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How Blockchain can end Illegal, Unreported, and Unregulated (IUU) Fishing in West Africa

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Abstract

Fisheries globally are crucial renewable resources that provide food and livelihoods for over a billion people, making these populations vulnerable to changes in fish supply. In West Africa, fish supply has been declining due to Illegal, Unregulated, and Unreported (IUU) fishing, which accounts for around 40% of all fish caught in the region. The consequences of IUU fishing include damage to ecosystems, food insecurity, economic instability, and strained international relations. To combat IUU fishing, several technological tools, including Vessel Monitoring Systems (VMS) and unmanned vehicles, have been used in developed countries. Blockchain technology, known for its decentralized and tamper-proof nature, holds promise for ensuring traceability and preventing IUU-caught fish from entering supply chains. Blockchain can be implemented through RFID and QR code tagging systems to track fish from catch to market, helping to reduce black market activity and promoting consumer awareness. However, challenges such as data accuracy, limited technological access in rural areas, and poor coordination among stakeholders must be addressed. For blockchain to be successfully adopted, training, infrastructure development, and collaborative efforts among governments and stakeholders are essential. Blockchain technology could significantly enhance the sustainability of West African fisheries and help reverse the destructive cycle of IUU fishing.

Keywords: Fisheries, blockchain, IUU fishing, RFID, QR code, traceability, West Africa

Introduction

West Africa refers to the area between the Strait of Gibraltar (36°8'N, 5°21'W) and the southernmost tip of Namibia (17°15'S, 11°48'E) excluding South Africa. It includes FAO statistical areas 34-East-Central Atlantic and 47 -South-East Atlantic (Belhabib, 2015) ^[1] and includes countries such as Morocco, Mauritania, Cape Verde, Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, and Nigeria. Majority of these countries are coastal states thus fishing is a major source of livelihood (Fabinyi and Barclay, 2022) ^[2]. Overtime there has been decline in fisheries resources in West Africa which has been attributed to illegal fishing and increasing cases of unreported fish catch (Macedo *et al.*, 2024) ^[5]. Illegal, unreported, and unregulated (IUU) fishing violates current conservation and management measures in many countries thus IUU is considered a serious threat to the sustainability of fisheries because of its negative impacts on marine ecosystems and the economies of fishing countries. Global losses from IUU fishing alone are estimated at \$50 billion per year (The Guardian, 2022) ^[8]. With West African waters considered the world's highest IUU area (OECD, 2012), much of the IUU fishing in the region is believed to be conducted by foreign vessels operating within the EEZs of West African coastal countries. Thus, this paper highlights how blockchain can be used to combat this notorious problem.

Blockchain Use in Combatting IUU Fishing in West Africa

IUU fishing still constitute nuisance to the sustainable management of West Africa fisheries stock (Lucas, 2022) ^[4]. However, with the sharp rise in the use of technological tools, blockchain has been seen as the better instrument that can be used to prevent IUU fishing (FAO, 2017), thereby improving the quality of the west Africa fisheries.

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Blockchain is a tamper-proof and tamper-resistant digital ledger that is decentralized (No central control), typically implemented without a central authority (Sharples and Domingue 2015) [7]. The technology has key properties including decentralization (Tiwari *et al.*, 2024) [9]. In traditional centralized systems, all activities must be verified by a central trusted authority (Port authorities), inevitably creating cost and performance bottlenecks at the port. Fishing

activities consistency can be verified quickly, and honest fishermen will not notice invalid activities. Once a fishing activity is on the blockchain, it is nearly impossible to delete or reverse it. Each Fishermen can interact with the blockchain through a generated address that does not reveal the fishermen's true identity. Note that complete privacy protection cannot be guaranteed due to the inherent limitations of blockchain.

