Design Thinking and Innovation Performance of Small and Medium-sized Enterprises in Guangxi: The Mediating Effects of Digital Transformation Ambidexterity

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Abstract

SME executives face limited access to actionable frameworks and best practices for leveraging design thinking methodologies to drive organizational innovation capabilities. This article aimed to study (1) the relationships of design thinking, digital transformation ambidexterity (exploitative and exploratory), and organizational innovation performance; (2) the moderating roles of institutional environment (regulatory, normative, and cognitive) between design thinking and organizational innovation performance in SMEs in Guangxi, China. The sample was managers and staff selected from 1490 innovative SMEs in Guangxi. The research utilized a quota sampling approach to gather 390 valid survey responses, followed by an examination of variable interconnections through descriptive statistics and structural equation modeling (SEM) analysis. The research results reveal that Design Thinking not only directly and positively affects SMEs' innovation performance but also exerts indirect positive effects through digital transformation ambidexterity, meanwhile indicating that normative and cognitive environment relationships moderate the effects of Design Thinking on organizational innovation performance. The results emphasize the importance of design thinking and digital transformation among SMEs. These findings provide new perspectives for academic discussions on organizational innovation management and offer valuable practical insights for SMEs seeking to enhance organizational innovation performance and achieve competitive advantages via design thinking and digital transformation.

Keywords: Design thinking; Digital transformation; Innovation performance; Organizational ambidexterity; Small and Medium-sized Enterprises

Introduction

The new round of technological revolution and industrial transformation brings new challenges and opportunities to enterprises. The importance of research on enterprise innovation management is on the rise, especially for small and medium-sized enterprises (SMEs). Design thinking has proven to be effective in shaping innovation, in problem-solving, and for creativity (Magistretti et al. 2022). Recent studies suggest that Design thinking can Integrate with artificial intelligence and big data to enable digital transformation, and foster organizational culture and capability building (Mortati et al. 2023; Magistretti et al. 2024; Olivares Ugarte & Bengtsson, 2024). Design thinking has not been widely disseminated among SMEs in China, and there is also a lack of theoretical research in this area. This study constitutes an empirical investigation into the application of design thinking in China's SMEs, which is intended to fill the current gap.

SMEs contribute significantly to employment and GDP but struggle with high mortality rates, often attributed to insufficient innovation capabilities and resource constraints. Chinese national agenda aims to cultivate 1 million innovative SMEs by 2025. By the end of 2024, China has cumulatively cultivated more than 600,000 technological and innovative SMEs. SMEs are vital to regional development yet lag in adopting innovative practices like design thinking and digital transformation. The successful adoption of Design Thinking in SMEs requires distinct critical success factors customized for small-to-medium enterprises. While time investment and financial commitments remain fundamental drivers for innovation execution, SMEs requirement substantially differ from corporate counterparts. Unlike large organizations that typically operate dedicated R&D teams and employ specialized roles like innovation coordinators or certified Design Thinking practitioners, SMEs generally lack equivalent institutional frameworks. This resource disparity creates fundamental differences in infrastructure readiness and human capital availability when assessing methodologies like Design Thinking implementation (Demir, Saur-Amaral & Polónia, 2023).

This study focuses on analyzing the impact of Design Thinking on organizational innovation performance of innovative SMEs, and examines the mediating effects of digital transformation ambidexterity and the moderating effects of institutional environment. This study selects a specific number of enterprises from 1,490 innovative SMEs in Guangxi for quantitative analysis.

The significance of this study lies in its dual theoretical and practical contributions. Academically, it extends the discourse on design thinking beyond large corporations, offering empirical evidence from SMEs. Practically, it guides policymakers and SME managers in leveraging design thinking and digital strategies to enhance competitiveness.

Research Objectives

1. To analyze the effects of design thinking, digital transformation ambidexterity (exploitative and exploratory) on organizational innovation performance in SMEs in Guangxi.

2. To explore how the institutional environment (regulatory, normative, and cognitive) moderates the relationship between design thinking and organizational innovation performance in SMEs in Guangxi.

Literature Review

Design Thinking

Design thinking is a human-centered, creative problem-solving process that has gained significant attention in both academic and practical fields. The literature review reveals that design thinking originated in the 1960s and 1970s, primarily focusing on the application of scientific methods to the design of physical artifacts (Simon, 1969). Over time, it evolved to emphasize designerly ways of problem-solving and investigating processes unique to designers (Buchanan, 1992). Key figures like Richard Buchanan and Tim Brown have contributed to its development, highlighting its iterative nature and focus on user needs (Brown, 2008).

The core attributes of design thinking include creativity and innovation, human-centeredness, problem-solving, iteration and experimentation, interdisciplinary collaboration, visualization, and abductive reasoning (Micheli, Perks & Beverland, 2018; Luchs, 2016; Liedtka, 2017; Carlgren, Elmquist & Rauth, 2016; Seidel & Fixson, 2013). These attributes are essential for fostering a culture of innovation and driving organizational change. Design thinking is often characterized by a three-stage process: inspiration, ideation, and implementation, which involves understanding user needs, generating ideas, and prototyping solutions (Brown, 2008).

