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I-CReST 2025:105-076 – Evaluating the Impact of Autonomous Mobile Robots on Warehouse Efficiency in a Malaysian Retail Pharmacy Chain

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ABSTRACT

This study investigates the operational impact of Autonomous Mobile Robots (AMRs) in the warehouse of a Malaysian retail pharmacy chain navigating the complexity of omni-channel fulfilment. The research addresses a key problem: how mid-sized warehouses can scale efficiency without major infrastructure overhaul in the face of high SKU variability and fluctuating order volumes. A mixed-methods design was used, combining survey data (n=30) based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and interview insights (n=7) aligned with the Supply Chain Agility and Resilience (SCAR) framework. Quantitative findings revealed a significant increase in picking accuracy from 94% to 99.95%, with a 50% reduction in peak manpower requirements. Regression analysis confirmed performance expectancy ($\beta = 0.383$, $p = .044$) and facilitating conditions ($\beta = 0.406$, $p = .032$) as strong predictors of employee intention to use AMRs. Qualitative insights supported these findings and highlighted the AMRs' ability to reduce physical strain and structure workflow, while also exposing critical dependencies on backend systems. Fulfilment continuity was vulnerable to Wi-Fi signal drops below -50 dBm and inaccurate SKU metadata, which caused system interruptions and rack failures. Nevertheless, AMR integration enabled a 30.7% increase in inventory value stored within the same footprint and improved throughput during campaigns, reaching up to 22,000 order lines daily. These results suggest that AMRs can act as scalable, labour-efficient solutions when paired with reliable digital infrastructure and well-planned operational redesign. The study concludes that while AMRs alone do not solve all fulfilment challenges, they significantly enhance agility and productivity in resource-constrained retail environments, offering a replicable model for automation in Southeast Asia's emerging logistics sector.

Keywords: Autonomous Mobile Robots; Warehouse Automation; Supply Chain Agility; Technology Adoption; Omni-channel Logistics