Digital Trust Infrastructure

How Blockchain and Legal Entity Identifiers Power the Modern Digital Economy

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Executive Summary

In an era of global supply chains, digital transactions, and regulatory demands for transparency, trust is no longer a soft virtue—it is a foundational infrastructure.

Digital Trust Infrastructure refers to the interconnected systems of verifiable identities, immutable data records, and standardized protocols that enable secure, transparent, and automated interactions across the digital economy.

At its core are two complementary technologies: blockchain and Legal Entity Identifiers (LEIs), particularly their verifiable digital evolution (vLEIs). Together, they form the bedrock for innovations like Digital Product Passports (DPPs), which are reshaping sustainability, compliance, and consumer empowerment.

This infrastructure shifts trust from centralized intermediaries to decentralized, cryptographically verifiable mechanisms—reducing fraud, streamlining operations, and unlocking new economic models in trade, finance, and circular economies.

Digital Trust Infrastructure: How Blockchain and Legal Entity Identifiers Power the Modern Digital Economy

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Blockchain: The Immutable Foundation of Trust

Blockchain technology provides the decentralized ledger layer essential for digital trust. At its essence, it is a distributed database where transactions are grouped into blocks, cryptographically linked in a chain, and validated through consensus mechanisms (such as proof-of-stake for energy efficiency).

Once recorded, data is immutable—tamper-evident and resistant to retroactive alteration—while remaining transparent to authorized parties.

Key features include:

- Decentralization: No single point of failure or control, mitigating risks of data breaches or manipulation.

- Smart contracts: Self-executing code that automates agreements (e.g., triggering payments upon verified delivery).
- Interoperability with identity layers: Modern blockchains (public like IOTA or permissioned like Hyperledger Fabric) integrate with standards such as Decentralized Identifiers (DIDs) and Verifiable Credentials (VCs) from the W3C.

In the digital economy, blockchain anchors provenance and ownership. It eliminates reliance on paper trails or siloed databases, enabling real-time verification across borders. However, blockchain alone lacks inherent entity verification—enter Legal Entity Identifiers.

Legal Entity Identifiers (LEIs): Verified Organizational Identity

The Legal Entity Identifier is a 20-character alphanumeric code issued under the Global LEI System (GLEIF), established post-2008 financial crisis by the G20's Financial Stability Board. Each LEI uniquely identifies a legal entity (companies, funds, governments) and links to reference data like ownership structure, addresses, and relationships. Over two million LEIs are now in use globally, supporting anti-money laundering (AML), Know Your Customer (KYC), and cross-border payments.

The breakthrough is the verifiable LEI (vLEI): a cryptographically secure digital credential that combines the traditional LEI with DIDs and VCs. Issued by Qualified vLEI Issuers (QVIs), vLEIs enable instant, automated verification without manual checks. They create a "chain of trust" where authorized representatives can cryptographically prove identity and authority.

GLEIF partnerships with blockchain platforms like IOTA and Chainlink demonstrate seamless integration: vLEIs can be anchored on-ledger for "on-chain trust" in trade finance, digital assets, and supply chains. This reduces compliance costs by up to 90% in pilots and cuts manual operations dramatically.

LEIs and vLEIs solve the "who" in digital interactions. Blockchain solves the "what happened and when." Their synergy creates verifiable, portable trust.

Synergies: Building a Robust Digital Trust Layer

When blockchain and LEIs/vLEIs converge:

- Entity-linked data integrity: A manufacturer's vLEI signs events on a blockchain, proving authorship without revealing sensitive details (via zero-knowledge proofs where needed).
- Interoperable ecosystems: Standards like GS1 Digital Link, EPCIS 2.0, and W3C VCs allow data to flow across platforms while remaining verifiable.
- Regulatory alignment: Supports EU directives on digital trade, crypto-asset reporting (DAC8), and sustainability.

This infrastructure powers everything from tokenized assets to automated trade documents (e.g., electronic bills of lading). It transforms fragile "collect-and-store" data models into privacy-preserving "request-and-verify" systems.

Key Innovation: Digital Product Passports

Digital Product Passports exemplify this infrastructure in action. Mandated by the EU's Ecodesign for Sustainable Products Regulation (ESPR, Regulation (EU) 2024/1781), DPPs are structured digital records detailing a product's full lifecycle: raw materials, manufacturing processes, carbon footprint, repairability, recycled content, and end-of-life instructions.

Phased rollout is underway as of 2026:

- Batteries: Mandatory from 2026–2027 under the EU Battery Regulation.
- Textiles, electronics, iron/steel, and others: Following in 2027–2029 via delegated acts.
- Broader coverage: Up to 30+ product categories by 2030, with a central EU DPP registry for access on a "need-to-know" basis.

Blockchain and LEIs/vLEIs are not mandatory but are widely adopted as the optimal enablers:

- Unique product identifiers: Often DIDs or GS1 GTINs linked to the manufacturer's vLEI.
- Immutable event logging: Each lifecycle step (sourcing, assembly, maintenance, recycling) is recorded as a verifiable credential anchored on blockchain—creating a tamper-proof audit trail.

- Decentralized storage with centralized access: Off-chain data (e.g., detailed scans) referenced via on-chain pointers or smart contracts for scalability and privacy.

Pilots using Hyperledger Fabric, IOTA, or public blockchains (with vLEI integration) already demonstrate benefits: enhanced traceability, reduced counterfeiting, and support for circular economy models like repair, resale, and recycling.

Consumers scan a QR code or NFC tag to access the passport via smartphone, gaining transparency on sustainability claims. Regulators verify compliance instantly. Businesses benefit from streamlined due diligence and new revenue from refurbished goods.

Broader Implications for the Modern Digital Economy

This trust infrastructure accelerates:

- Sustainable supply chains: Full visibility supports Scope 3 emissions reporting and carbon taxation.
- Digital trade and finance: vLEI-enabled blockchain platforms cut cross-border friction.
- Consumer and B2B empowerment: Verifiable data fosters loyalty and enables new models like product-as-a-service.
- Global interoperability: While EU-led, the approach aligns with initiatives in Asia and the US, potentially becoming a de facto global standard.

Challenges and the Road Ahead

Scalability, data standardization, and interoperability remain hurdles—blockchain must handle high-volume events without excessive energy use or costs. Privacy (GDPR compliance) and governance (who controls data access?) require careful design. Adoption costs may burden SMEs, though open-source tools and phased regulation help.

Looking forward, integration with AI for predictive analytics and emerging standards like

the Universal Network Trade Protocol (UNTP) will further mature the ecosystem.

Conclusion: The Foundation of a Trusted Digital Future

Digital Trust Infrastructure—powered by blockchain's immutability and LEI/vLEI's verifiable identities—is not merely technical; it is economic and societal. By embedding trust at the protocol level, it enables the transparent, efficient, and sustainable digital economy the world needs. Innovations like Digital Product Passports prove the model works: from raw material to recycling bin, every step is verifiable, accountable, and valuable.

As implementation accelerates in 2026 and beyond, organizations that invest early in these building blocks will lead the transition to a circular, low-friction global marketplace. The infrastructure is here; the question is who will build upon it.