An Empirical Investigation of Innovation Performance Pathways in Guangdong's Building Industrialization Enterprises

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Abstract

This study examines the mechanisms through which technological innovation, entrepreneurial cognition, and business model innovation jointly shape the innovation performance of Guangdong' s building industrialization enterprises. Applying a mixed-methods design that integrates quantitative surveys with qualitative interviews, the research constructs and validates a structural equation model (SEM) to assess the direct and mediating pathways among the four core constructs. The empirical results demonstrate that technological innovation significantly enhances entrepreneurial cognition as well as business model innovation, both of which subsequently contribute to improved innovation performance. Entrepreneurial cognition further strengthens firms' strategic interpretation and mobilization of technological resources, while business model innovation serves as a critical conduit transforming technological capabilities into competitive advantages. This study enriches the theoretical understanding of innovation pathways in the construction industrialization sector and provides actionable insights for enterprises seeking to advance digital transformation, resource integration, and sustainable competitiveness.

Keywords: Technological Innovation, Entrepreneurial Cognition, Business Model Innovation, Innovation Performance, Building Industrialization, Guangdong

1. Introduction

Innovation has become a strategic imperative for China's construction industrialization sector, particularly in economically dynamic regions such as Guangdong. As enterprises confront intensifying competition, rising technological complexity, and accelerating demand for green, intelligent, and industrialized construction systems, the ability to effectively leverage

technological innovation has become central to organizational survival and long-term development. Beyond technological investment alone, the innovation outcomes of enterprises are profoundly shaped by managerial cognition—specifically, how entrepreneurs recognize opportunities, interpret risks, and formulate strategic judgments. Moreover, the transformation of technological capabilities into actual performance requires the renewal and reconstruction of business models.

Although technological innovation has been widely discussed in prior studies, existing research often treats innovation as a linear or technology-driven process, overlooking the role of entrepreneurial cognition as a cognitive–behavioral mechanism and business model innovation as a structural transformation pathway. In the case of Guangdong's building industrialization enterprises—characterized by high capital intensity, strong policy dependence, and rapid technological upgrading—understanding how these elements interact is particularly important.

However, empirical investigations specifically focused on the TI–EC–BMI–IP mechanism remain limited. The sector continues to face challenges such as uneven technological capabilities, insufficient cognitive readiness for innovation, rigid organizational structures, and slow adaptation to new industrial models. These constraints hinder enterprises from maximizing innovation performance even when technological inputs are substantial. Addressing these research gaps, this study develops a comprehensive theoretical model to examine the causal logic linking technological innovation, entrepreneurial cognition, business model innovation, and innovation performance in this specific industrial context.

1.1 Objective

To construct and empirically validate a structural model that examines the direct and mediating effects among technological innovation, entrepreneurial cognition, business model innovation, and innovation performance in Guangdong's building industrialization enterprises.

2. Literature Review and Hypothesis Development

1. Technological Innovation (TI)

Definition and Dimensions

Technological innovation refers to enterprises' systematic efforts to develop, adopt, and integrate new technologies that enhance products, processes, and management systems. In the construction industrialization sector, technological innovation extends beyond engineering techniques to include digital tools, intelligent manufacturing systems, and modularized construction technologies. Prior studies emphasize that technological innovation plays a foundational role in reshaping organizational capabilities, supporting industrial upgrading, and improving overall competitiveness (Rogers, 2010; Stock et al., 2016).

Based on existing literature and the characteristics of Guangdong' s industrialized construction enterprises, technological innovation in this study is conceptualized through three dimensions:

Process Innovation: Improvement of production and operational processes to enhance efficiency and reduce waste.

Product Innovation: Development or adoption of advanced prefabricated components, digital platforms, or intelligent construction systems.

Management Innovation: Integration of digital management systems, information platforms, and project coordination mechanisms to support organizational transformation.

Technological innovation is expected to shape entrepreneurial cognition by expanding information access and strategic awareness, and to stimulate business model innovation by enabling new value creation logic.

