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論文題目	An AI-Enabled Innovation Ecosystem Framework for Micro, Small, and Medium Enterprises in the Chinese Apparel Manufacturing Industry		
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論文の内容の要旨

Background

The fashion industry offers a compelling research scope with the evolution of artificial intelligence (AI) driving profound transformations in Industry 4.0 and 5.0 contexts. This is because of its mass production and its significant sustainability issues and challenges. This rapid advancement of AI in the traditional apparel manufacturing sector is accelerating innovation and transformation, as AI applications have been increasingly integrated into the industry in recent years. China's apparel industry is the world's largest apparel producer, which is predominantly composed of micro (fewer than 20 employees), small (21-300 employees), and medium-sized (301-1000 employees) enterprises (MSMEs). These MSMEs face challenges posed by AI-integrated technologies, particularly in adapting to digital transformation with limited resources and talents. At the same time, the Chinese government has introduced numerous policies to foster the application of AI in transforming traditional manufacturing in different areas of industry.

Rationale and Gaps

However, the favorable technological, industrial, and Chinese AI policy context has not attracted scholars' research interest in the Chinese apparel manufacturing sectors. While China has made outstanding achievements in applying AI in the apparel manufacturing sectors, the adoption of AI by traditional apparel manufacturers has progressed slowly. Therefore, it is necessary to investigate the factors that drive or hinder AI adoption. Among the 41 studies selected on technology adoption in manufacturing sectors from the Scopus database using preferred reporting items for systematic reviews and meta-analysis protocol, the study focused on a specific manufacturing sector with evidence from China is still relatively rare, with limited studies focus on specific manufacturing, and only one, focuses on MSMEs (Gap 1). Second, current studies have not examined the correlations between AI adoption and open innovation toward these emerging technologies applied to Chinese apparel manufacturing sectors through knowledge/resource-based views (Gap 2). Third, current research overlooks how apparel manufacturing companies collaborate with the government and universities to develop an innovation ecosystem, considering the China's

institution's regulations and policy context (Gap 3).

Research Objectives

Therefore, this thesis's main research objective (***MRO***) aims to develop a framework for propositions for micro, small, and medium-sized Chinese apparel manufacturing's innovation ecosystem. Accordingly, this thesis comprises two sub-research objectives (***SROs***). ***SRO 1*** provides the initial exploratory correlations between AI adoption and open innovation from apparel manufacturing MSMEs managers' perspectives, identifying knowledge absorptive capacity (KACAP)'s significant impacts through an integrated and extended technology acceptance model (TAM) and technological, organizational, and environmental (TOE) framework; ***SRO 2*** aims to ground the required AI capabilities and barriers to adopting AI in Chinese apparel manufacturers, subsequently through coding the diverse perspectives from managers of the apparel industry, university staffs and leaders of apparel associations, thereby developing a novel triple-layer framework of AI-enabled innovation ecosystem, thus generating the conceptual propositions. This demonstrates a significant connection between ***SRO 1*** and ***SRO 2***, which achieves the ***MRO***.

Design/Methodology/Approach

Two studies fulfill the two ***SROs***. ***Study 1*** (to achieve ***SRO 1***) predominantly utilized a quantitative research approach, leveraging Partial Least Squares-Structural Equation Modeling (PLS-SEM) to empirically validate the antecedents of AI adoption and its consequential effects on knowledge absorptive capacity and open innovation capability. It collected 269 apparel MSMEs' top managers from June to August 2024. Through the rigorous statistical analysis of a substantial dataset, this study examined the causal relationships underpinning AI adoption and these critical innovation-related constructs, thereby furnishing robust empirical evidence that substantiates the proposed hypotheses. ***Study 2*** (to achieve ***SRO2***) adopted a qualitative research approach grounded in the principles of grounded theory to explore the intricate processes through which organizations architect an AI-driven innovation ecosystem from two required AI capabilities and three barriers to adopting AI. Through semi-structured interviews with 15 participants and another 5 for data saturations conducted from June to October 2024, this study constructed an interpretive framework and propositions that explain the specific mechanisms and pathways through which AI catalyzes the development of innovation ecosystems within organizational settings.