Innovation Performance of SMEs

Innovation performance is a critical measure of an organization's ability to generate new products, services, or processes that enhance its competitive advantage. SMEs, which are vital to

economic growth and employment, face unique challenges in achieving innovation due to limited resources and capabilities (Uchenwamgbe, 2013). In China, SMEs are legally defined as enterprises with relatively small staff size, revenue, and assets, classified into medium, small, and micro categories based on industry-specific thresholds for employees (e.g., <1,000 in industry) and annual revenue (e.g., <400 million CNY). Innovation in SMEs can take various forms, including product, service, and process innovations, and is influenced by factors like organizational culture, leadership, and external environment (Acs & Audretsch, 1988; Damanpour, 1992; Amabile, 1996).

Digital Transformation

Digital transformation involves the integration of digital technology into all areas of a business, fundamentally changing how it operates and delivers value. The literature highlights the importance of digital transformation in enhancing organizational efficiency, customer experience, and innovation capabilities (Westerman, Bonnet & McAfee 2014; Verhoef et al., 2021). Key elements of digital transformation include customer understanding, revenue growth, customer touchpoints, process digitization, employee support, performance management, digital modification of business models, new digital business, and digital globalization (Westerman et al., 2014). SMEs face specific challenges in digital transformation, such as high costs, technical complexities, and a lack of digital talent (Li & Lv, 2021). Gurusamy, Srinivasaraghavan and Adikari (2016) propose an integrated framework that combines design thinking and agile methodologies to facilitate faster, more innovative project delivery in the context of digital transformation. This framework emphasizes the importance of design thinking in driving digital transformation by fostering a user-centric approach and iterative development processes.

Organizational Ambidexterity

Organizational ambidexterity refers to a firm's ability to balance exploration (pursuing new opportunities) and exploitation (optimizing current operations). This concept is crucial for sustained competitive advantage (March, 1991). The literature discusses three types of ambidexterity: structural, contextual, and temporal (Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004; Duncan, 1976). Structural ambidexterity involves separating exploration and exploitation into different organizational units, while contextual ambidexterity focuses on individual employees' ability to switch between exploratory and exploitative tasks. Temporal ambidexterity refers to organizations sequentially shifting between exploration and exploitation phases. Jing, Zhang and Ma (2023) found that digital exploitation capabilities are positively linked to market-driven

business model innovation, while digital exploration capabilities are positively associated with driving–market business model innovation.

Hypotheses Development

Design thinking significantly enhances organizational innovation performance by fostering creativity, user–centered design, and iterative problem–solving (Zhang et al., 2024; Rösch, Tiberius & Kraus, 2023). Studies show that design thinking improves innovation performance by encouraging multidisciplinary collaboration, empathy, and rapid prototyping, and helps organizations better understand user needs, leading to more relevant and effective innovations (Wattanasupachoke, 2012). Based on these observations, this study proposes the following hypothesis in the context of SMEs:

H1: Design thinking positively affects organizational innovative performance.

Design thinking plays a crucial role in facilitating digital transformation by providing a structured approach to innovation and change (Gurusamy et al., 2016). It helps organizations identify and prioritize digital opportunities, fostering a culture of continuous improvement and adaptability. The integration of design thinking with digital transformation can lead to more effective and sustainable organizational change (Fehér & Varga, 2017). Based on these observations, this study proposes the following hypothesis in the context of SMEs:

H2: Design thinking positively affects exploitative digital transformation.

H3: Design thinking positively affects exploratory digital transformation.

Digital transformation ambidexterity positively impacts innovation performance by enabling organizations to both exploit existing capabilities and explore new opportunities (Jing et al., 2023). Exploitative digital transformation focuses on optimizing current operations, while exploratory digital transformation seeks to create new value through innovation. Zahra, Abdelgawad and Tsang (2021) suggests that a balanced approach to digital transformation ambidexterity can enhance organizational agility and innovation capabilities. Based on these observations, this study proposes the following hypothesis in the context of SMEs:

H4: Exploitative digital transformation positively affects innovation performance.

H5: Exploratory digital transformation positively affects innovative performance.

H6: Exploitative digital transformation positively affects exploratory digital transformation.

Magistretti, Pham and Dell'Era (2021) found that design thinking's dynamic capabilities, such as extending, debating, cropping, interpreting, and recombining, are essential for managers to cultivate. These capabilities enable firms to transform technological challenges into opportunities,

fostering a more human-centric approach to digital transformation and enhancing innovation performance. Based on these observations, this study proposes the following hypothesis in the context of SMEs:

H7: Design Thinking positively affects organizational innovative performance through the mediating effect of exploitative digital transformation.

H8: Design Thinking positively affects organizational innovative performance through the mediating effect of exploratory digital transformation.

H9: Design Thinking positively affects organizational innovative performance through the mediating effect of a chain of exploitative digital transformation and exploratory digital transformation.

The institutional environment encompasses formal and informal rules, policies, laws, and cultural norms that influence organizational behavior. Scott (1995) emphasized that key dimensions of the institutional environment include regulatory, normative, and cognitive factors and the role of institutional environment in shaping innovation, economic performance, and entrepreneurial activity. Regulatory factors involve government policies and laws, normative factors relate to industry standards and ethics, and cognitive factors pertain to shared beliefs and values within an organization or society (Peng, 1996). Busenitz, Gomez and Spencer (2000) introduced the concept of country institutional profiles, which describe the institutional conditions that influence entrepreneurial behavior. This suggests that different aspects of the institutional environment can have varying impacts on the relationship between design thinking and innovation performance. Based on these observations, this study proposes the following hypothesis in the context of SMEs:

H10: Design Thinking positively affects organizational innovative performance through the moderating effect of regulatory environment.

