Blockchain for Waste Tracking: Enhancing Transparency and Accountability in Waste Management.

Peng Zhang*

Department of Industrial Engineering and Management, Business School, Sichuan University, China

Introduction

In the face of growing environmental challenges and increasing pressure to build sustainable systems, the waste management sector is undergoing a digital transformation. One of the most promising innovations in this space is the use of **blockchain technology for waste tracking**. Known for powering cryptocurrencies like Bitcoin, blockchain is now being repurposed to bring transparency, traceability, and trust to various industries—including waste management. By creating tamper-proof records of waste generation, transportation, and disposal, blockchain can help governments, companies, and consumers ensure that waste is managed responsibly from start to finish.

At its core, blockchain is a decentralized, distributed ledger technology that records data in a secure, immutable way. Each transaction or data entry is stored in a "block" and linked to previous entries in a chronological "chain." Because the data is encrypted and shared across a network of participants, it cannot be altered without consensus, making it ideal for applications that require transparency and security.Traditional waste tracking systems often rely on paper records, manual input, and disconnected databases. These systems are vulnerable to fraud, data manipulation, and inefficiencies. For example, waste might be illegally dumped, mislabeled, or diverted without proper documentation. In high-stakes areas like hazardous waste or electronic waste (e-waste), these lapses can have serious environmental and health consequences.

Once data is recorded on the blockchain, it cannot be changed. This ensures a trustworthy and auditable trail of all waste-related transactions—from origin to disposal.Blockchain allows multiple stakeholders—such as waste generators, transporters, recyclers, and regulators—to access and verify data in real time.These are self-executing agreements coded into the blockchain. For instance, a smart contract could trigger payments only when waste has been verified as delivered and processed according to regulations.Blockchain systems can use digital tokens to reward proper waste segregation, recycling, or ethical disposal, encouraging responsible behavior.Each transaction can include location and time data, making it easier to track the movement and handling of waste materials at every stage.

Ensures compliance with environmental laws by providing a clear chain of custody for dangerous materials.Tracks electronics from production to disposal, helping to recover valuable materials and reduce illegal dumping.Monitors plastic use and recycling, supporting extended producer responsibility (EPR) and corporate sustainability claims. Enhances accountability in city-wide collection programs by verifying pickups and disposal activities.

Uses blockchain to reward people in developing countries for collecting and returning plastic waste, promoting recycling and poverty reduction.Implements blockchain to track construction and demolition waste in real-time across supply chains.Partnered to use blockchain for tracking carbon credits and waste offsets tied to corporate sustainability efforts.

Implementing blockchain systems can be expensive and technically complex.Blockchain ensures data integrity, but it still relies on accurate data input; "garbage in, garbage out" remains a risk.Processing and verifying transactions on public blockchains can be slow and energy-intensive, although newer platforms are addressing this.\Legal frameworks may need to evolve to recognize and accommodate blockchain-based tracking systems.

Conclusion

Blockchain technology offers a powerful tool for transforming waste tracking from a fragmented, opaque process into a transparent and accountable system. By ensuring that every stage of the waste management chain is recorded, verified, and accessible, blockchain not only helps prevent illegal dumping and fraud but also empowers better decision-making for sustainability. As environmental regulations tighten and the circular economy gains momentum, blockchain-based waste tracking stands out as a forward-thinking solution for building trust, efficiency, and environmental integrity into waste management practices.

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***Correspondence to**: Peng Zhang, Department of Industrial Engineering and Management, Business School, Sichuan University, China. E-mail: pengzhang@scu.edu.cn

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