quantitative questionnaires and qualitative interviews, and based on data collected and experience summarized, attempting to construct a theoretical structural model of intellectual property innovation capability of Chongqing's SMEs, build up the Intellectual Property Innovation Ability Promotion and evaluation system of SMEs.

Research Methodology

This study adopted a mixed-methods research design, combining quantitative and qualitative approaches to provide both generalizable and in-depth insights into the mediating role of intellectual property (IP) in enhancing the innovative capability of SMEs in Chongqing. The mixed design was selected to validate statistical relationships through large-scale survey data and to capture contextual insights from practitioners' experiences, thereby addressing the research problem of how organizational culture, digital technology, and innovation inputs interact to influence IP-based innovation capability.

1. Population and Sample

The research population consisted of SMEs located in Chongqing, China. A stratified sampling technique was used to ensure representation across different enterprise sizes (small, medium), industries (manufacturing, services, technology), and establishment periods. A total of 420 questionnaires were distributed, and 390 valid responses were retained for analysis, satisfying minimum sample requirements for Structural Equation Modeling (Hair et al., 2019).

2. Research Instruments

The main tool for quantitative analysis was a structured questionnaire. The instrument measured key constructs, including:

- Organizational Culture (adapted from Ahmed, 1998; Aksoy, 2017)
- Innovation Inputs (measured by R&D expenditure, training, and resource allocation indicators)
- Digital Technology Adoption (measured by investment in IT systems, AI, and digital platforms)

- Intellectual Property Innovation Capability (measured through IP applications, IP commercialization, and knowledge integration)

A 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) was applied to all items. Content validity was confirmed by expert review, and reliability was tested with Cronbach's alpha values, all above the 0.70 threshold.

3. Data Collection Procedures

- Quantitative data were collected through online questionnaires to allow convenient participation by SMEs. Respondents included enterprise managers, R&D staff, and IP managers.

- Qualitative data were collected through semi-structured interviews with 20 participants, including SME managers, innovators, and service providers. The interviews explored challenges and strategies regarding organizational culture, IP management, and digital technology integration.

4. Data Analysis

- Quantitative Analysis: Data were analyzed using AMOS and SPSS software. Statistical techniques included descriptive statistics, correlation, multiple regression, confirmatory factor analysis (CFA), and Structural Equation Modeling (SEM) for hypothesis testing and mediation analysis.

- Qualitative Analysis: Interview transcripts were analyzed using thematic analysis (Braun & Clarke, 2006). Coding was conducted independently by two researchers to ensure reliability, with an intercoder agreement rate of 85%. Themes were developed around digital adoption, cultural enablers, and IP practices, and then compared with quantitative results for triangulation.

5. Ethical Considerations

Participation was voluntary, and informed consent was obtained before data collection. Anonymity and confidentiality were maintained throughout the study, and data were used exclusively for academic purposes.

6. Methodological Contribution

This methodology ensures rigor by combining SEM-based quantitative analysis with qualitative depth. It directly addresses the research problem of understanding how organizational culture, digital technology, and innovation inputs jointly affect IP innovation capability, thereby contributing both theoretical advancement and practical implications for SMEs in Chongqing.

Research Results

Quantitative Analysis

Model Fit

To test the hypothesized model, Structural Equation Modeling (SEM) was applied using AMOS 26.0. The measurement model showed strong reliability and validity. As reported in Table 1, the model fit indices met recommended thresholds (Kelloway, 2014):

Table 1 Model Fit Indicators of the Structural Equation Model

Indicator	Threshold Value	Result
χ^2/df	< 5.000	1.219
RMR	< 0.080	0.044
RMSEA	< 0.080	0.026
GFI	> 0.800	0.965
AGFI	> 0.800	0.948
IFI	> 0.900	0.990
TLI	> 0.900	0.987
CFI	> 0.900	0.990

All indices were well within acceptable ranges, confirming the model's robustness and suitability for hypothesis testing.

Path Coefficients

The structural model results are presented in Table 2. All hypothesized paths (H1–H6) were statistically significant, indicating that organizational culture, innovation inputs, and digital technology directly enhance SMEs' intellectual property (IP) innovation capability.

Table 2 Path Coefficient Test of the Structural Equation Model

Pathway	B	S.E.	β	C.R.	p
Cul $\rightarrow$ Input	0.403	0.073	0.409	5.560	***
Cul $\rightarrow$ Tec	0.335	0.076	0.344	4.410	***
Input $\rightarrow$ Tec	0.268	0.078	0.271	3.419	***
Cul $\rightarrow$ SME	0.256	0.078	0.241	3.270	0.001

Pathway	B	S.E.	β	C.R.	p
Input $\rightarrow$ SME	0.269	0.081	0.250	3.334	***
Tec $\rightarrow$ SME	0.335	0.086	0.308	3.905	***

Note: *** $p < 0.001$.

