

Palm Oil traceability: Blockchain meets supply chain

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Topic Areas: Blockchain, Sustainability, Tracking & Tracing.

Summary: There is a current lack of visibility in the transfer of goods from farmers to oil mills, to manufacturers, to retail outlets and finally to the consumer in the palm oil industry. While leading brands have pledged to commit to a 100% sustainable certification, only 19% of global palm oil production is certified as sustainable. Emerging technologies, such as blockchain, a distributed ledger, can transform supply chain traceability as we know it and bring more transparency through the value chain, creating value to stakeholders. From a process perspective, the proposed solution leverages the mass balance, and book and claim traceability models that RSPO has defined. From a technology perspective, the proposed solution leverages blockchain, geospatial imagery classification, and IoT technologies to keep track of the flow of physical goods and sustainable palm oil certificates. From a people perspective, the proposed solution includes a set of incentive models that could be utilized in easing change management efforts.



Before SCM, Toufic graduated with an MBA from MIT Sloan. Prior to that, he graduated with a Bachelor's degree in Business administration from the Lebanese American University. He worked in manufacturing and consulting in Lebanon and France. Toufic will join Amazon's HQ in Seattle as a Senior Product Manager upon graduation from MIT SCM.

KEY INSIGHTS

1. **The proposed solution leverages blockchain, geospatial imagery classification, and IoT technologies to keep track of the flow of physical goods and sustainable palm oil certificates**
2. **A permissioned Blockchain is recommended**
3. **Need to introduce traceability solutions that reduces the smallholders' liability for data collection**

Introduction

Due to the opaque nature of the palm oil supply chain, regulators, as well as customers have been unable to determine which producers are genuinely sustainable. Consumers, despite their growing concerns, are still in the dark on what products are sustainable.

Emerging technologies, such as blockchain, a distributed ledger, can transform supply chain traceability as we know it and bring more transparency through the value chain, creating value to stakeholders both upstream and downstream.

Methodology

The study engaged in a multi-method approach (Figure 1) from a multi- and interdisciplinary perspective:

1. A comprehensive literature review of current traceability models in the palm oil industry, identifying key technological solutions and reviewing different people-oriented challenges that arise with implementing a traceability solution.
2. A gap analysis of the status quo of the palm oil industry. The analysis is based on NGO reports, company sustainability reports, and industry interviews.
3. Content analysis of selected cases
4. Development of proposed solution.

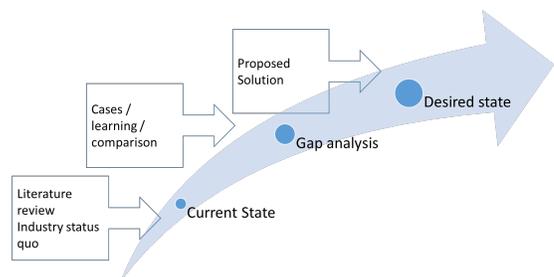


Figure 1 Analysis approach

The paper analyzed the problem using a process, technology and people framework. The activities performed include:

- Reviewing existing traceability models and solutions
- Mapping out how emerging technologies can increase traceability
- Highlighting existing barriers to implementation
- Identifying roadmap for potential next steps.

Gap Analysis

While leading brands have pledged to commit to 100% certification, only 19% of global palm oil production is certified as sustainable (“Impacts,” 2018.). One-third of certified sustainable palm oil (CSPO) sales in 2016 were “book and claim” and cannot be traced back to the plantation/smallholder (“Impacts,” 2018.).

The key obstacle to traceability in the palm oil value chain lies in its first component, the smallholders/plantations. Tracing back palm oil to the smallholder using current certifications such as the RSPO process has not proven to be efficient.

Content analysis

Content analysis involved analysing 5 cases of traceability from different industries:

1. Tracking tuna on a public blockchain
2. Tracking pig meat using NFC Technology
3. Tracking beef using a distributed RFID-based network
4. Tracking oats using a private blockchain
5. Tracking deforestation caused by palm oil plantations through near real-time satellite imagery.

The 5 cases were chosen because they represented 5 different technologies and processes and yielded different results. The learning derived from these cases, along with a comparison of the status quo of the palm oil industry and the knowledge generated by industry interviews allowed me to select and then map out a process that can improve the traceability level of the palm oil value chain.

Using blockchain in case 1 and 4 was effective from a dependability, performance and practicality perspective. However, four of the case studies dealt mainly with products that were discrete and larger. The palm fruit would be similar to these items in that it is identifiable, but as soon as the palm fruit is milled into oil, the oil itself would be impossible to identify individually. Palm oil is similar in this respect to oats in case 4. One take-away from case 3 is that it is important to keep the cost low and dependability high throughout the implementation to maintain stakeholder interests.