H11: Design Thinking positively affects organizational innovative performance through the moderating effect of normative environment.

H12: Design Thinking positively affects organizational innovative performance through the moderating effect of cognitive environment.

Conceptual Framework

Building on the theoretical background literature discussed above, the conceptual framework of the research model has been proposed, as shown in Figure 1. The research model depicts that the impact of Design thinking on digital transformation ambidexterity appears significant. Design thinking has a positive impact on exploitative and exploratory digital

transformation. Meanwhile, exploitative and exploratory digital transformation are posited to impact innovation performance positively. Thirdly, the institutional environment moderates the effect of Design thinking on innovation performance.

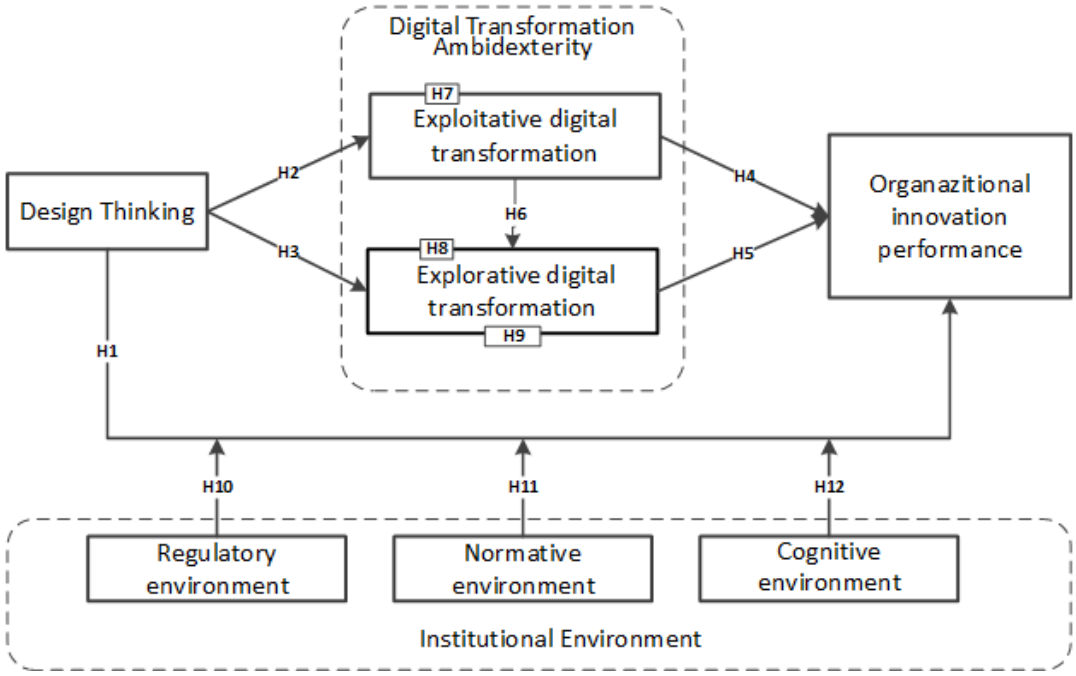

Figure 1 Conceptual Framework of the Research Model

Research Methodology

This study aims to explore how design thinking influences organizational innovation performance of innovative SMEs in Guangxi and examines the mediating effects of digital transformation ambidexterity. In this study, a quantitative research approach was employed. Data was collected by distributing questionnaires to same representative samples of SMEs across various industries. The data collected from the survey would test the research hypothesis through statistical techniques such as descriptive statistics, confirmatory factor analysis (CFA), regression Analysis, structural equation modeling (SEM) and hypotheses testing utilizing software SPSS 26 and AMOS 26.

Population and Sampling Method

This study focuses on innovative SMEs in Guangxi Province, China, with a total of 1,490 such enterprises identified as the population. The reason for this focus is that Guangxi's innovative SMEs have closer business ties with ASEAN countries. The findings from this research will

contribute to academic exchanges between China and ASEAN nations, providing insights into enhancing the international competitiveness of SMEs. The calculation of the sample size was based on Cochran's (1977) approach, targeting a 95% confidence level and a 5% margin of error. As a result, the necessary sample size was ascertained to be 384. A total of 413 responses were collected during the questionnaire survey. After screening, 390 samples were valid, which were used for subsequent analysis.

Research Measurements

The questionnaire prepared by the researcher uses the 5-level Likert scale (Kothari 2004). The components of questionnaire are based on the research objectives including demographic characteristics of the respondents to ensure the relationship between the background of the respondents and the construction of the research variables developed. Meanwhile, the questionnaire consists of seven variables: Design Thinking (DT), Exploitative digital transformation (EID), Exploratory digital transformation (ERD), Organizational Innovation performance (OIP), Regulatory environment (RE), Normative environment (NE), and Cognitive environment (CE). In addition, the measurement for each variable included 4 items.

Research Results

Descriptive statistics

The descriptive statistics of demographic information for 390 respondents shows that 66.15% of the respondents are male and 33.85% are female. In terms of roles, 50.26% are frontline employees, 32.31% are middle managers, and 17.44% are senior managers.

