LEVERAGING AI FOR SUSTAINABLE DEVELOPMENT IN SMES: THE MEDIATING ROLES OF INNOVATION CAPABILITY AND ORGANIZATIONAL LEARNING

Zhaoyang Lu
E-mail: 81422706@qq.com
Srochinee Siriwattana
E-mail: srochinee.si@ssru.ac.th

Abstract

With the rapid advancement of artificial intelligence (AI) technologies in Beijing and the growing emphasis on enterprise sustainability, AI applications have become a key driver of sustainable growth for small and medium-sized enterprises (SMEs). This study investigates how AI influences enterprise sustainable development, emphasizing the mediating roles of innovation capability and organizational learning. Grounded in Technology Innovation Theory, Organizational Learning Theory, and Enterprise Sustainable Development Theory, the research adopts a mixed-methods approach that integrates quantitative and qualitative analyses. Data are collected through online questionnaires and semi-structured interviews with senior and middle managers from SMEs across various industries in Beijing. Partial Least Squares Structural Equation Modeling (PLS-SEM) is applied to test the proposed conceptual framework. The results reveal that AI adoption significantly enhances enterprise sustainable development, both directly and indirectly, through innovation capability and organizational learning. AI fosters innovation by enabling data-driven insights, automation, and rapid prototyping, while simultaneously promoting organizational learning through improved knowledge management and global knowledge access. A sequential mediation pathway is identified in which AI strengthens organizational learning, which subsequently enhances innovation capability, ultimately driving sustainable development. This study contributes to the theoretical understanding of how AI facilitates sustainable enterprise growth and offers practical insights for SMEs in Beijing aiming to integrate AI into their innovation and learning strategies for long-term sustainability.

Keywords: Artificial Intelligence, Enterprise Sustainable Development, Innovation Capability, Organizational Learning.

Introduction

SMEs in Beijing are navigating the complexities of digital transformation, with the rise of AI presenting both opportunities and significant challenges. While AI offers a path to improved efficiency and reduced costs, the adoption of this technology is hindered by several factors. A report from the China Association of Small and Medium-sized Enterprises (2020) highlights technical issues like the incompatibility of AI systems with existing infrastructure (Liu & Zhang, 2020). There's also a considerable talent gap, as SMEs struggle to attract and retain the specialized professionals needed to implement and maintain AI technologies (Wang & Li, 2021). Furthermore, the high costs associated with AI research, development, and maintenance pose a significant barrier for many SMEs with limited capital (Chen & Zhao, 2022).

The academic community lacks a consensus on the overall impact of AI on SME sustainability. Some studies, like those by Sun & Wu (2019), point to the positive effects of AI in enhancing production and reducing costs (Zhao & Liu, 2020). Conversely, other research,

such as Li & Wang (2020), warns of potential negative consequences like job displacement, data security risks, and an over-reliance on technology that could stifle core competency development (Zhang & Chen, 2021). The mediating roles of innovation capability and organizational learning in this process remain underexplored. While innovation capability is recognized as a key driver of sustainable development (Liu & Chen, 2021), the specific ways in which AI fosters innovation and how this, in turn, promotes sustainability are not well-defined (Gao & Wang, 2022). Similarly, the mechanism through which organizational learning helps SMEs effectively absorb AI technology and the interplay between learning and innovation require further investigation (Zhao & Sun, 2022). From a practical standpoint, SMEs in Beijing often lack a cohesive strategy for integrating AI into their innovation and learning frameworks (Liu & Zhang, 2023). This includes a lack of employee training and underdeveloped collaboration models with external partners like research institutions (Wang & Li, 2023; Chen & Zhao, 2023). Addressing these multifaceted issues is crucial for providing SMEs with practical guidance and a deeper understanding of how to leverage AI for long-term sustainable growth.

Research Objectives (1) To assess the impact of artificial intelligence adoption on sustainable development outcomes among SMEs in Beijing. (2) To examine how innovation capability and organizational learning mediate the relationship between artificial intelligence adoption and sustainable development among Beijing SMEs. (3) To develop and validate an integrated model explaining how artificial intelligence, innovation capability, and organizational learning collectively enhance sustainable development in Beijing SMEs. Use the theory is Technology Innovation Theory, Organizational Learning Theory, Enterprise Sustainable Development Theory. This research employs a comprehensive mixed-methods approach that systematically integrates quantitative and qualitative methodologies, enhanced by triangulation techniques to ensure the robustness, validity, and depth of findings.

This research explores how AI adoption, mediated by innovation capability and organizational learning, can drive the sustainable development of SMEs in Beijing. It offers policy-level insights by guiding the development of targeted support measures, such as training, funding, and innovation incentives, to help SMEs overcome AI adoption barriers. For businesses, the study demonstrates how AI can improve operational efficiency, foster innovation, and enhance competitiveness, even for resource-constrained firms. Academically, it contributes to interdisciplinary research by linking AI, sustainability, and organizational behavior, offering both theoretical enrichment and practical guidance. Overall, the study serves as a strategic reference for policymakers, enterprises, and scholars focused on digital transformation and SME sustainability.

Research Objectives

1. To assess the impact of artificial intelligence adoption on sustainable development outcomes among SMEs in Beijing.
2. To examine how innovation capability and organizational learning mediate the relationship between artificial intelligence adoption and sustainable development among Beijing SMEs.
3. To develop and validate an integrated model explaining how artificial intelligence, innovation capability, and organizational learning collectively enhance sustainable development in Beijing SMEs.

Research Methodology

1. Assess AI's Impact on SME Sustainability in Beijing.

Examine how artificial intelligence adoption influences the sustainable development of small and medium-sized enterprises. Focus on the mediating roles of innovation capability and organizational learning.

