BLOCKCHAIN APPLICATION IN AGRI-FOOD DOMAIN: THE FIRST WAVE

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INTRODUCTION

- Nowadays, agri-food supply chains are structured, global and interconnected.
- Compliance data and food documentation on safety, sustainability, provenance, and other attributes are typically stored on paper or private databases, and can only be inspected by trusted third-party authorities .
- This situation makes access to data to be costly, extended, subject to fraud, corruption or error, causing threats of foodborne disease and/or financial loss.
- The industry in collaboration with government, and consumer associations intervened to enable better transparency of information and build trust among stake holders in agri-food supply chains.
- This topic aims to systematically investigate the application potential of blockchain technology to solve issues in the agri-food industry by looking into the early adopter companies.

BACKGROUND

- Blockchain technology is a type of distributed ledger, that has been used for deploying cryptocurrencies as Bitcoin. The blockchain constructs chronological chains data in an irreversible and immutable manner
- Blockchain systems rely on several technologies and the various deployments use different combinations of them. Most commonly blockchain applications are associated with smart contracts, peer-to-peer networks, distributed ledgers, and consensus mechanisms.
- A peer-to-peer network is a connected network of users that exchange information by being both a client and server. Blockchain is a decentralized or distributed network that uses individual nodes to store and distribute the information directly to each connected peer.

- This chapter discusses the case studies identified via snowball sampling in the two main databases. Six companies were selected, as they implemented a blockchain system in realworld case scenarios in the agri-food sector, i.e., they have (self-)reportedly passed the "proof-of-concept" stage. These six companies exhibit high diversity in their application areas and the use of blockchain technology.

BLOCKCHAIN APPROACHES IN THE AGRI-FOOD DOMAIN

FOOD COIN

- FoodCoin system is an Ethereum-based blockchain system designed to create a global market of food and agricultural products on the platform 1000 EcoFarm.
- This market is open to all actors of the agri-food supply chain from the producers to the consumers. The system works with a token system, called FoodCoin,to buy and sell goods on the 1000 EcoFarmplatform.
- The system employs blockchain to ensure the validity of the reported transactions has seven technical elements (Foodcoin, 2017): a database implemented as a distributed ledger; its own cryptocurrency, called FoodCoin; a multi-functional cryptowallet, called the Wallok; its own payment system, called DiPay; a remote user verification; a system for smart contracts, and a product authentication system,called the Product OriginID. A producer or farmer can sell their products, and the corresponding transactions are implemented via smart contracts, which are checked at every stage of the supply chain by it sectors.

Olive Oil Tracking (Ambrosus)

- The stakeholders of this supply chain are the olive farmer, the first processor at the olivemill,the packaging at the factory, the supplier, and the retailer. The first step of the process is when the farmer transports the olives to the olivemill, and this is also when counterfeiting may occur.
- Adulteration can be more difficult to detect, and there is no unique method to spot all the types of contamination. A traceability management system, called GestOlive, aims to address such problems by collecting information, entered manually by the producer. The system does not follow the product after it lefts the mill.
- RFID tags are used to uniquely identify the product items. The unique identifier are associated with process and transportation information, stored in a blockchain. Consumers can access information stored in the blockchain via QR codes.

Celeia Dairy (OriginTrail)

- The company OriginTrail introduced the concept of traceability in the supply chain using blockchain for storing supply chain data. This system runs on a token economy, the trace token system. It tokenizes data exchange and the supply chain processing functionalities. The project uses Ethereum to ensure the proof of concept and the initial set-up. The company system works around two principles:
- (a) Seamless and automatic data connection and interoperability between IT systems of different stakeholders in multi-organization supply chains, with consensus mechanisms for ensuring the integrity of data
- (b) a decentralized public solution for performance, cost and scalability issues by providing a tailored decentralized system for supply chain data based on the blockchain.

Wine Blockchain (EzLab)

- Wine Blockchain is a project of EzLab that uses blockchain technology to enhance the traceability and the authenticity of wine.
- The project aims to fight adulteration and forgery of Italian wines via a QR code on the bottle. The QR code allows the final user to verify the authenticity of the products and their certifications, using an app.
- The data collected at the first mile comes from hardware and software, and they are stored both on a blockchain and the AgriOpenData platform to certify product and automate the supply chain.
- All the data stored on the blockchain and the AgriOpenData platform are published using a tool that allows producers to format and control access level to their data.
- The final consumer can access this information via the QR code. Finally, all data flow into a blockchain to ensure immutability, certified by a single Agri Open Datanode.

Summary

- We summarized the case studies across three dimensions. The first is concerned with the use of blockchain frameworks, the second with the utilization of tokens, and the third with the implementation realization.
- Most case studies use Ethereum to run their blockchain implementation; only Provenance used Hyperledger for their Ethereum Virtual Machine.
- FoodCoin employed tokens for their case studies.
- EzLab combine their software with some kind of hardware implementation to enhance the capability of the software implementation to collect data, typically using RFID or QRcodes.
- By comparing our findings in Sections "Blockchain Applications Potentially Relevant for Agri-Food " and "Blockchain Approaches in the Agri-Food Domain.

LIMITATIONS AND RECOMMENDATIONS

- This study was able to elicit new knowledge to accelerate the digital modernization of the agri-food industry, due to the information gathered by the case studies and literature.
- The study framework gathered possible parameters to evaluate the status of blockchain technology application in the agri-food industry.
- The parameters chosen are general enabling the study to replace other components to better suit the application of the framework in a different context.
- Nevertheless, there certain limitations when analyzing the literature and the case study
- Most sources are non-academic, some of which are in a continuous update or partially complete.
- This limits the applicability of the research, as it depends on the focus of the study considers.

CONCLUSION

- The objective of this research was to investigate the early application of blockchain technology in the agri-food industry, by following a case study approach focused on the early-adopter companies.
- From the pre-literature review were found two characteristics that are historical and recurrent in the agri-food industry, trust and transparency.
- The two major blockchain characteristics identified in the pre-literature study and the case study in the agri-food industry have been identifying as Trust and Automation.
- These two characteristics mirror the two issues identified in the agri-food supply chain. Both the literature and the case study research identified the importance of trust and transparency, as they may enhance and facilitate the collaboration and lower the risk among the supply chain stakeholders.

THANK YOU