



Technology Watch: Blockchain and the Cross-border Multi-modal Cargo Logistics Chains

Background

In the intricate tapestry of modern global trade, cross-border multimodal cargo transportation stands as a crucial thread, weaving together economies and cultures through the efficient movement of goods. Its significance is not merely logistical; it is a catalyst for economic growth, expanded market access, cost optimization, and environmental sustainability. With the growth of multiple international transport corridors spreading across regions and infrastructure development continuing apace, the role of multimodal transportation is poised to become even more pivotal in the future.

At its core, cross-border multimodal cargo transportation involves the seamless integration of various modes of transport, such as ships, trucks, trains, and airplanes, to move goods across international borders. This approach is far from a novel concept; it has been a fundamental pillar of trade for centuries. However, its relevance has been amplified in recent times due to the rapid globalization of markets, increasing complexity of supply chains and the ambition for making it seamless.

One of the primary reasons for the indispensability of multimodal transportation lies in its ability to unlock new markets for businesses. By leveraging different modes of transport, companies can reach consumers and businesses in remote or landlocked regions that would otherwise be inaccessible through a single mode. This not only opens up avenues for increased sales but also fosters economic development in remote hinterland areas.

Furthermore, cost optimisation is another compelling factor driving the adoption of multimodal transportation. Different modes of transport have varying cost structures and operational efficiencies. By strategically combining modes, businesses can minimise expenses, streamline their supply chains, and bolster their overall competitiveness. For instance, using sea freight for long-haul international transport and rail or road for inland distribution can result in significant cost savings.

Multimodal transportation plays a crucial role in reducing transit times, which is paramount in today's fast-paced

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business environment. By utilising faster modes for certain legs of the journey and avoiding bottlenecks at ports or border crossings, goods can reach their destinations quicker. This translates to improved customer satisfaction, reduced inventory holding costs, and ultimately, a more competitive advantage for businesses. These very principles underpin the development of international cross-border corridors by the international community.

The environmental impact of transportation cannot be ignored in the modern era. Cross-border multimodal cargo transportation can contribute to sustainability efforts by incorporating eco-friendly modes of transport, such as rail or inland waterways. These modes can often have lower carbon emissions compared to road or air transport, making them a more sustainable choice for long-haul shipments.

Need for Technology Integration in Complex Logistics

Technological advancements and platforms can further integrate the complex supply chain network of multimodal transportation. Digital platforms, blockchain technology, and the Internet of Things (IoT) can simplify the way cargo is tracked, managed, and secured across borders. These technologies enhance transparency, streamline processes, and improve security, making multimodal transportation even more efficient and reliable.

As the complex logistics world continues to evolve, the importance of cross-border multimodal cargo transportation will only intensify. Continued investment in infrastructure development, such as the construction of intermodal terminals and the

expansion of rail networks, will further facilitate the seamless movement of goods. Furthermore, advancements in artificial intelligence and automation are expected to optimize routing and scheduling, reducing costs and transit times even further.