It is important to note that the authenticity of the traceability information is a key issue.

To identify the need for a blockchain (or not) in increasing transparency in the value chain, I have created a decision tree (Figure 2) that I applied to the palm oil industry. The database needs were acknowledged: Stakeholders have different incentives and a need for a strict immutability of records; the business logic is simple and the records should be kept private. As a result, a permissioned database is recommended.

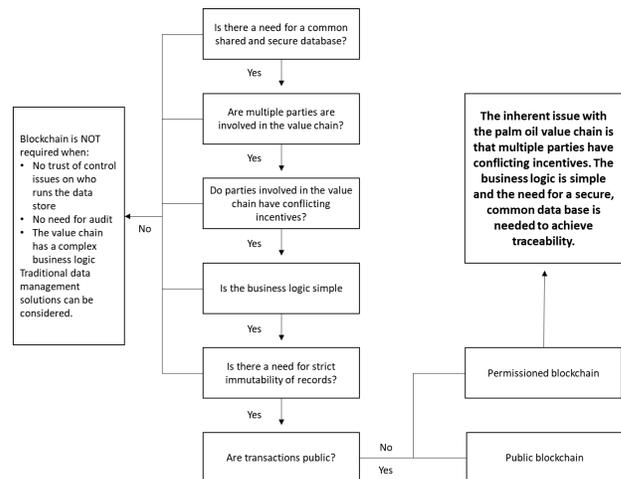


Figure 2 Blockchain decision model for the palm oil value chain

No single case provides a comprehensive and full solution for the palm industry. I have opted for a combination of technologies and processes as a potential solution and adapted the learning from the different cases to the palm oil industry.

Proposed Solution

This future-state process takes into account the analyses from a Technology, Process, and People perspective.

Process: Leverage mass balance and book and claim traceability models to put the overall value chain in a position to certify the different sustainability certificates

The mass balance model is used because it is the least costly (from time and money perspectives) to implement and can thus attract the most adopters. The book and claim model, which provides sustainability certificates, can attract additional adopters by creating a market in which certificates can be traded. By creating a trading market, organizations that are not directly part of the supply chain can also participate in the traceability process and thus increase the demand for sustainable products.

the proposed solution leverages the mass balance, and book and claim traceability models that RSPO has defined.

users to adopt and use the program over time, especially when a full traceability model may conflict with their own personal and organizational goals?