Reliability and Validity Analysis

The Cronbach's α coefficient was measured for the 44 items of the questionnaire using SPSS. As shown in the Table1, the α values for all factors are greater than 0.7, indicating that the data are reliable, and the Average Variance Extracted(AVE) for each factor are greater than 0.5, the CR (Composite Reliability) values are greater than 0.7, indicating that the model has good convergent validity.

Table 1 Cronbach Reliability and Convergent Validity Analysis

Variable	Factors	Cronbach's α	AVE	CR
Design Thinking	User-centered	0.903	0.705	0.905
	Abductive Reasoning	0.923	0.748	0.922
	Team diversification	0.928	0.768	0.930
	Iteration and Experimentation	0.905	0.705	0.905
	Visualization and Representation	0.924	0.754	0.924
Digital transformation Ambidexterity	Exploitative digital transformation	0.927	0.763	0.928
	Exploratory digital transformation	0.940	0.799	0.941
Organizational Innovation performance	Organizational Innovation performance	0.880	0.653	0.882
Institutional Environment	Regulatory environment	0.917	0.737	0.918
	Normative environment	0.905	0.706	0.906
	Cognitive environment	0.913	0.725	0.913

Correlation analysis

Correlation analysis is used to study the relationship between quantitative data, including whether there is a relationship and the degree of closeness of that relationship. Design Thinking has a significant relationship with EID, ERD, OIP, RE, NE, and CE at the significance level of $p < 0.001$. The correlation coefficients are 0.707, 0.691, 0.672, 0.576, 0.569, and 0.458, respectively, and all values are greater than 0, indicating a positive correlation between Design Thinking and these six variables. Additionally, other variables also show a positive correlation with each other.

Table 2 Results of Pearson's Correlation Analysis for Each Dimension

	Mean	S.D.	DT	EID	ERD	OIP	RE	NE	CE
DT	3.961	0.563	1						
EID	3.988	0.673	0.707***	1					
ERD	3.840	0.708	0.691***	0.757***	1				
OIP	3.949	0.571	0.672***	0.641***	0.665***	1			
RE	3.653	0.691	0.576***	0.560***	0.593***	0.624***	1		
NE	3.991	0.621	0.569***	0.600***	0.550***	0.643***	0.619***	1	
CE	4.118	0.616	0.458***	0.531***	0.459***	0.498***	0.437***	0.642***	1

Note: * $p<0.05$ ** $p<0.01$ *** $p<0.001$

The Structural Equation Model and Hypotheses Test

The framework model proposed in this study was constructed using AMOS as shown in Figure 2. The main index of the model fit meets the requirements with χ^2=202, df=113, χ^2/df=1.79, GFI=0.9435, CFI=0.983, NFI=0.963, TLI=0.980, IFI=0.984, RMSEA=0.045. So the model is reasonable.

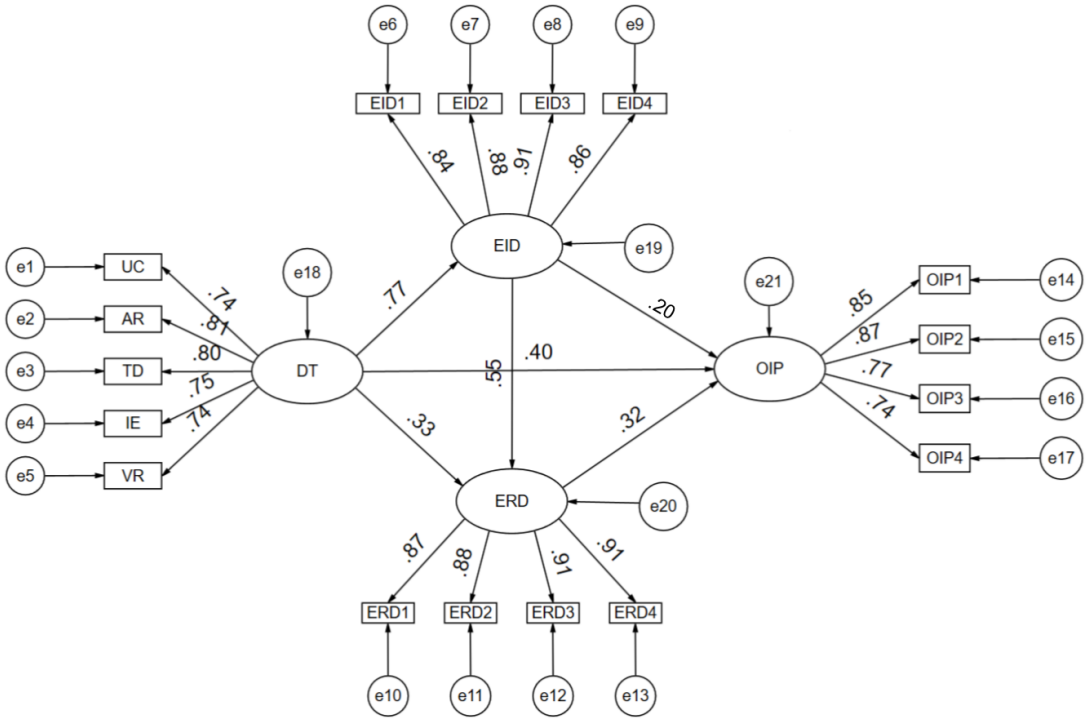

Figure 2 The Structural Equation Model

Table 3 presents the test results for six direct effect hypotheses and reveals the relationships among Design Thinking (DT), Exploitative Digital Transformation (EID), Exploratory Digital Transformation (ERD), and Organizational Innovation Performance (OIP). The result outlines path relationships, providing estimates, standard errors (S.E.), critical ratios (C.R.), and significance levels (P) for each path, indicating six hypotheses(H1–H6) are supported.

