Traceability 5.0: Why Digital Product Passports Will Reshape Consumer Trust and Business Models

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Abstract

The latest advancement in product lifecycle transparency comes from Traceability 5.0 which combines the human-focused principles of Industry 5.0 with sustainable industrial growth. Traceability 5.0 advances beyond traditional traceability systems through the combined use of blockchain technology and AI systems with IoT and digital product passports to establish an intelligent supply chain network that functions as a unified system. The system advances past simple tracking by implementing trust-building and ethical sourcing practices that support circularity and consumer empowerment to enable supply chain participants and end-users to access verified live product histories and carbon footprints together with sustainability credentials.

Traceability 5.0 represents a groundbreaking change that transforms the relationship between businesses, regulators, consumers and supply chain transparency along with product sustainability. Digital Product Passports (DPPs) represent a disruptive technological advancement that employs blockchain technology together with AI and IoT to deliver immutable and verifiable real-time insights about a product throughout its entire lifecycle. The research investigates Digital Product Passports (DPPs) role in supporting regulatory compliance and building consumer trust while advancing circular economic practices and innovative business strategies.

Traceability 5.0 revolutionizes supply chains by transforming them into intelligent networks that offer clear product insights, thereby enhancing decision-making capabilities, sustainability, and consumer engagement. This study examines how Digital Product Passports act as intermediaries between regulatory frameworks such as the European Green Deal and Eco-design for Sustainable Products Regulation (ESPR), and market-driven initiatives focused on ethical sourcing and circular economy practices.

Using powerful real-world case studies this paper will show how product lifecycle tracking systems powered by blockchain-enabled DPPs transform supply chain processes by reducing waste and enhancing accountability. Brands take advantage of blockchain technology to develop reward tokens for plastic waste collection and economic inclusion activities and to deliver unmatched provenance verification which prevents fraud and encourages ethical trading for valuable materials.

The paper details how decentralized ledgers along with smart contracts and AI-powered analytics serve as key components of DPP architecture to enhance traceability and automate compliance without wasting resources. Real-time tracking through IoT capabilities in DPPs helps minimize fraud risks and enhances supply chain resilience by providing consumers access to trustworthy product origin data and environmental impact information.

The research examines the future development of sustainable practices alongside digital traceability while forecasting the transition of DPPs into essential solutions for product lifecycle management and regulatory adherence as well as consumer transparency. Throughout the transition to a regenerative low-carbon economy businesses and policymakers require DPPs as essential tools that connect sustainability requirements to consumer demands.

The paper establishes Traceability 5.0 as the cornerstone of a future commercial landscape characterized by trust-based innovation and responsibility, where businesses benefit from real-time data visibility and consumers find better engagement opportunities while promoting sustainable circular economic practices.