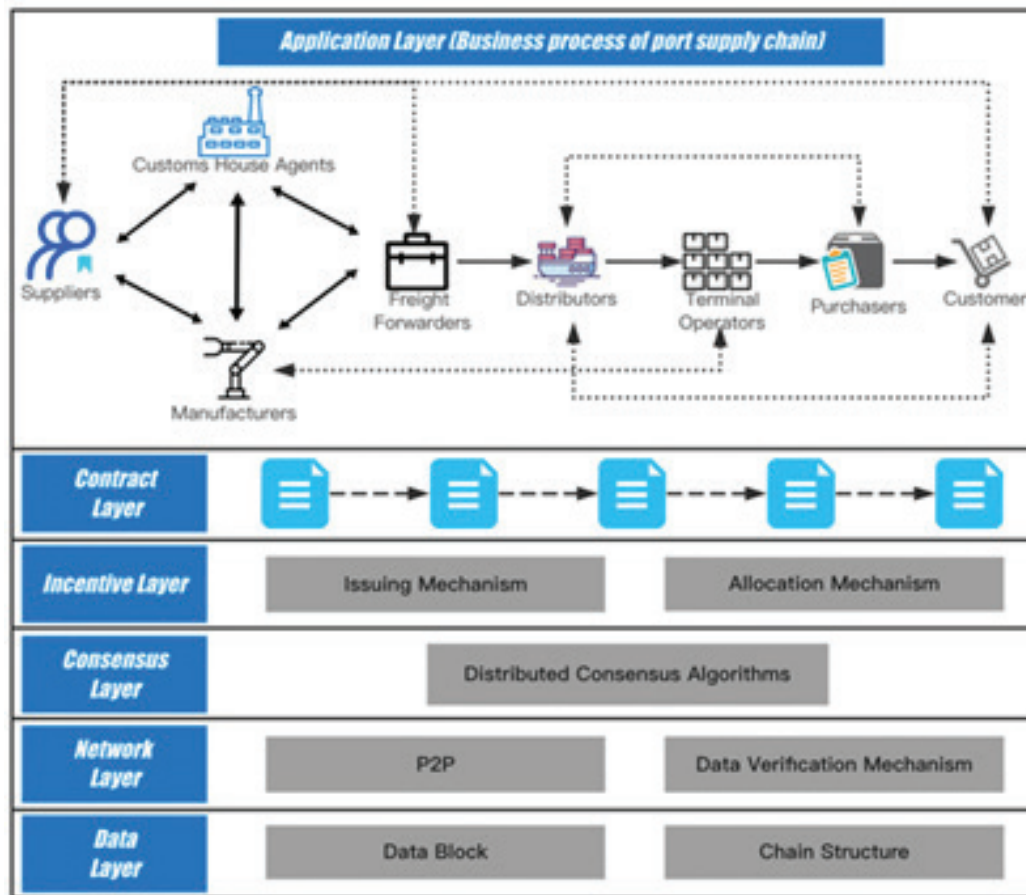
Complexities of Cross-border Multimodal Cargo

While multi-modal cargo offers several advantages like flexibility and cost-effectiveness, it also presents numerous challenges. Each country has its own set of regulations and documentation requirements for cross-border trade. Navigating these varying rules can be time-consuming and prone to errors. Customs clearance procedures can be lengthy and complex, leading to delays and additional costs. Ensuring compliance with different regulations and standards (e.g., safety, environmental, security) across multiple jurisdictions can be a challenge.

Similarly, coordinating the movement of goods across different modes of transport and multiple stakeholders (e.g., shippers, carriers, freight forwarders, customs agents) hinges on efficient communication and coordination. Differences in infrastructure quality and standards between countries can lead to bottlenecks and delays. For example, incompatible rail gauges or inadequate road networks can hinder seamless cargo movement. Additionally, tracking movement of cargo across diverse modes and borders can be a challenge, leading to a lack of visibility and potential for delays or loss.

Navigating payments and insurance across borders presents a significant hurdle in multimodal transportation. The complexities of dealing with different

Figure 1: Hierarchy of Blockchain for Port Supply Chain



Source : Article in Business Model- The Perspectives of Systems Thinking and Innovation -Open access.

currencies and regulations can lead to additional costs and administrative burdens. Exchange rate fluctuations add another layer of uncertainty, potentially impacting transportation costs and exposing shippers and logistics providers to financial risks. Cargo theft, damage, and other security risks are higher in cross-border transportation, particularly in regions with weak governance or high levels of crime.

While multimodal transportation offers efficiency benefits, it can contribute to greenhouse gas emissions if not designed and regulated effectively. Different countries have varying environmental standards, making it challenging to ensure compliance

throughout the transportation process. This highlights the need for stricter regulations and the adoption of cleaner technologies.

Integrating data from different systems and stakeholders across the supply chain can be a significant obstacle, leading to fragmented information and potential errors. The biggest vulnerability lies in the computer and digital systems used for tracking, documentation, and communication. Their susceptibility to cyberattacks poses a major risk to data integrity and security.

