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Blockchain for Protection of Critical Infrastructure

Sixteen Critical Infrastructures as defined by DHS/FEMA.

Mission Statement:

Establish through Blockchain a Secure and Resilient Global
Supply Chain that Protects the United States Economic Prosperity

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Supply Chain Disruptions

COVID:

Unscheduled closures of manufacturing and distribution facilities.

China:

Hording Food- Department of Agriculture Projections

- 69% of the world's corn reserves
- 60% of world's rice reserves
- 51% of world's wheat reserves

Russia:

- In 2014, Russia shifted from military invasion to cyber warfare against Ukraine, targeting its infrastructure. Spreading through the global supply chain.
- Paralyzed companies like FedEx and Maersk, with an estimated \$10 billion in damages

Ransomware:

41% have experienced a ransomware attack in the past year and projected that cyber attacks will cause \$6 trillion in damages

Supply Chain Disruptions

Government Response

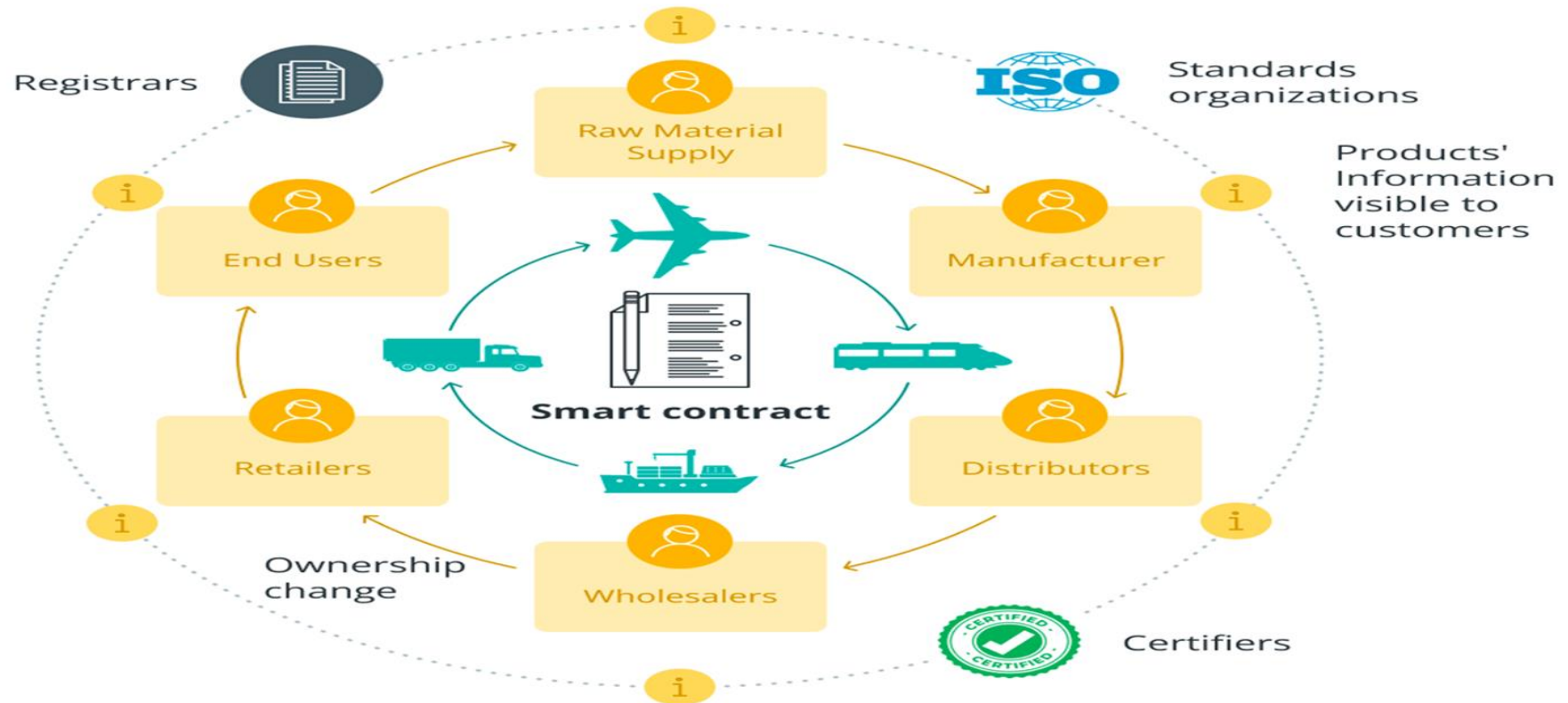
“The United States needs resilient, diverse, and secure supply chains to ensure our economic prosperity and national security.” DHS