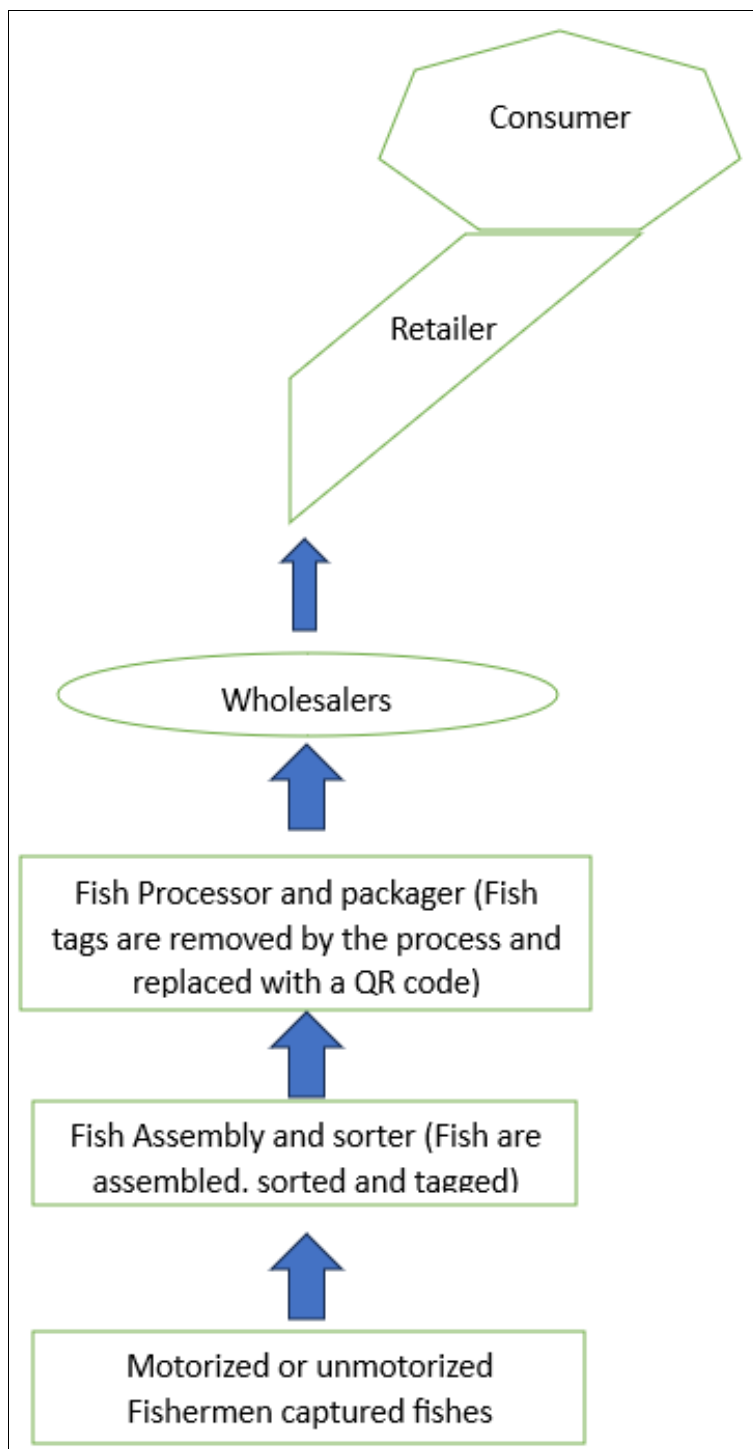


Fig 1: Block-chained tagged Fish

This key features of blockchain technology makes it very useful to monitor or trace the history of harvested fishes. Thus, using a combination of RFID and QR codes, information is captured throughout the fish supply chain. Individual fish are tagged after capture at the port or landing site thus providing a means to address the issue of catch theft

on fishing vessels and also helps fishing companies analyze fishing activities. Typically, the label or tags are removed during packaging and replaced with a unique QR code (FAO, 2017) that accompanies the fish or product to be marketed (Fig. 1). Each QR code is unique to the original ID of the RFID tag, allowing real-time mass balance matching. Some

theft can still occur at the landing site. Such fishes find their way into the black market which can still be sold to unsensitized consumers. However, tagged fish easily finds their way to the sensitized consumer in the authentic market. It is important to note to make this technology effective, the wholesalers, retailers and consumers must be sensitized and made aware that buying fish from the black market would

make our fish disappear over a short period of time, however to sustainably manage the ocean resources, fish must be purchased from the authentic market. Increased awareness about the benefits of buying from authentic market will drastically reduce the penetration of illegal fish from the black market into the authentic fish market thus making the blockchain technology 100% effect.