Table 3 Direct effects of the four variables

	Path	STD. Estimate	S.E.	C.R.	P	Result
H1	DT-->OIP	.399	.092	5.105	***	supported
H2	DT-->EID	.774	.073	13.075	***	supported
H3	DT-->ERD	.330	.088	5.123	***	supported
H4	EID->OIP	.197	.076	1.635	*	supported
H5	ERD->OIP	.324	.066	4.242	***	supported
H6	EID->ERD	.547	.071	8.447	***	supported

Note: * p<0.05 ** p<0.01 *** p<0.001

Verification of Mediating Effect

The Bootstrap method is considered more effective than the stepwise regression method and the Sobel test in testing mediating effects (Preacher & Hayes, 2004). Using Model 6 of the PROCESS program developed by Hayes (2022), a sample size of 5000 was selected, with a confidence interval of 95%. The data in Table 4 confirm that those mediating effect paths exist. Therefore, H7, H8 and H9 are supported.

Table 4 Mediating Effect Analysis of DT to OIP

Path	Effect	Boot SE	BootLLCI	BootULCI	*z*	*p*
Total Indirect Effect						
DT=>OIP	0.332	0.046	0.238	0.419	7.179	0.000
Parallel Mediating Effects						
H7: DT⇒EID⇒OIP	0.126	0.044	0.041	0.212	2.875	0.004
H8: DT⇒ERD⇒OIP	0.093	0.025	0.047	0.146	3.666	0.000
Chain Mediating Effect						
H9: DT⇒EID⇒ERD⇒OIP	0.113	0.026	0.062	0.165	4.360	0.000

Note: BootLLCI refers to the lower limit of the 95% confidence interval obtained through Bootstrap sampling, and BootULCI refers to the upper limit of the 95% confidence interval obtained through Bootstrap sampling. The type of Bootstrap used is the percentile Bootstrap method.

Verification of Moderating Effects

This study uses linear regression analysis to detect the moderating effect. In the regression analysis, the independent variable, the moderator variable, and their interaction coefficient (independent variable × moderator variable) are all included in the model for analysis. If the interaction coefficient is significant, it indicates that the moderator variable has a moderating

effect. With Regulatory Environment as the moderating variable, the interaction coefficient isn't significant (p=0.303), so this result indicates that regulatory environment is unable to moderates the influence of Design Thinking on organizational innovation performance, meaning that H10 isn't supported. On the contrary, with normative environment and cognitive environment as the moderating variable, the interaction coefficients are significant, indicating that normative environment and cognitive environment positively moderates the influence of Design Thinking on organizational innovation performance, so H11 and H12 are supported.

Discussions

The study offers significant theoretical and practical contributions by elucidating the relationships among design thinking, digital transformation ambidexterity, institutional environments, and organizational innovation performance in SMEs. By addressing the two research objectives, this research advances the understanding of how SMEs can strategically leverage design thinking and digital capabilities to enhance innovation outcomes while navigating institutional complexities.

Research Objective 1: To analyze the effects of design thinking, digital transformation ambidexterity (exploitative and exploratory) on organizational innovation performance in SMEs in Guangxi.

The study confirms that design thinking directly and indirectly enhances SMEs innovation performance through the mediating roles of exploitative and exploratory digital transformation. This aligns with Brown (2008) conceptualization of design thinking as an iterative, user-centric process that fosters creativity and problem-solving. The direct positive effect underscores design thinking capacity to cultivate a culture of experimentation and interdisciplinary collaboration, enabling SMEs to align innovations with market needs. Moreover, the mediation analysis reveals that design thinking amplifies innovation performance by driving both exploitative and exploratory digital transformations, with a significant chain mediation effect. These findings resonate with Jing et al. (2023) argument that digital ambidexterity that balancing incremental optimization (exploitation) and radical innovation (exploration) is critical for sustaining competitive agility.

The contextual ambidexterity highlights that exploitative digital transformation optimizes existing operations, reducing inefficiencies and fostering incremental innovation. Conversely, exploratory digital transformation (e.g., AI-driven product development, IoT integration) enables SMEs to disrupt markets through novel solutions. The interdependence between exploitation and

exploration suggests that SMEs must synergize these approaches to avoid resource conflicts, as emphasized by ambidexterity theory (Gibson & Birkinshaw 2004).

Research Objective 2: To explore how the institutional environment (regulatory, normative, and cognitive) moderates the relationship between design thinking and organizational innovation performance in SMEs in Guangxi.

The institutional environment, which comprise of regulatory, normative, and cognitive dimensions, significantly shapes the efficacy of design thinking in driving innovation. While the regulatory environment (H10) did not moderate the relationship between design thinking and innovation performance, normative and cognitive environments emerged as critical enhancers in SMEs (Park, Wu & Funk, 2025). Normative environment, such as industry standards and ethical expectations, incentivize SMEs to adopt design thinking as a legitimized practice. Guangxi SMEs operating in sectors with strong ASEAN trade networks may emulate peers' innovation strategies to maintain reputational parity. Cognitive factors, including managerial mindsets and employee adaptability, further amplify design thinking impact (Magistretti et al., 2022). The non–significance of the regulatory environment indicates that regulatory frameworks for SMEs remain underdeveloped or inconsistently enforced, diluting their moderating effect.