Widespread adoption of blockchain technology across the shipping industry is crucial for its success. Developing

- 1 <https://www.ibm.com/topics/blockchain#:~:text=Blockchain%20is%20a%20shared%2C%20immutable,patents%2C%20copyrights%2C%20branding>
- 2 <https://scholarship.law.umn.edu/cgi/viewcontent.cgi?article=1496&context=mjlst#:~:text=Blockchain%20could%20be%20the%20technology,potential%20in%20the%20shipping%20industry>

common standards and protocols for data exchange and interoperability is essential. Governments need to establish clear legal frameworks to address issues like data privacy and security.

Thus, many of these challenges need to be addressed holistically through holistic framework agreements agreed across cross-border nations, in at least the following explicit areas of harmonizing regulations and standards across countries can simplify procedures and reduce complexity. Adopting eco-friendly practices and technologies can minimize the environmental impact of cross-border multimodal cargo logistics. It is also significant to map and record the emissions during multi-modal transits, in order to meet the collective responsibility and sustainability targets. By addressing these challenges and adopting innovative solutions, the cross-border multimodal cargo logistics sector can become more efficient, reliable, and sustainable, contributing to the growth of global trade.

Blockchain as a Solution to Complex Logistics

Blockchain creates an immutable ledger of all transactions, including the movement of goods, customs clearance, and payment details.¹ This ensures transparency and prevents tampering or fraud. Smart contracts can be used to trigger updates on the blockchain whenever cargo changes hands or crosses a border, providing real-time visibility into the shipment's location and status to stakeholders. The technology also has drivers of improved accountability, where all parties involved in the supply chain can access the same information, fostering accountability and reducing disputes over missing or damaged goods.

Blockchain can also replace paper-based documents like bills of lading, invoices, and customs declarations with tamper-proof digital versions.² This reduces the risk of errors, forgeries, and delays. Automated execution of smart contracts upon fulfilment of predefined conditions (e.g., arrival of goods, payment verification) can expedite customs clearance and reduce manual intervention. Blockchain can facilitate seamless exchange of information between different stakeholders (e.g., shippers, carriers, customs authorities) across borders, reducing bureaucratic hurdles. Blockchain's consensus mechanism also verifies the authenticity of transactions, reducing the risk of fraudulent activities. Streamlined customs procedures and automated verification can expedite the release of goods, reducing delays and associated costs.

International Initiatives

International use-cases have shown that blockchain can facilitate secure and transparent transfer of electronic Bill of Landings (B/Ls) between different parties involved in the shipment, reducing the risk of fraud and delays. Blockchain-based can also ensure Proof-of-Delivery (POD), proving irrefutable evidence of delivery, reducing disputes and ensuring timely payments. Blockchain can streamline trade finance processes, such as letters of credit, by automating verification and reducing the need for intermediaries. Although, the full-scale adoption of blockchain systems is in its early stages, the number of ports exploring and piloting blockchain solutions is steadily increasing and few notable initiatives are covered below.

Port of Rotterdam

The Port of Rotterdam has been actively involved in blockchain initiatives, exploring its use for container tracking, supply chain finance, and data sharing.

Singapore

The Maritime and Port Authority of Singapore (MPA) has launched several blockchain-based projects, including a digital platform for bunker delivery verification and a system for electronic bills of lading.³

Port of Antwerp-Bruges

This port has experimented with blockchain for secure data sharing among supply chain partners. Through the use of blockchain technology, documents like certificates of origin and phytosanitary certificates are transferred, while the process itself is automated using ‘Smart Contracts’. This cuts cost and speed things up. A consortium effort by Belfruco, Enzafruit, PortApp, 1-Stop, and T&G Global, has tailored a solution specifically for phytosanitary certificates, ensuring the safety of fruits and vegetables.

Currently Available Platforms

Blockchain technology is revolutionising trade by creating secure and transparent platforms for document management and collaboration. A major industry platform was developed by IBM and Maersk to leverage blockchain in supply chain transparency. However, this initiative was closed down by IBM in 2023. Here’s a look at some of the other key platforms, which could transform the maritime trade landscape by streamlining processes, enhancing security, and fostering collaboration

between stakeholders across the global trade community.