Supply chain diplomacy continues through bilateral and regional mechanisms including through the:

U.S.- E.U. Trade and Technology Council, the Indo-Pacific Economic Framework, and Americas Partnership for Economic Prosperity.

Blockchain Supply Chain

Key actors in a blockchain-based supply chain



Blockchain Supply Chain

Smart Contracts

- A smart contract is a type of blockchain record that contains externally written code, and **controls blockchain-based digital assets**.
- A smart contract executes its code and may result in another blockchain event.
- Time value of Money- crypto transactions (Weeks versus Minutes)
- Smart contracts can only read from, and write to, the blockchain.

Blockchain Supply Chain Cryptocurrency

Accuracy- Smart contracts calculate payment amounts automatically, eliminating errors that may otherwise occur.

Enforcement- Release payment to a provider upon the occurrence of one of more events (such as the verified acceptance of delivery of goods).

Security- The currency used to pay for products or services can be included in the smart contract itself.

Autonomy- Because smart contracts live on a blockchain, they are highly resistant to tampering or manipulation.

Efficiency- Using smart contracts to execute payment automatically decreases the need for payment intermediaries and their associated fees. **(Need for Speed)**

Non-repudiation- A smart contract can verify both delivery of goods and services, as well as the acceptance of the delivered goods and services.

Blockchain Supply Chain Internet of Things

The IoT means the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.

Blockchain of Things (BoT) goes one step further and provides an enterprise-class security infrastructure by leveraging cryptographic blockchain for IoT.

Intel CEO: Chip supply chains will shape geopolitics more than oil over the next 50 years

Intel announces plans for an initial investment of more than \$20 billion for two new chip factories in Licking County, Ohio. Jan. 2023

Blockchain Supply Chain Digital Identification

Disadvantages:

Traditional digital identity involves centralized authorities-

Governments, Financial institutions- Social media platforms- Ecommerce- Healthcare

Data breaches- Identity theft- Lack of user control over personal information.

Advantages:

Security: - Allows for the decentralized and tamper-proof storage and sharing of personal info.

Privacy- Gives consumers more control over their personal data.

Interoperability:- Makes it easier to interchange personal information across organizations/borders.

Efficiency- Eliminating the need for intermediaries and decreasing the time and resources necessary for identification verification, blockchain-based digital identity can cut costs and boost efficiency

Trust:- By providing a reliable and transparent method of confirming identities, blockchain-based digital IDs can boost trust in online transactions.

Blockchain Supply Chain Artificial Intelligence

Artificial Intelligence enables machines to assist humans and make decisions, while blockchain technology is a distributed ledger that allows for secure, transparent and tamper-proof applications

Authenticity- AI models provides an audit trail, and pairing blockchain and AI can enhance data security.

Augmentation- AI can rapidly and comprehensively read, understand and correlate data at incredible speed, bringing a new level of intelligence to blockchain-based business networks.

Automation- AI, automation and blockchain can bring new value to business processes that span multiple parties — removing friction, adding speed and increasing efficiency.

Blockchain Supply Chain
Quantum Computing
[The Quantum Economic Development Consortium](#)

Volume of data/information created, captured, copied, and consumed worldwide is forecasted by 2025 to reach 64.2 zettabytes, which equals 64 Trillion Gigabytes.

Quantum computing is the next frontier for faster and more powerful computing technologies. It has the potential to **better optimize routes for shipping and delivery**, speed up battery development for electric vehicles, and more accurately predict trends in financial markets. <https://news.mit.edu/>

In simplest terms, quantum computing uses the properties of quantum physics in combination with information technology to solve complex problems.

Makes use of the quantum states of subatomic particles to store information.