Knowledge from Research

In the era of the digital economy, design thinking can have a positive impact on the innovation performance of SMEs, with mediating role of digital transformation ambidexterity. The digital transformation of SMEs should not be implemented blindly. Instead, it should be carried out from the perspective of design thinking, planned at a systematic level, adopting a problem–oriented mechanism, and advanced step by step steadily. Exploitative digital transformation is the basic step in the business model transformation of enterprises. It is incremental and gentle, reducing employees' technical anxiety. Its main purpose is to optimize internal processes and maintain the reliable operation of existing businesses. Explorative digital transformation is more radical, mainly used for opening up new markets and customers. Combined with the previous literature review, the application of design thinking in SMEs can be divided into three steps from the dimension of time cycle: discovery, ideation, and implementation, among which discovery is the most critical step, determining whether the delivered product or service meets the needs of users. Discovery includes understanding customers from their perspective and observing their characteristics and behaviors. The ideation step should integrate data elements to correct definition

errors. The implementation step can carry out iterative testing, collect feedback data for rapid optimization. As shown in the Figure 3, the practice of design thinking is like a set of wheels, enabling SMEs to have dynamic capabilities and be more agile, achieving fine innovation performance through digital transformation.

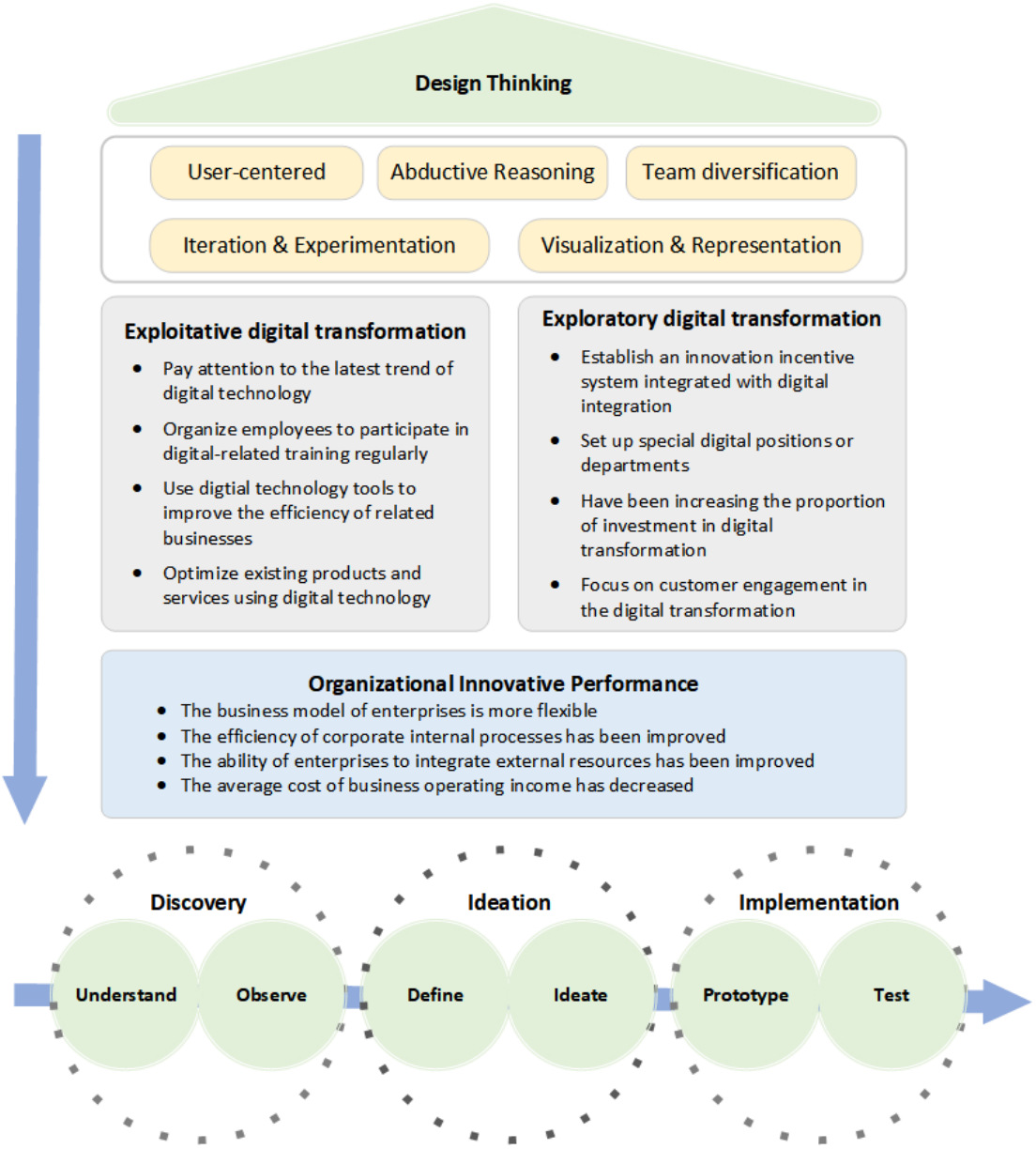

Figure 3 A Design Thinking Application Model in SMEs

Conclusion

This study provides a comprehensive understanding of the role of design thinking and digital transformation ambidexterity in enhancing the innovation performance of SMEs in Guangxi, China. The findings reveal that design thinking not only directly influences organizational innovation performance but also indirectly enhances it through both exploitative and exploratory digital transformation. The study also highlights the moderating effects of the institutional environment, particularly the normative and cognitive dimensions, which significantly amplify the impact of design thinking on innovation performance. However, the regulatory environment did not show a significant moderating effect, suggesting that formal policies may not be as influential as informal norms and shared beliefs in driving innovation within SMEs. This research offers valuable insights for both academics and practitioners. It extends the theoretical understanding of design thinking and digital transformation in the context of SMEs, particularly in emerging markets like Guangxi. For practitioners, the study provides actionable strategies for enhancing innovation performance through the strategic application of design thinking and digital transformation ambidexterity, while also considering the influence of the institutional environment.

Suggestions

Suggestions for SMEs Leaders

Firstly, SMEs leaders should prioritize the adoption of design thinking as a core organizational strategy. This involves fostering a culture of creativity, empathy, and iterative problem–solving. Leaders should encourage cross–functional collaboration and ensure that all employees, from frontline staff to senior management, are trained in design thinking methodologies. This will help in aligning innovation efforts with user needs and market demands. Secondly, SMEs Leaders should recognize the importance of balancing exploitative and exploratory digital transformation. While exploitative transformation focuses on optimizing existing processes and reducing inefficiencies, exploratory transformation aims at creating new market opportunities through radical innovations. SMEs should allocate resources strategically to ensure that both types of transformation are pursued in tandem, thereby achieving a balanced approach to innovation. Thirdly, SME leaders should be aware of the influence of normative and cognitive environments on innovation. By aligning their innovation strategies with industry standards and ethical expectations, SMEs can enhance their legitimacy and competitive advantage. Additionally, fostering a cognitive