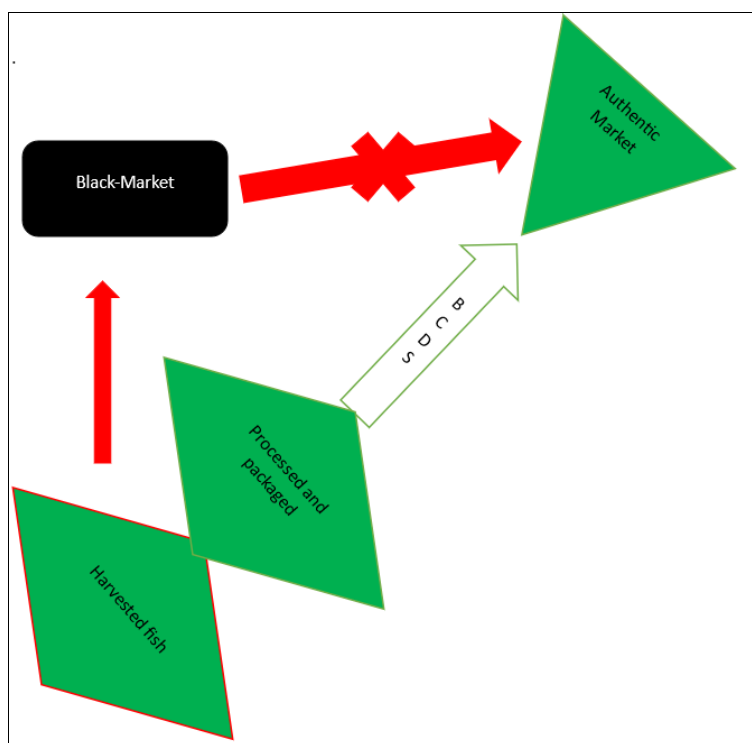


Fig 2: Blockchain preventing products derived from IUU fishing from entering supply chains. BCFS (Block-chain Driven Solution)

Challenges and Limitations

Despite the promise, there are several challenges to implementing blockchain in the West African fisheries supply chain. This includes:

- 1. Data Inaccuracy:** Poor or inaccurate data is one of the major problem West Africa Countries. Blockchain can only record data that is inputted by humans, so ensuring the accuracy of the data is critical and crucial. If the fisheries data entering the blockchain is incorrect or fraudulent, the entire system's integrity could be compromised.
- 2. Limited Technological Access:** West Africa is a growing region where some areas have limited access to the necessary technology, infrastructure, and digital literacy in rural fishing communities. This may hinder the adoption of blockchain technology in the West African Countries.
- 3. Poor Coordination:** Blockchain systems require extensive collaboration between multiple stakeholders (governments, local fishers, supply chain actors, NGOs port authorities). Effective coordination and harmonization of regulatory frameworks are essential for ensuring the success of blockchain initiatives.

Conclusion and Recommendations

There is more illegal, unregulated and unreported fishing in West Africa than anywhere else globally. IUU fishing is destroying livelihoods, threatening food security and undermining the achievement of SDG 14 in West Africa. Reversing the current cycle of destruction before fish stocks

are irreversibly destroyed is a priority that requires the highest level of technology. Thus Western and Central Gulf of Guinea Fisheries Commission (FCWC) and the West African Task Force (WATF) should send some of their staff for training in utilizing blockchain technology with the government of West African Countries providing enough funding for blockchain implementation within the fisheries supply chain.

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