Findings

The results of ***Study 1*** show that the TAM-TOE structural model explains 60.7% of the variance in AI adoption, 47.4% in KACAP, and 55.4% in open innovation, which suggests the good explanatory, and all these Q^2 values indicate a large predictive accuracy threshold. Drawing on the proposed model, the study has identified technological (e.g., perceived usefulness) and environmental factors (e.g., competitive pressure, market uncertainty, and government support and policy) that significantly impact AI adoption. Meanwhile, organizational factors (e.g., organizational readiness) directly impact KACAP, and environmental factors (competitive pressure, supplier involvement, and market uncertainty) directly impact open innovation. Subsequently, the AI construct having a significant influence on MSMEs' open innovation through KACAP. Based on the preliminary results

of ***Study 1***, ***Study 2*** adopted a grounded theory approach to qualitatively analyze interviews with representatives from enterprises, universities, and apparel associations to obtain the required AI capabilities and barriers to adopting AI. Through systematic coding and comparison, the study selected a coding framework to align the 13 propositions with the theoretical framework, ultimately forming a new AI-enabled Triple Layer Innovation Ecosystem Framework. This framework reflects the dynamic interplay between external knowledge absorption and the firm's internal innovation capacity, highlighting the collaborative roles of different stakeholders in driving AI adoption and open innovation, thereby achieving the ***MRO*** of the thesis.

Research Significance

Theoretically, the research developed a novel extended TAM-TOE framework that integrates AI adoption with open innovation and KACAP in the Chinese apparel manufacturing industry. This fills existing theoretical gaps by linking AI technology to organizational innovation processes and demonstrating the mediating influence of KACAP. Also, the proposed model provides a foundation for future research exploring the intersection of AI and innovation in similar industries. By categorizing key required AI capabilities in the Chinese apparel manufacturing sector and the factors hindering their AI adoption, this study also provides a theoretical lens in a novel theoretical triple-layer framework for innovation ecosystems to understand how open innovation within the apparel industry, universities, associations, and government entities collaborate to leverage AI technologies for mutual benefit.

Practically, the research provides insights for apparel manufacturers seeking to adopt AI technologies to foster open innovation. By identifying the key factors affecting AI adoption and highlighting the importance of KACAP, the study offers enterprises 13 propositions for integrating AI into their innovation processes. This will enhance their ability to produce small-batch, highly personalized products and increase their competitiveness in a rapidly evolving market. Furthermore, the framework developed offers guidance on how traditional businesses improve collaboration with universities, associations, and government agencies to co-create values in the AI-enabled innovation ecosystem. Simultaneously, the research outcomes provide the innovation path for university talent cultivation in the AI-driven innovation context.

Policy-related, the research informs policymakers by unveiling the mechanisms through which AI can promote collaboration between enterprises, academic institutions, and government bodies. Policymakers can use the findings to develop strategies that encourage the integration of AI into industry and innovation systems, contributing to the broader goal of sustainable economic development in the Chinese apparel manufacturing sector, concreting, and practical policy measures for apparel industrial transformation and upgrading.

Keywords: Artificial Intelligence adoption; Open innovation; Innovation ecosystems; Knowledge absorptive capacity; Chinese apparel manufacturing micro, small and medium-sized enterprises

論文審査の結果の要旨

Her research provided insightful contribution to the field of innovation management, within the context of AI adoption in the Chinese apparel manufacturing industry. It developed an extended TAM-TOE framework that integrates AI adoption with open innovation and Knowledge Absorptive Capacity (KACAP). This framework addresses critical gaps in existing literature by linking AI technology to organizational innovation processes and emphasizing the mediating role of KACAP, providing valuable insights for both academia and industry.

Moreover, the introduction of a triple-layer framework for innovation ecosystems is a novel theoretical lens that sheds light on the collaboration between various stakeholders, such as businesses, universities, associations, and government entities. This makes a significant contribution to the growing body of knowledge on an AI-enabled innovation ecosystem.

The identification of key factors affecting AI adoption and the emphasis on KACAP as a critical enabler for innovation are particularly useful for businesses aiming to integrate AI into their innovation processes. The 13 propositions offered for AI integration are practical and directly relevant to enhancing competitiveness, especially in terms of enabling small-batch, highly personalized products.

The research fills important gaps in the literature, provides actionable insights for industry practitioners, and informs policy development in the context of AI-driven innovation.

This is an excellent dissertation, and we approve awarding a doctoral degree to QU, Chen.