These results demonstrate that:

- Organizational culture positively influences both innovation inputs ($\beta = 0.409$) and digital technology adoption ($\beta = 0.344$).
- Innovation inputs positively affect digital technology ($\beta = 0.271$).
- All three variables—organizational culture, innovation inputs, and digital technology—directly improve SMEs' IP innovation capability ($\beta = 0.241, 0.250$, and 0.308 , respectively).

Hypotheses Testing

Table 3 Hypotheses and Results

Hypothesis	Statement	Result
H1	Innovative organizational culture positively impacts SMEs' IP capability.	Accepted
H2	Innovation inputs positively influence SMEs' IP capability.	Accepted
H3	Digital technology positively influences SMEs' IP capability.	Accepted
H4	Organizational culture $\rightarrow$ mediated by innovation inputs.	Accepted
H5	Organizational culture $\rightarrow$ mediated by digital technology.	Accepted
H6	Innovation inputs positively influence digital technology.	Accepted

All six hypotheses (H1–H6) were supported, confirming the mediating role of innovation inputs and digital technology in strengthening the relationship between organizational culture and IP innovation capability.

Qualitative Analysis

To complement the survey findings, semi-structured interviews were conducted with 21 participants, including R&D personnel, IP managers, SME managers, IP authority officials, and service providers. Thematic analysis revealed four key insights:

1. Organizational Culture as a Catalyst Respondents emphasized that creative culture, inclusive leadership, and participatory practices encourage employees to generate innovative ideas and pursue IP protection.

“When our leadership promotes open communication, more patents are proposed and implemented.”

2. Innovation Inputs as a Foundation Investment in R&D, infrastructure, and intellectual capital was consistently linked to enhanced IP innovation capability.

“Without stable R&D funding, it is impossible to sustain patenting and product innovation.”

3. Digital Technology as an Enabler The use of AI, cloud computing, big data, and IoT was identified as a critical enabler for IP management and innovation.

“Digital tools allow us to track, protect, and commercialize our intellectual property more effectively.”

4. Interaction Between Variables Qualitative evidence reinforced the mediating effects identified in SEM: organizational culture influences innovation inputs, which in turn support digital technology adoption, ultimately enhancing SMEs’ IP innovation capability.

Integration of Quantitative and Qualitative Results

The integration of findings provides a comprehensive answer to the study’s objectives:

Objective 1: Confirmed that organizational culture, innovation inputs, and digital technology each positively affect SMEs’ IP innovation capability.

Objective 2: Supported that innovation inputs and digital technology serve as mediating variables, linking organizational culture to innovation capability.

Objective 3: Qualitative insights explained *how* and *why* these relationships exist, highlighting culture as the catalyst, inputs as the foundation, and technology as the enabler.

Together, these findings demonstrate that strengthening IP innovation capability in SMEs requires an integrated approach that combines supportive organizational culture, sustained investment in innovation, and effective adoption of digital technologies.

Discussion

The findings confirm that organizational culture significantly enhances SMEs’ intellectual property innovation capability, aligning with Ahmed (1998) and Aksoy (2017), who emphasized the role of inclusive and participatory cultures in fostering creativity and innovation. The mediating effect of innovation inputs and digital technology corresponds with previous studies (Ma & Yu, 2020; Zhao, 2021),

suggesting that resources and digital adoption are necessary pathways for culture to translate into innovation performance. Interestingly, the qualitative evidence showed that while digital technologies such as AI and big data strengthen IP practices, some SMEs still face constraints due to limited financial resources. This contrasts with prior studies that assumed technology adoption was primarily a matter of strategy rather than resource availability. Hence, this study contributes by showing that cultural support alone is insufficient unless combined with innovation investments and digital tools, particularly in the Chinese SME context.

Conclusion

This study demonstrates that organizational culture, innovation inputs, and digital technology each positively influence SMEs' intellectual property innovation capability, with innovation inputs and technology serving as mediating mechanisms. By integrating SEM results with qualitative insights, the research highlights the importance of aligning culture, resources, and digital adoption to enhance innovation capacity in Chongqing SMEs.

Suggestions

For SMEs: Develop inclusive and creative organizational cultures that encourage employee participation while ensuring sustained investment in R&D and digital platforms.

For Policymakers: Provide targeted support to SMEs in Chongqing through funding programs, digital infrastructure, and IP training initiatives.

For Future Research: Extend the model to other regions in China or cross-country comparisons to evaluate the generalizability of cultural, technological, and input-based mediating mechanisms.

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