Blockchain for Transparency and Traceability in the Seafood Supply Chain

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SUMMARY

The role of information and communication technologies in driving innovation is pivotal in transforming food systems and achieving the Sustainable Development Goals. The latest advancements, such as smart networks, mobile technologies, drones, remote-sensing, distributed computing, and disruptive technologies like blockchain, artificial intelligence, and the Internet of things, are laying the foundation for a "digital revolution" that can potentially optimize resource management to an intelligent and anticipatory level. This publication discusses the role of technology, especially blockchain, in driving innovation in the food industry. It emphasizes the importance of chain traceability and examines the critical development and operational factors for blockchain applications. The report also assesses the suitability of blockchain technology in addressing issues related to legality, transparency, species fraud, and food safety in seafood value chains. Finally, it presents potential trade and public policy implications and recommendations.

INTRODUCTION

Seafood is a highly sought-after food item worldwide, valued for its rich nutritional content and exquisite taste. The seafood industry relies on a complex supply chain that spans the globe to meet consumer demands and industry standards. From harvesting in one part of the world to processing, packaging, and transportation over great distances, seafood faces numerous challenges before arriving at its final destination. However, growing concerns around sustainability and consumer awareness have led the seafood industry to adopt blockchain technology. Traditional supply chain management systems are no longer sufficient, which is why blockchain has emerged as a promising solution. By using consensus to maintain standards and certifications related to sustainability issues, such as quotas and certificates, blockchain ensures greater accuracy, transparency, and reliability. With this technology, the seafood industry can guarantee the highest quality products, and consumers can trust that they are getting the very best.

Blockchain technology is revolutionizing the seafood supply chain

Blockchain technology is a powerful tool that enhances both transparency and trust in a system by storing all transactions in a decentralized manner. The digital ledger of transactions is replicated across each participant in the network, eliminating the need for a single authority to control the entire system. This persistence provides fault-tolerance and immutability, ensuring that data cannot be corrupted. Auditability and transparency are critical features, as each transaction is recorded on the blockchain and can be audited at a later time. Permissionless blockchains are transparent, allowing anyone to view the transactions. The network's integrity and security are maintained by consensus algorithms, which are responsible for upholding the utmost diligence. A blockchain cannot access data from outside of its system, so data is supplied through a predefined entity known as an oracle. Oracles can be hardware-based, software-based, or consensus-based. Some examples of hardware oracles include sensors, IoT devices, and weather stations, while software examples include the New York Stock Exchange index, expiration dates, or computation outputs.

Traceability refers to a set of records that enable the tracking of a product's journey through the production process or supply chain. By incorporating blockchain technology, it is possible to safeguard public health, enhance trade, promote sustainability practices, incentivize the production of sustainable products, minimize the scope of product recalls, foster consumer trust, ensure quality control, boost the efficiency of the value chain, mitigate the risk of damaging brand association with unacceptable labour practices, and improve regulatory compliance.

The two most commonly used blockchains in seafood value chains today are Ethereum and Hyperledger. Ethereum is a leading programmable blockchain, while Hyperledger is an open-source collaborative effort that advances cross-industry blockchain technologies. Ethereum is considered one of the leading blockchain platforms in the world.

Understanding the Blockchain Technology's Work in the Seafood Supply Chain from Catch to Plate

Viant is a tool that utilizes the Ethereum blockchain platform for tracking supply chain assets. It uses a Proof of Authority consensus mechanism, which is more efficient than Bitcoin's Proof of Work algorithms. Blockchain technology is an excellent solution for tracking the journey of fish from the vessel they were caught on to the retail outlets and finally to the consumer. This process involves several highly efficient steps that offer unparalleled transparency into the entire supply chain.

To ensure the utmost accuracy and reliability of data, the process of tracking fish from the vessel to the consumer involves multiple steps. Firstly, if the fishing vessel has internet access, the tagged fish data can be transmitted and recorded as digital assets on the blockchain. This guarantees the authenticity of the data, resulting in a trustworthy and dependable system.

Secondly, a mobile device with the TraSeable app is used to record crucial data when fish are tagged. Once an internet connection is established, the app automatically sends the recorded data to TraSeable's servers, which then stores the information on the blockchain. This innovative technology effectively combats the problem of catch theft on fishing vessels and provides a wealth of information about fishing activity. Moreover, fishing companies can utilize this data for insightful analysis of their fishing efforts.

Thirdly, as part of the processing operations, the RFID (radio-frequency identification) tag is eliminated. Instead, a unique QR code is assigned to each fish, corresponding to its original tag identity. This methodology enables real-time mass balance reconciliation, thereby guaranteeing the complete monitoring and tracking of every fish and its journey.