Blockchain Supply Chain

Six Sigma

Six Sigma is 3 Defects per 1 million Opportunities or 99.99966%

- Big data is not as effective without Six Sigma and Six Sigma is sub-optimized without big data.
- Six Sigma is a methodology that enables the firms to review their existing SCM practices and guide them in making improvements.
- Six Sigma focuses on reducing variation, measuring defects and improving the quality of products, processes and services.
- Six Sigma-based SCM effectively manages typical disruption issues in supply chain as it ensures the delivery of the most appropriate product, in right time, in right place with the least cost to the customer.

Six Sigma can achieve 99.99966% Security of the Global Supply Chain.

Blockchain Supply Chain

Human Trafficking inside the Global Supply Chain

Trafficking in persons has emerged as a key challenge and risk in a wide range of industries and sectors integrated into global markets.

Human trafficking victims has grown from around 40,000 in 2012 to nearly 120,000 in 2022, with One Third being children.

If Smart Contracts, Cryptocurrency, Digital Identification, Artificial Intelligence, Quantum Computing, the Internet of Things, and Six Sigma be used to protect legitimate cargo, and its owners from financial loss, could it not also be used to prevent or mitigate human trafficking?

Global Blockchain Market Growth

According to MarketsandMarkets the Global Blockchain Market:

- Was around \$7.4 billion in 2022
- Projected to be \$94 billion by the end of 2027
- Compound annual growth rate (CAGR) of 66.2%

Blockchain Supply Chain Association for Supply Chain Management

“Blockchain is garnering a tremendous amount of hype as a potentially world-changing technology in the realm of manufacturing and supply chain.”

Incorporate Blockchain into your Supply Chain

<https://www.ascm.org/ascm-insights/scm-now-impact/incorporate-blockchain-into-your-supply-chain/>

6 Far Reaching Blockchain Applications in Supply Chain

- <https://www.ascm.org/ascm-insights/6-far-reaching-blockchain-applications-in-supply-chain/>

Accommodating Next Generation Supply Chain with Blockchain

- <https://www.ascm.org/events/Accommodating-next-gen-supply-chain-needs-with-blockchain/>

National Science Foundation

Research Initiatives

<https://www.nsf.gov/>

“America's economic and national security depend on our ability to invest heavily in the technologies of today while making the discoveries that are the foundation for the technologies of tomorrow.” Sethuraman Panchanathan NSF Director

Partnerships:

NSF supports research partnerships between colleges and universities, industry, nonprofits, government and other organizations within the U.S. and across the globe.

We cultivate partnerships between academia, industry, nonprofits, government, civil society and other sectors so they can pursue transformative research, solve societal problems, fuel economic progress and build a future-ready workforce.

NSF's **Industry-University Cooperative Research Centers** <https://iucrc.nsf.gov/> program catalyzes breakthrough pre-competitive research by enabling close and sustained engagement between industry innovators, world-class academic teams and government agencies.

University of Cincinnati Industry University Cooperative Research Center

- [Center for Hardware and Embedded Systems Security and Trust "CHEST"](#)
- MISSION STATEMENT: The mission of the CHEST Center is to address the research challenges that industry faces in the design, protection, and resilience of hardware from the security vulnerabilities associated with electronic hardware and embedded systems and develop the much-needed workforce for government and industry.
- VISION STATEMENT: CHEST is the largest NSF IUCRC. **Our vision is to coordinate university-based research with needs of industry and government partners to advance knowledge of security, assurance, and trust for electronic hardware and embedded systems.** We will achieve natural growth by continuously providing high quality security, assurance and trust strategies for cyber-physical systems and the IoT. Through integrity, tenacity and growth, we will enable confidence in our members' ability to meet fundamental human needs, along with supporting broader social, environmental, and economic progress as a nation.

University of Cincinnati- IUCRC Smart Supply Chain

- The University of Cincinnati facilitates an IUCRC and is offering a research initiative on the Smart Supply Chain.
- The SMART Supply Chain's Center will focus on research efforts which will provide increased synergy, productivity and profitability in three main sectors:
Manufacturing, Logistics and Distribution, and Retail
- The Center relies on existing groups and resources at UC with expertise in:
- IoT and Blockchain Technologies, Crypto-economics, Cybersecurity, Law and Regulations, Behavioral Economics, Privacy-Risk Management using AI/ML/DL, Big Data, Data Provenance, Information Security and Assurance, and Quantum.

Contact Information

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