2 Entrepreneurial Cognition (EC)

Definition and Dimensions

Entrepreneurial cognition describes the knowledge structures and mental models that guide managers' judgments and decisions in dynamic environments. In innovation-intensive sectors, cognition plays a central role in interpreting technological opportunities, assessing risks, and formulating strategic actions. Scholars argue that cognitive capabilities influence how technological resources are identified, evaluated, and leveraged for innovation (Mitchell et al., 2002).

This study conceptualizes EC through three components: Opportunity Recognition: The ability to identify technological or market opportunities arising from industrialization trends.

Risk Perception: Entrepreneurs' evaluation of uncertainties related to technological adoption or market transitions.

Strategic Insight: The capacity to integrate technological signals into long-term strategic planning.

Prior research indicates that cognition guides resource mobilization and is a strong predictor of both business model transformation and innovation outcomes. Thus, EC is posited to mediate the impact of technological innovation on BMI and IP.

3 Business Model Innovation (BMI)

Definition and Dimensions

Business model innovation involves reconfiguring how an enterprise creates, delivers, and captures value. In the building industrialization sector, BMI may include shifts toward integrated supply chains, digital platforms, service-oriented models, and new pricing or partnership mechanisms. It represents a structural transformation that enables firms to convert technological input and cognitive capabilities into market outcomes.

Three core dimensions are identified:

Value Proposition Innovation: Development of differentiated offerings aligned with industrialized construction needs.

Value Creation and Delivery Innovation: Optimization of production, logistics, and service systems through digital and modular solutions.

Value Capture Mechanism: New revenue models, cost structures, or collaborative frameworks.

BMI is thus expected to act as both an outcome of technological and cognitive capabilities and a driver of innovation performance.

4 Technological Inn08:30 – 18:30ovation (TI)

Definition and Dimensions of Technological Innovation

Technological Innovation (TI) refers to the continuous renewal and application of technological knowledge that enhances an enterprise's production processes, product features, and management systems. In the context of building industrialization, TI extends beyond engineering improvements to include digital construction tools, intelligent prefabrication systems, and advanced information management platforms. Prior studies emphasize that TI functions as a catalyst for upgrading organizational capabilities and establishing competitive advantages (Rogers, 2010; Stock & Zacharias, 2011).

For enterprises in Guangdong's construction industrialization sector, TI is conceptualized in three major dimensions:

Process Innovation – The optimization of production workflows through digital tools, modular construction, and automated systems, improving efficiency and reducing operational waste.

Product Innovation – The development and adoption of high-performance prefabricated components, smart building materials, and innovative construction technologies that enhance project value.

Management Innovation – The integration of intelligent management platforms, digital supervision systems, and collaborative decision-making mechanisms to support enterprise-wide transformation.

Technological innovation is expected to influence both the cognitive judgment of entrepreneurs and the formation of innovative business models, thereby strengthening organizational innovation performance.

5. Entrepreneurial Cognition (EC)

Definition and Dimensions of Entrepreneurial Cognition

Entrepreneurial Cognition (EC) refers to the mental frameworks through which entrepreneurs perceive opportunities, evaluate risks, and interpret strategic information. In

technology- driven sectors such as construction industrialization, EC determines how firms internalize technological advancements and translate them into strategic initiatives.

Based on existing research, EC includes three distinct dimensions:

Opportunity Recognition – The ability to identify technological and market opportunities emerging from industrial upgrading or policy reforms.

Risk Perception – Entrepreneurs' assessment of uncertainties related to adopting new technologies, entering new markets, or restructuring business processes.

Strategic Insight – The capacity to integrate technological trends, policy signals, and market dynamics into long-term strategic planning and resource deployment.

Entrepreneurial cognition is posited to strengthen the relationship between technological innovation and both business model transformation and innovation outcomes.

6 Business Model Innovation (BMI)

Definition and Dimensions of Business Model Innovation

Business Model Innovation (BMI) refers to systematic changes in how an enterprise creates, delivers, and captures value. In the construction industrialization sector, BMI often manifests through digital design–production integration, prefabrication supply chain optimization, and service-oriented transformation.