Fourthly, after being packaged, the goods are distributed to their intended markets. To track the fish as it moves downstream to retail outlets and ultimately to consumers, users can utilize either the TraSeable or Viant apps. Throughout the process, the system continually records and updates the "fish story" by scanning the QR code on the packaging and inputting essential details. Additionally, actors handling the products can access the item's history.

Finally, participants at the event were able to sample the fish, scan the code, and connect with the story of the fish. The traceability system ensures that the product is of the highest quality and safety by using traceable resource units (TRUs) and identification/numbering schemes that provide unique identification codes/numbers for TRUs (e.g. GS1 barcodes). This system could also provide an online infrastructure for the permanent storage and sharing of key data elements (KDEs) along with critical tracking events (CTEs). Additionally, being a digital ledger already, it is suitable for recording product transactions between supply chain actors.

Fishcoin is a cutting-edge blockchain-based data ecosystem that offers incentives for collecting data about seafood products throughout the supply chain using a stablecoin token. The technology is being adopted by a variety of seafood projects, including the Provenance project, yellowfin tuna loins and skipjack tuna canning, WWF-New Zealand, ConsenSys, Sea Quest (Fiji) Ltd, TraSeable Solutions, and more. These projects are focused on a range of seafood products, such as purse-seine-caught, MSC-certified, canned skipjack tuna from Pacifical and Atato, Patagonian toothfish from OpenSC - WWF-Australia and BCG Digital Ventures, and "Fair Trade" yellowfin tuna from Bumble Bee Foods.

Traditional paper-based vs blockchain approaches

Traditional record-keeping methods are insufficient and fail to give us a complete picture of the supply chain. It is the time to ditch the paper-based systems and embrace the power of blockchain technology.

With its cost-effective, efficient, and reliable traceability system, products can be easily tracked and traced. Activities are also carried out through consensus, reducing transaction costs and friction for supply chain players. Smart contracts enable instant execution of payments and transactional arrangements, further streamlining the process. Additionally, this technology can help eliminate unethically or illegally sourced products, giving us the ability to make informed purchasing decisions and improving our targeted market leverage.

Implementing a paperless system could effectively reduce costs and expedite trade transactions. This allows regulatory authorities to utilize a shared digital platform to validate data and authenticate legal

documentation, resulting in a more efficient and transparent process. On a global level, the implementation of blockchain technology has the potential to transform the production and consumption of commodities, including seafood products, promoting sustainability and ethical practices.

Estimated cost of constructing a blockchain technology for supply chain management

Developing a blockchain solution from scratch can be a costly undertaking, as experienced blockchain developers are scarce. However, there are pre-existing blockchain services that can be subscribed to with minimal investment.

It's difficult to estimate the cost accurately, as expenses vary from location to location. Implementing such a system involves hardware (such as RFID tags and scanners, vessels, etc.), software (such as Viant and TraSeable), resources (such as man-hours), and other expenses (such as fish tag and label printing for cartons and loins, mobile data per tablet, etc.).

Regulatory and private initiatives

Numerous non-governmental organizations (NGOs) have been engaging in partnerships with conglomerates to establish accountability measures for suppliers by leveraging blockchain technology. Nonetheless, these initiatives are currently restricted to certain parts of the value chain and are not universally accessible in the market. In the seafood industry, regulatory authorities, NGOs, and other stakeholders have implemented traceability systems to enhance transparency and accountability in the supply chain.

CONCLUSION

Blockchain technology has immense potential to enhance the seafood industry through increased transparency and traceability. By facilitating the exchange of data among value chain participants, the private sector can improve operational efficiencies and build stronger brands. Additionally, governments can ensure compliance with export market requirements and NGOs can hold all stakeholders accountable. The integration of a biochemical approach in blockchain technology can yield better results in the seafood industry. Furthermore, blockchain technology can help address the issue of illegal fishing and contribute to achieving Sustainable Development Goal 14 (Life below water). To fully leverage the benefits of blockchain technology, it will be essential to integrate it with national seafood traceability systems. Conducting due diligence at legal, commercial, and operational levels is crucial. Greater awareness of the technology and its application in seafood value chains is also needed.

Highlights

1. Blockchain provides transparency and traceability in seafood industry.
2. Tamper-proof record of transactions and movement of seafood can be created.
3. Blockchain prevents fraud and illegal fishing, ensuring ethical sourcing.
4. Blockchain reduces time and cost of paperwork, improving supply chain operations.
5. Blockchain improves food safety by identifying the source of contamination quickly.

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