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THE INVERTED U-SHAPED IMPACT OF ARTIFICIAL INTELLIGENCE ON GREEN INNOVATION: AN ORGANIZATIONAL LEARNING PERSPECTIVE IN MANUFACTURING SUPPLY CHAINS

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Abstract

As manufacturing firms navigate the dual pressures of environmental sustainability and technological innovation, understanding how artificial intelligence (AI) shapes green innovation has become increasingly critical. Although AI enhances environmental performance by strengthening data analytics and knowledge integration, emerging evidence suggests that its effects are not uniformly positive. Drawing on organizational learning theory, this study explores the nonlinear link between AI adoption and green innovation performance, suggesting an inverted U-shaped effect. This study empirically tests the theoretical model using panel data from 6,353 Chinese manufacturing firms over the period 2010–2024, applying generalized least squares estimation with Stata 17.0. The findings indicate that moderate levels of AI adoption enhance green innovation by strengthening organizational learning capabilities, whereas excessive reliance on AI induces “learning myopia” that constrains innovation outcomes. Furthermore, supply-chain network structures moderate this relationship: network centrality amplifies the curvilinear effect by generating information redundancy, while structural holes weaken it by providing access to diverse and non-redundant knowledge channels. These results highlight that AI’s impact on green innovation is strongly shaped by both the intensity of adoption and the context of interorganizational networks. By going beyond the traditional linear view, this study is the first to uncover an inverted U-shaped relationship between AI adoption and green innovation from the standpoint of organizational learning. By articulating the dual mechanisms of learning enhancement and learning myopia, the study provides a nuanced theoretical explanation of why moderate AI adoption promotes, whereas excessive dependence inhibits, green innovation, offering refined theoretical insights into the application of AI in environmental domains.

Key words: artificial intelligence, green innovation, organizational learning, environmental management, supply chain network position

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