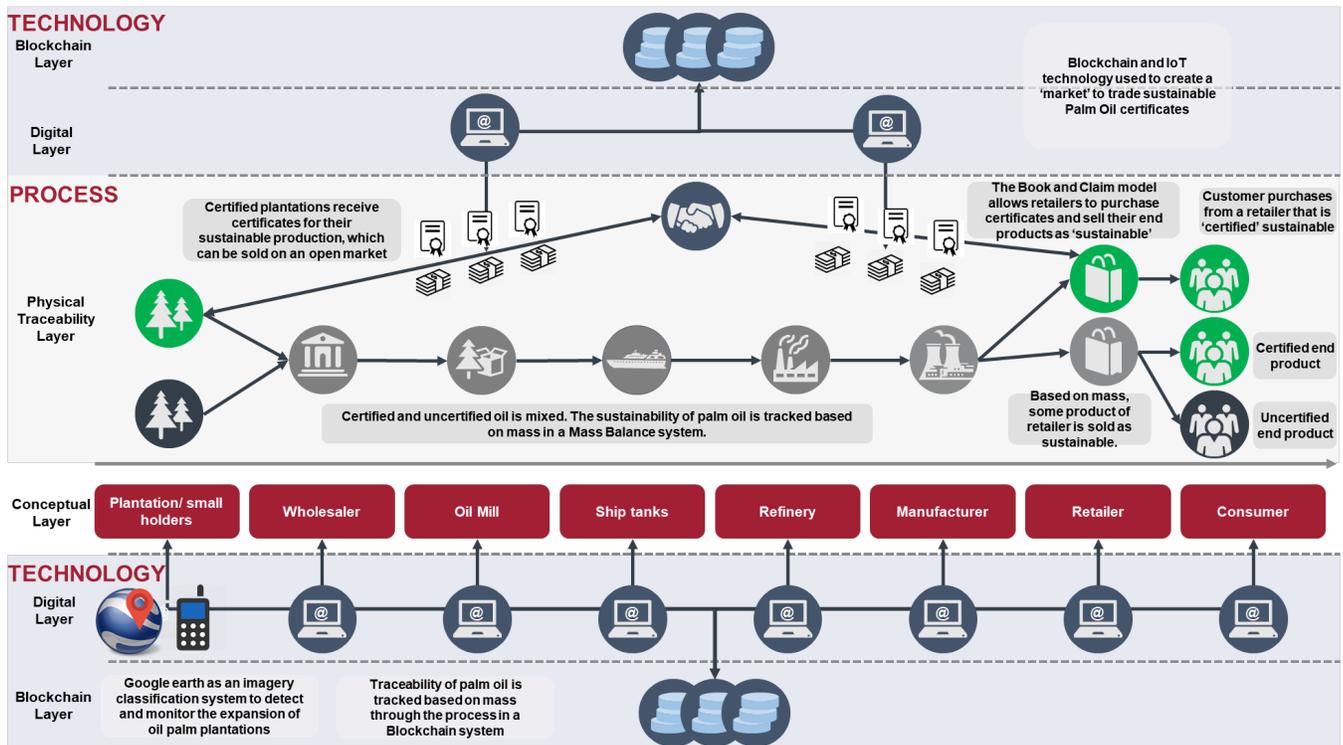


Figure 3 Proposed solution

Technology: The proposed solution leverages blockchain and IoT technologies to enable the traceability of palm oil. IoT technologies can be used to input the data and to provide online visibility of the information. For example, plantation farmers can use their phones (or computers) to scan in the number of palm fruits harvested per day and the destination they were shipped to. Each stakeholder in the process will also use scan in the batch number into the system as well. Using near real-time satellite imagery, a low cost solution, discussed in case 5, the farmers can be localized though GPS and their plantation. Therefore, it could be determined whether the plantation has been planted on deforested land. Blockchain is proposed as a data management system for two purposes. The first is to provide traceability to sustainable palm oil products throughout the value chain. The second is to provide a way to keep track of the sustainable certificates and allow traders to trade on a blockchain-backed platform and to support the book and claim model. The book and claim model will help draw additional participants into the palm oil sustainable cause and provide farmers in developing countries with an additional revenue stream.

People: One of the main challenges in implementing a traceability program is in change management. Specifically, how does one entice

Table 1 lists the different types of incentives that should be provided to engage the users in using the proposed model.

Table 1 Stakeholder incentives

Stakeholders	Incentives
Plantation	<ul style="list-style-type: none"> • Make sustainable farmers more competitive on the market • Additional revenue stream in selling sustainable certificates • Mitigates risk from future regulatory ramifications
Small Holders	<ul style="list-style-type: none"> • Make sustainable farmers more competitive on the market • Additional revenue stream in selling sustainable certificates • Mitigates risk from future regulatory ramifications
Oil Mills	<ul style="list-style-type: none"> • Provides additional value to their customers (refineries) to distinguish themselves from competitors. • Can improve operational effectiveness with the technology implementation • Additional revenue stream in selling sustainable certificates
Wholesaler	<ul style="list-style-type: none"> • Can improve operational effectiveness with the technology implementation, but loses out on their core value linking customers to their suppliers
Ship Tanks	<ul style="list-style-type: none"> • Provides additional value to their customers (refineries) to distinguish themselves from competitors. • Can improve operational effectiveness with the technology implementation
Refinery	<ul style="list-style-type: none"> • Provides a way for refineries to keep their major cpg manufacturing clients satisfied.
Manufacturer	<ul style="list-style-type: none"> • Provides retailers with a way to unlock additional market potential by being in a position to provide assurance to consumers that the goods come from a sustainable source. • Provides retailers with way to improve their branding and public image • Allows manufacturer to differentiate itself from competitors • Additional revenue stream in selling sustainable certificates
Retailer	<ul style="list-style-type: none"> • Provides retailers with a way to unlock additional market potential by being in a position to provide

Lastly, in contrast to the many well-known public blockchain applications such as bitcoin, "...corporate-designed Blockchain lack one of the main elements that made bitcoin a success: the decentralized structure." (Kshetri, 2018). Only a limited set of participants can have access to a corporate designed blockchain system, which increases the vulnerability of the system to hacking.

Conclusions

Many additional challenges must be considered prior to the implementation of such a solution. Firstly, the global value chain of palm oil is a complex environment that requires different stakeholders to comply with the different regulations in different countries. There will be challenges during the implementation in getting all stakeholders to comply while the implementation team operates within this complex setting of established laws, customs, and institutions. Secondly, the implementation of the suggested model is contingent on the participation of all the different stakeholders. These stakeholders have different capabilities, interest and objectives. They are highly geographically distributed, with no regular interaction among them. Thirdly, blockchain can provide a robust traceability system, but the physical/digital separation cannot be easily overcome. The gap between the physical and virtual worlds can still provide an opportunity for human mistakes at best or fraudulent activities at worst. Fourthly, the technology required might become a barrier for some stakeholders in developing countries. Without their participation, it is not possible to reach the full potential of the suggested traceability model.