environment that encourages adaptability and continuous learning will further amplify the impact of design thinking on innovation performance.

Suggestions for Government Officials

While the study found that the regulatory environment did not significantly moderate the relationship between design thinking and innovation performance, this does not diminish the importance of supportive policies. Government officials should focus on creating regulatory frameworks that encourage innovation, such as providing tax incentives for R&D investments, simplifying bureaucratic procedures for SMEs, and offering grants for digital transformation initiatives. Government bodies should work towards establishing industry standards and best practices that encourage the adoption of design thinking and digital transformation. This could involve organizing workshops, seminars, and training programs to disseminate knowledge about these methodologies. Additionally, government-led initiatives to benchmark and recognize innovative SMEs can create a competitive environment that drives further innovation. Governments should play a proactive role in ensuring that SMEs have access to the necessary digital resources and infrastructure. This could include providing subsidies for digital tools and technologies, offering low-interest loans for digital transformation projects, and establishing innovation hubs where SMEs can collaborate and share resources.

Suggestions for Future Research

Future research should expand geographical and industry diversity in sampling, such as conducting cross-national comparisons, would clarify how institutional heterogeneity, such as policy stability or market openness, shapes the relationship of design thinking and innovation. While this study provides insights into the immediate effects of design thinking on innovation performance using cross-sectional data, future research should explore the long-term impact. Longitudinal studies could track the performance of SMEs over several years to understand how sustained design thinking and digital transformation efforts contribute to sustained competitive advantage. Given the significant moderating effects of normative and cognitive environments, future research should investigate how cultural factors influence the adoption of design thinking and digital transformation in different regions. Comparative studies across various cultural contexts could provide a more nuanced understanding of how these methodologies are adapted and implemented globally. There is a need for more robust metrics to measure the impact of design thinking on organizational performance. Future research could focus on developing and validating

new scales that capture the multifaceted effects of design thinking, including its influence on employee engagement, customer satisfaction, and financial performance.

References

Acs, Z.J., & Audretsch, D.B. (1988). Innovation in large and small firms: an empirical analysis. *The American Economic Review*, 78, 678–690.

Amabile, T.M. (1996). Creativity and innovation in organizations. *Harvard Business School Background*, (1), 396–239.

Brown, T. (2008). Design thinking. *Harvard Business Review, 86*(6), 84.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues, 8*(2), 5–21.

Busenitz, L. W., Gomez, C., & Spencer, J. W. (2000). Country institutional profiles: unlocking entrepreneurial phenomena across national boundaries. *Academy of Management Journal, 43*(5), 994–1005.

Carlgren, L., Elmquist, M., & Rauth, I. (2016). The challenges of using design thinking in industry–experiences from five large firms. *Creativity & Innovation Management, 25*(3), 344–362.

Cochran, W. G. (1977). *Sampling techniques*. (3rd ed.). New York: John Wiley & Sons.

Damanpour, F. (1992). Organizational Size and Innovation. *Organization Studies*, 13, 375–402.

Demir, F., Saur–Amaral, I., & Polónia, D. (2023). Design thinking and innovation strategy by SMEs for competitiveness: a review. *International Journal of Marketing Innovation and Strategy, 1*(2), 74–86.

Duncan, R. B. (1976). The ambidextrous organization: designing dual structures for innovation. In R. H. Kilmann, L. R. Pondy & D. P. Slevin (Eds.), *The Management of Organization*, 1, 167–188. North–Holland.

