ABSTRACT

The global and national pharmaceutical industries face critical challenges regarding counterfeit drug circulation, which threatens public safety, and distribution tracking inefficiencies caused by centralized recording systems vulnerable to data manipulation and information silos. This research develops a transparent, immutable and decentralized drug supply chain system to ensure the integrity of pharmaceutical distribution data. Utilizing the Design Science Research (DSR) approach, the system was built using smart contracts on the Base network (Ethereum Layer-2), implementing batch management, provenance tracking, and recall mechanisms enforced through Role-Based Access Control (RBAC) to address high transaction cost issues and security vulnerabilities. Test results conclude that the implementation on the Base network is economically viable, with batch minting costs as low as ±0,0019 USD, while successfully ensuring storage efficiency and security validation compliant with modern pharmaceutical regulatory standards.

Keywords: Blockchain, Supply Chain, Pharmaceutical, Smart Contract, Base Network, Ethereum Layer-2.