2. Quantitative Analysis of Key Relationships.

Use survey data from SMEs to measure AI adoption, innovation capability, organizational learning, and sustainability performance. Apply PLS-SEM to test hypothesized relationships and mediation effects.

3. Qualitative Exploration for Deeper Insights.

Conduct in-depth interviews with SME managers to understand experiences, challenges, and strategies in AI adoption. Explore contextual factors influencing innovation, learning, and sustainability outcomes.

4. Integrate Quantitative and Qualitative Findings.

Employ a sequential explanatory mixed-methods approach to validate and enrich results. Use triangulation to develop a comprehensive understanding of the "what" (statistical patterns) and the "how/why" (underlying mechanisms).

Research Results

The key findings of this study are both significant and far-reaching. It has been clearly demonstrated that artificial intelligence implementation exerts a positive and profound impact on innovation capability and organizational learning initiatives. A well-integrated AI system serves as the cornerstone for promoting enhanced innovation and knowledge acquisition within SMEs. For instance, it streamlines data analysis processes, ensuring that decisions are made based on comprehensive considerations and actionable insights. It also fosters better knowledge management by establishing efficient information processing systems, providing ample opportunities for continuous learning, and creating a tech-enabled working atmosphere. Additionally, it enhances organizational adaptability, which not only builds competitive advantage among stakeholders but also enables effective monitoring and evaluation of the enterprise's sustainability performance.

In terms of innovation capability, strong AI implementation encourages enterprises to go beyond mere operational efficiency and actively engage in activities that transform their products, services, and business models. This includes taking proactive measures in product innovation, such as implementing data-driven design processes, reducing time-to-market, and promoting customer-centric development. Enterprises also contribute to process innovation through various means, such as automating routine tasks, optimizing resource allocation, and enhancing quality control through AI-powered systems. Moreover, they develop business model innovations, ensuring sustainable revenue streams, creating new value propositions, and maintaining high-quality service standards.

These positive impacts on innovation capability and organizational learning, in turn, play a crucial role in significantly contributing to the enhancement of enterprise sustainable development. The empirical results confirm that innovation capability and organizational learning fully mediate the relationship between artificial intelligence and enterprise sustainable development. Through a series of technological and organizational mechanisms, SMEs in Beijing can improve their sustainable development outcomes by strengthening AI implementation, optimizing innovation capability, and nurturing organizational learning. For example, enhanced innovation capability can boost product sustainability and eco-efficient processes, while active organizational learning can develop the enterprise's sustainability

knowledge base and adaptive capacity, both of which ultimately lead to increased environmental performance, social responsibility, and economic sustainability.

Overall, the empirical results obtained from the survey and interviews not only contribute significantly to the academic understanding of the factors influencing enterprise sustainable development in the context of Beijing's dynamic business environment but also have important practical implications. For stakeholders, this study offers valuable guidance on how to leverage artificial intelligence, foster innovation capability, promote organizational learning, and strengthen sustainable development to enhance competitiveness and achieve long-term sustainability. However, it should be noted that the technological and business environment is constantly evolving, and future research may include longitudinal studies on sustainable development metrics to track changes over time, cross-industry comparisons to understand the differences in influencing factors among different sectors, and in-depth exploration of specific artificial intelligence, innovation capability, or organizational learning interventions to further refine and improve the strategies for enhancing enterprise sustainable development.

Discussion

The paper emphasizes the crucial roles of artificial intelligence (AI), innovation capability, and organizational learning in achieving sustainable development for small and medium-sized enterprises (SMEs) in Beijing. The study's findings align with existing literature, confirming that AI implementation forms a foundation for boosting both innovation and learning. However, it also offers unique insights into the specific context of Beijing SMEs.

The positive relationship between AI and innovation is attributed to several factors:

- Data-driven insights: AI systems provide advanced analytics to identify new market opportunities and customer needs, helping to prioritize R&D efforts.
- Automation: AI automates routine tasks, freeing up human resources for creative, high-value innovation.
- Rapid prototyping: AI-powered tools and simulations reduce the time and cost of product development, which is especially beneficial for resource-constrained SMEs.

Regarding the link between AI and organizational learning, the paper highlights how AI facilitates better knowledge management:

- Knowledge capture and sharing: AI-powered systems automatically document and categorize organizational knowledge, making it easily accessible.
- Personalized learning: AI can tailor learning content and methods for individual employees, enhancing engagement and retention.
- Global knowledge access: AI tools like natural language processing can break down language barriers, enabling SMEs to access global knowledge resources.

The study also identifies a sequential mediation path where AI first enhances organizational learning, which in turn strengthens innovation capabilities. This process is driven by improved knowledge acquisition and distribution, leading to a learning-oriented workforce that is more likely to experiment and collaborate.

References

Agrawal, A., Gans, J., & Goldfarb, A. (2018). *Prediction machines: The simple economics of artificial intelligence*. Harvard Business Review Press.

Anderson, B., & Roberts, K. (2023). Deep learning applications in enterprise decision-making: A systematic review. *Information Systems Research, 34*(2), 456–478.

Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science, 22*(5), 1123–1137.

Argyris, C. (1999). *On organizational learning*. Blackwell Publishers.

Brock, J. K.-U., & von Wangenheim, F. (2019). Demystifying AI: What digital transformation leaders can teach you about realistic AI adoption. *California Management Review, 61*(4), 110–134.

Brown, A., Lee, D., & Kim, J. (2023). AI and revenue growth in SMEs. *Journal of Business Research, 76*(4), 345–360.

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986–1014. https://doi.org/10.5465/amr.1995.9512280033

Teece, D. J. (2018). Dynamic capabilities and innovation. *Strategic Management Journal, 39*(6), 1025–1052.