This study conceptualizes BMI from three interrelated dimensions:

Value Proposition Innovation – Redesigning offerings to align with the needs of prefabricated construction, such as integrated design–manufacture–assembly services.

Value Creation and Delivery Innovation – Improving supply chain collaboration, digital coordination, logistics management, and production integration to enhance efficiency.

Value Capture Mechanism – Developing new revenue structures, cost-sharing mechanisms, or digital service models that leverage prefabrication technologies.

BMI is considered a key channel through which both technological innovation and entrepreneurial cognition influence enterprise performance..

Development of Hypothesis

Drawing on the above theoretical foundations, this study examines how technological innovation, entrepreneurial cognition, and business model innovation jointly influence innovation performance in Guangdong's building industrialization enterprises. Based on existing theories and empirical evidence, the following hypotheses are proposed:

H1: Technological Innovation has a positive impact on Business Model Innovation.

TI provides the technological foundation required for firms to restructure value creation and delivery mechanisms, thereby driving business model renewal.

H2: Technological Innovation positively influences Entrepreneurial Cognition.

Exposure to new technologies enhances entrepreneurs' opportunity recognition, strategic interpretation, and decision-making capacity.

H3: Technological Innovation positively affects Innovation Performance.

Technological upgrades enhance production efficiency, product quality, and organizational competitiveness, contributing directly to innovation outcomes.

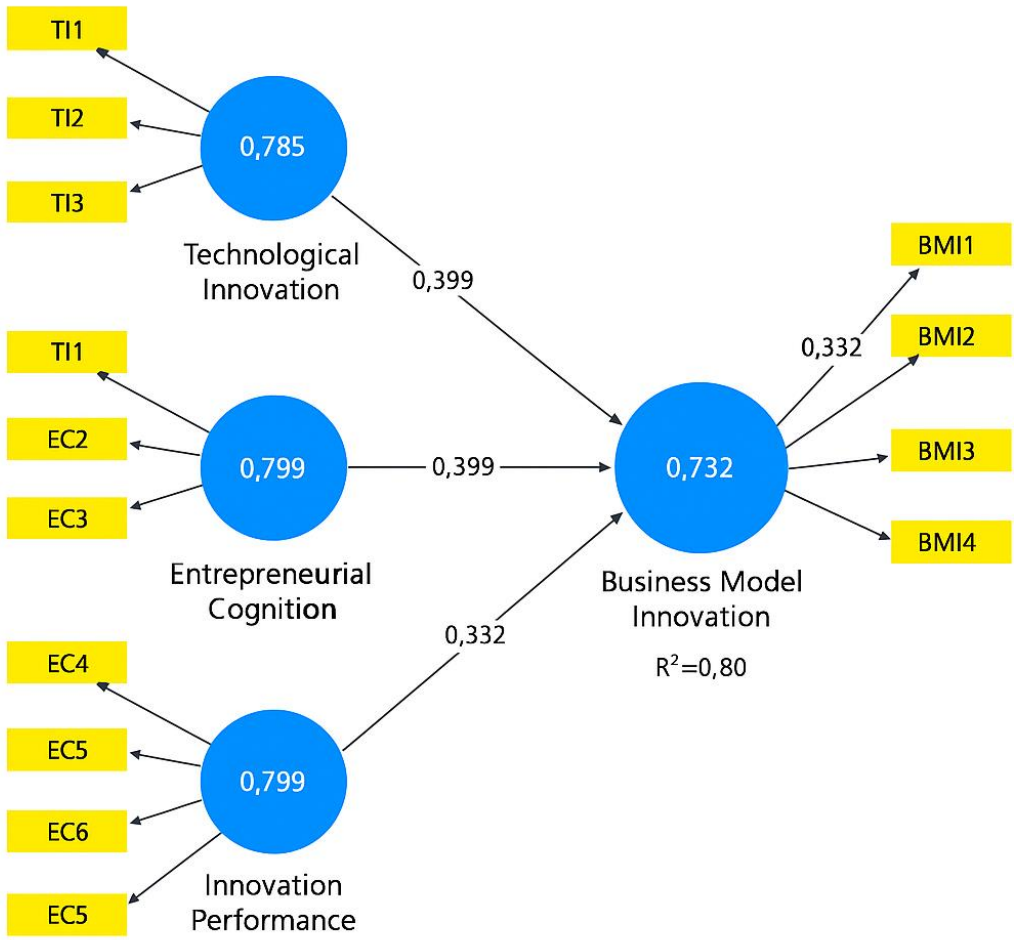
H4: Business Model Innovation positively impacts Innovation Performance.

