4th World Conference on Management, Business, and Finance

12-14 December 2025 I Dubai, United Arab Emirates

Automated Multi-ERP Unit of Measure Harmonization: A Machine Learning and Reinforcement Learning Approach for Supply Chain Data Consistency

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ABSTRACT

Effectively managing Units of Measure (UOM) inconsistencies across diverse ERP systems remains a critical bottleneck impeding data accuracy and operational efficiency in large-scale supply chains. This study presents an automated Multi-ERP UOM Harmonization System implemented via a KNIME workflow, addressing this challenge by integrating physics-aware validation, machine learning prediction, and reinforcement learning automation. The system consolidates UOM data from three ERP environments, including development (PRE), production (PRD), and production planning (PRP), while supporting CSV uploads in the absence of SAP ERP. This enables the effective transformation of a demanding manual reconciliation process consuming over 200 person-hours monthly into an autonomous operation processing 10,000+ records in 2–3 minutes with a 94% resolution rate. The system architecture implements a four-stage pipeline: multi-source data acquisition (direct Oracle ERP integration for PRE, PRD, and PRP, and a web portal for CSV file uploads), intelligent harmonization using a PRP-centric standardization logic, autonomous decision-making, and standardized output for production use. Physics-based validation enforces dimensional consistency per NIST standards, with uncertainty propagation across multi-step conversions. A machine learning model, leveraging over 60 features, achieves 85–92% accuracy in predicting UOM errors and generating risk scores. Implementing a reinforcement learning framework optimizes remediation actions, reducing manual interventions dramatically. Concluding, this system transforms manual, error-prone UOM reconciliation into a scalable, automated solution that delivers high accuracy, operational efficiency, and strategic value. Its integration of physics-based validation, machine learning, and reinforcement learning provides a new standard for supply chain data management in complex multi-ERP environments.

Keywords: Data Integration, KNIME workflow, Machine Learning Automation, NIST standards, Reinforcement Learning