CargoX: This user-friendly platform focuses on secure document transfer using blockchain. It simplifies document sharing and facilitates instant, secure transactions for various trade documents, including electronic bills of lading (eBLs).

SilSal: Launched by Abu Dhabi Ports, SilSal aimed to create a trade facilitation platform using blockchain.

Blockchain Consortia

Among other global technology providers, a blockchain platform, built on Microsoft Azure global cloud technology, has been developed to provide significant value to the insurance industry.⁴ The first of its kind in the insurance industry, the platform goes beyond insurance, aiming to utilize the benefits of blockchain for end-to-end applications across the marine industry. To address traceability and transparency in the marine fuel supply chain, blockchain technology and governance experts Blockchain Labs for Open Collaboration (BLOC) – through their subsidiary Maritime Blockchain Labs (MBL) – have established a consortium. This consortium includes significant industry players like Lloyd’s Register, Precious Shipping, Bostomar, BIMCO, the International Bunker Industry Association (IBIA), and Good Fuels.

Future Opportunities

While the full-scale adoption of blockchain systems are not too many, the number of ports exploring and piloting blockchain solutions is steadily increasing. As technology matures and regulatory frameworks evolve, we can expect to see more widespread adoption of blockchain in ports worldwide, leading to greater

3 <https://www.offshore-energy.biz/mpa-worlds-first-digital-bunkering-initiative-launched/>

4 <https://www.marineinsight.com/know-more/7-major-blockchain-technology-developments-in-maritime-industry-in-2018/>

efficiency, transparency, and security in the global supply chain.

Initial Mover Advantage: India, a leading force in digital innovation, has a golden opportunity to spearhead the development of blockchain solutions specifically tailored to address the complexities of multimodal cargo movement. This focus, coupled with maturing technology and broader adoption, can revolutionise how goods traverse international border.

Collaborative Port Projects: To solidify its position as a leader in cross-border trade, India can leverage blockchain technology through Collaborative Pilot Projects. Partnering with key trading partners and domestic stakeholders on these projects will involve developing and implementing blockchain-based platforms for specific trade corridors. This collaborative approach allows India to test, refine, and showcase the benefits of blockchain in a controlled setting. By demonstrating the efficiency, security, and cost-effectiveness of this technology, India can pave the way for a more streamlined and competitive trade environment.

Digital Infrastructure Push: Strong foundational infrastructure is critical for

India to thrive in the world of blockchain. This requires investment in building a robust digital ecosystem. High-speed internet connectivity is crucial for smooth operations, while digital identity solutions will ensure secure participation.

Capacity Building: Educating stakeholders through digital literacy programs is equally important for widespread acceptance. Additionally, collaboration and forming consortiums with international organizations on the usage of blockchain technology in the marine industry is essential. By ensuring compatibility across blockchain platforms, India can foster seamless information exchange and unlock the technology's full potential for network effects.

Integrating blockchain ledgers into existing digital platforms has the potential to revolutionize cargo logistics by enhancing transparency, security, and efficiency. Embracing blockchain technology for cross-border cargo logistics, has the potential to position India as a frontrunner in transforming global trade. This will unlock a future of efficiency, security, and cost savings, propelling India's global competitiveness, integration and more importantly taking lead in the maritime sector.

About CMEC at RIS: The Centre for Maritime Economy and Connectivity (CMEC) has been established at RIS under the aegis of the Ministry of Ports, Shipping and Waterways (MoPS&W), Government of India. The Centre is a collaboration between Research and Information System for Developing Countries (RIS) and Indian Ports Association (IPA). CMEC at RIS has been mandated to act as an advisory/technological arm of MoPSW to provide the analytical support on policies and their implementation. CMEC at RIS seeks to integrate the stakeholders towards the realization of India's Maritime Amritkaal Vision (MAKV-2047) and the Maritime India Vision (MIV-2030) of the Government of India.

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