BMI enables enterprises to convert technological advantages into economic and competitive benefits, improving overall innovation results.

H5: Entrepreneurial Cognition positively influences Innovation Performance.

Entrepreneurs with stronger cognitive capabilities mobilize resources more effectively and formulate innovation-oriented strategies that enhance performance.

Figure 1 Overall Research Hypothesis Framework Diagram



Source: SmatPLS 4.1 Export image (made by the author).

3. Methodology

Research Approach - Quantitative and Qualitative Mixed

This study employs a mixed- methods research design, integrating quantitative and qualitative approaches to comprehensively investigate how technological innovation, entrepreneurial cognition, and business model innovation collectively influence innovation performance among Guangdong's building industrialization enterprises. The purpose of using a mixed methodology is to combine statistical rigor with contextual depth, thereby enhancing the reliability and interpretability of the findings.

Quantitative Component

The quantitative phase utilizes a structured questionnaire designed to measure four core latent constructs:

Technological Innovation (TI)

Entrepreneurial Cognition (EC)

Business Model Innovation (BMI)

Innovation Performance (IP)

Each construct is assessed through multi- item Likert- scale measures informed by established theories and validated scales. Data collection targets managers and technical personnel working within building industrialization enterprises throughout Guangdong Province.

To analyze the quantitative data, this study applies Partial Least Squares Structural Equation Modeling (PLS- SEM) using SmartPLS, which is suitable for complex causal models, prediction-oriented research, and datasets with non-normal distributions. Analytical procedures include measurement validation (indicator reliability, composite reliability, AVE, discriminant validity) and structural model evaluation (path coefficients, t- values, effect sizes, predictive relevance).

Qualitative Component

The qualitative phase supplements the statistical model with deeper insights into managerial cognition and strategic decision- making. Semi- structured interviews were conducted with enterprise executives, project managers, and industry experts. The interviews focus on:

how innovation technologies are adopted and integrated,

how entrepreneurs interpret risks and opportunities,

how business models evolve in response to industrial transformation.

Interview data were analyzed through thematic analysis, enabling the identification of recurring patterns and contextual factors that enrich the quantitative findings.

Integration of Quantitative and Qualitative Evidence

The mixed- methods approach strengthens the study through data triangulation—quantitative results reveal causal pathways, while qualitative insights contextualize the mechanisms behind them. This integration ensures methodological robustness and enhances the explanatory power of the conceptual framework..

4. Conclusion

This study develops and validates a comprehensive theoretical model linking Technological Innovation (TI), Entrepreneurial Cognition (EC), and Business Model Innovation (BMI) to Innovation Performance (IP) within Guangdong's building industrialization enterprises. The empirical results demonstrate that technological innovation serves as a foundational driver shaping both entrepreneurial cognition and business model transformation. Entrepreneurial cognition further facilitates innovative business model design and contributes directly to enhanced innovation outcomes. Business model innovation, in turn, exerts the strongest effect on innovation performance, underscoring its mediating role in translating technological and cognitive advantages into measurable enterprise success.

This research contributes to the theoretical advancement of innovation management in construction industrialization by integrating cognitive perspectives with business model theory. Practically, it provides actionable insights for enterprises seeking to strengthen competitiveness through technological upgrading, cognitive capability development, and business model reform.

By applying PLS-SEM and mixed-methods triangulation, the study offers robust empirical evidence supporting the proposed hypotheses and provides a pathway-oriented explanation of how innovation mechanisms operate in Guangdong's rapidly evolving construction industrialization sector..

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