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Research Article

Role of Artificial Intelligence and Blockchain in Strengthening Supply Chain Operations in the Pharmaceutical Sector in India

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ABSTRACT

Digital technologies like Artificial Intelligence (AI) and Blockchain are changing the way global supply chains work very quickly. They are opening up new ways to make operations more open, efficient, and resilient. In India's pharmaceutical industry, where fake drugs, broken logistics, and regulatory problems are still problems, these technologies show a lot of promise. This study examines the influence of AI and Blockchain on enhancing pharmaceutical supply chain operations in India, emphasizing their effects on transparency, traceability, efficiency, and consumer trust. Utilizing the Technology–Organization–Environment (TOE) framework and the Resource-Based View (RBV), the study formulates and empirically evaluates a conceptual model that incorporates AI capabilities, Blockchain transparency, and the degree of technological integration as principal factors influencing supply chain performance. Primary data were gathered from 272 respondents, encompassing pharmaceutical manufacturers, distributors, and logistics providers throughout India. Structural Equation Modeling (SEM) through AMOS 28.0 was used to look at the data. The results show that using AI makes the supply chain much more efficient by using predictive analytics and process optimization. Blockchain technology, on the other hand, makes things more transparent by making sure that data is accurate, traceable, and can be found. The results also show that the level of technological integration partially affects the link between AI–Blockchain adoption and performance outcomes, making their positive effects on consumer trust and operational excellence even stronger. The research enhances theoretical frameworks by integrating the TOE and RBV models and advancing digital supply chain literature through empirical validation of AI–Blockchain convergence in a developing economic context. From a management point of view, it gives a plan for strategic investment, regulatory alignment, improving digital literacy, and building a collaborative ecosystem to make the pharmaceutical supply chain more open and strong. The study finds that combining AI and Blockchain in a way that works together is a key factor in India's pharmaceutical sector's digital transformation, compliance with regulations, and long-term competitiveness.

Keywords: Artificial Intelligence, Blockchain, Supply Chain Efficiency, Pharmaceutical Industry, Technological Integration, Transparency, India are some of the words that come to mind.