Fehér, P., & Varga, K. (2017). Using design thinking to identify banking digitization opportunities – snapshot of the Hungarian banking system. *BLED 2017 Proceedings*, 39. http://aisel.aisnet.org/bled2017/39

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal, 47*(2), 209–226.

Gurusamy, K., Srinivasaraghavan, N., & Adikari, S. (2016). An integrated framework for design thinking and agile methods for digital transformation. In: Marcus, A. (eds) design, user experience, and usability: design thinking and methods. DUXU 2016. *Lecture Notes in Computer Science, 9746*. Springer, Cham. https://doi.org/10.1007/978–3–319–40409–7_4

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis*. (3rd ed). The Guilford Press.

Jing, H., Zhang, Y., & Ma, J. (2023). Influence of digital ambidextrous capabilities on SMEs' transformation performance: The mediating effect of business model innovation. *Heliyon, 9*, e21020. https://doi.org/10.1016/j.heliyon.2023.e21020

Kothari, C.R. (2004). *Research methodology: methods and techniques*. (2nd ed.). New Delhi: New Age International Publishers.

Li, Z., & Lv, T. (2021). Digital transformation: literature review and research prospects. *Study & Exploration*, (12), 130–138.

Liedtka, J. M. (2017). Evaluating the impact of design thinking in action. *Academy of Management Proceedings,* (1). https://doi.org/10.5465/AMBPP.2017.177

Luchs, M. G. (2016). A brief introduction to design thinking. In M. G. Luchs, K. S. Swan, & A. Griffin (Eds.), *Design thinking: new product development essentials from the PDMA*, 1–12. Wiley.

Magistretti, S., Bellini, E., Cautela, C., Dell'Era, C., Gastaldi, L., & Sina, L. (2022). The perceived relevance of design thinking in achieving innovation goals: The individual microfoundations perspective. *Creativity and Innovation Management*, 31, 740–754. https://doi.org/10.1111/caim.12519

Magistretti, S., Legnani, M., Pham, C. T. A., & Dell'Era, C. (2024). The 4S model for AI adoption. *Research–Technology Management, 67*(3), 54–63. https://doi.org/10.1080/08956308.2024.2325859

Magistretti, S., Pham, C., & Dell'Era, C. (2021). Enlightening the dynamic capabilities of design thinking in fostering digital transformation. *Industrial Marketing Management*, 97, 59–70. https://doi.org/10.1016/j.indmarman.2021.04.014

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71–87.

Micheli, P., Perks, H., & Beverland, M. B. (2018). Elevating design in the organization. *Journal of Product Innovation Management, 35*(4), 629–651. https://doi.org/10.1111/jpim.12434

Mortati, M., Magistretti, S., Cautela, C., & Dell'Era, C. (2023). Data in design: how big data and thick data inform design thinking projects. *Technovation*, 122. https://doi.org/10.1016/j.technovation.2022.102688

Olivares Ugarte, J. E., & Bengtsson, L. (2024). Central characteristics and critical success factors of design thinking for product development in industrial SMEs—a bibliometric analysis. *Businesses*, *4*(4), 843–864. https://doi.org/10.3390/businesses4040046

Park, M., Wu, S., & Funk, R. J. (2025). Regulation and innovation revisited: How restrictive environments can promote destabilizing new technologies. *Organization Science, 36*(1), 240–260.

Peng, M. W. (1996). The resource-based view of the firm in two environments: The Hollywood film studios from 1936 to 1965. *Journal of Management Studies, 33*(5), 593–614.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments & Computers, 36*(4), 717–731.

Rösch, N., Tiberius, V., & Kraus, S. (2023), Design thinking for innovation: context factors, process, and outcomes. *European Journal of Innovation Management, 26*(7), 160–176.

Scott, W. R. (1995). *Institutions and organizations*. Sage.

Seidel, V. P., & Fixson, S. K. (2013). Adopting design thinking in novice multidisciplinary teams: the application and limits of design methods and reflexive practices. *Journal of Product Innovation Management, 30*(S1), 19–33.

Simon, H. (1969). *The sciences of the artificial*. MIT Press.

Tushman, M.L., & O'Reilly, C.A. (1996). Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. *California Management Review, 38*(4), 8–30.

Uchenwamgbe, B.P. (2013). Effects of leadership style on organizational performance in Small and Medium Scale Enterprises (SMEs) in Nigeria. *European Journal of Business and Management, 5*, 53–73.

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: a multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901.

Wattanasupachoke, T. (2012). Design thinking, innovativeness and performance: an empirical examination. *International Journal of Management and Innovation, 4,* 1–14.

Westerman, G., Bonnet, D., & McAfee, A. (2014). The nine elements of digital transformation. *MIT Sloan Management Review, 55*(3), 1–6.

Zahra, S. A., Abdelgawad, S. G., & Tsang, E. W. (2021). The promise and peril of big data for SMEs: Managing technology adoption and innovation. *Journal of Business Venturing Insights, 15,* e00226. https://doi.org/10.1016/j.jbvi.2021.e00226

Zhang, X., Liu, C., Cang, X., Lyu, Y., Zhang, M., Chen, Z., Yu, Y., Sun, Z., & Xue, Y. (2024). Research on the effect of design thinking on enterprise sustainable innovation ability and team performance. *Sustainability, 16*(11), 4428. https://doi.org/10.3390/su16114428