The potential of digital technologies to improve the sustainability of agriculture supply chains

A focus on blockchain to enhance the traceability of soy

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Funders

The UK Research and Innovation Global Challenges Research Fund (UKRI GCRF) Trade, Development and the Environment Hub is working with over 50 partner organisations from 15 different countries. The project aims to make sustainable trade a positive force in the world by focusing on the impact of the trade of specific goods and seeking solutions to these impacts.

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This report is an annex to a longer research on Mechanisms enabling Brazil-China soy traders to meet increasing demand while reducing deforestation[1]. To better understand the context of this report it is recommended to consult the full research report.

List of Abbreviations

CAR	Cadastro Ambiental Rural (Brazil's Environmental Registry of Rural Properties)
4G	Fourth generation mobile network technology
AI	Artificial Intelligence
CDP	Carbon Disclosure Project
CISL	Cambridge Institute for Sustainability Leadership
EA	Ethereum address
EDI	Electronic data interchange
ERP	Enterprise resource management
ETC	Easy Trading Connect
FI	Anonymous code for 'financial institution'
GPS	Global Positioning System
IBAMA	Brazilian Institute of Environment and Renewable
IoT	Internet of Things
LDC	Louis Dreyfus Company
NGO	Non-profit organization
QR	Quick Response (code)
SaaS	Software as a Service solution
TR	Anonymous code for 'trader'
UKGCRF	United Kingdoms' Global Challenges Research Fund

Glossary of terms

Blockchain is a decentralized, shared ledger of transactions which allows participants to keep track of transactions without central recordkeeping. It is composed of add-on blocks that include details of all transaction data and execution outcomes. It is built on distributed computing peer to peer (P2P) technology and therefore data processing and storage are decentralised. Prior to recording a transaction, shared processing (carried out by multiple nodes of the system) is applied to verify the data.

Downstream refers to the part of the supply chain that, from an international trader's perspective, moves towards the end-consumers.

Upstream refers to the part of the supply chain that, from an international trader's perspective, moves towards the producers.

Ethereum is a blockchain with a built-in programming language that give users power to write smart contracts. Decentralised applications allow users to define their own arbitrary rules for ownership, transaction formats and transition functions.

Smart contracts are protocols intended to digitally verify and carry out credible transactions that are traceable and irreversible, without third party intervention. They render transactions traceable, transparent and irreversible. They can be stored in blockchain networks requiring the consensus of several blockchain nodes[2].

Supply chain digital platform/solution, in the context of this report, it refers to a digital platform that facilitates the connection and communication among any actors involved in a specific supply chain. This could take place through the interconnection of participants' digital systems or by accessing a third-party digital service through participants' interfaces.

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1. Introduction and contextual review

If downstream soy supply chain actors want their suppliers to be held accountable for the deforestation linked to their supply, they need to have access to information about where and how the soy has been produced.

Traceability of products in agricultural supply chain requires collection, communication and management of critical information[3]. However, current traceability practices in agriculture supply chains suffer from data fragmentation and centralized controls. This makes data management complex and vulnerable to malicious modifications[3]. Controversially, while one of the main challenges is that current practices depend on the grower taking manual steps to collect data that need to be sent through the internet from very remote areas, most of the agricultural data successfully generated to date have never been used[4].

It is argued that supply chain end-to-end digital platforms could enhance the transparency and traceability of agricultural supply chains as digital technologies can improve how organizations manage and share information.

For instance, blockchain could enhance the way supply chain actors capture and share digital information while guaranteeing the certainty, transparency, and accountability of the information generated. Blockchain[5] is a database shared and synchronized across multiple parties on a distributed ledger network. Communications are encrypted and information blocks can't be altered once created. Furthermore, different participants co-agree and co-process the appending of new transactions in the distributed ledger.

While the applicability of blockchain for traceability purposes in agriculture supply chains has been explored by a number of authors in recent years[6,7,8,9,10], very few provide specific details on implementation. In an attempt to cover the gap, Salah et al. proposed a solution that combines Ethereum blockchain and smart contracts to trace, track, and perform transactions in soybean supply chains with integrity, reliability, and security. Although their focus is primarily on food security, the same technology could be applied to link a specific volume of soy to a specific sourcing location and its corresponding information on land use management (see Section 3).

The business case for the adoption of blockchain is that its use can reduce companies' costs[2,11]. Furthermore, a study by Infosys[5] found that banks involved in supply chain blockchains could also benefit from a 30% reduction of costs associated with the clearing and settlement of credits and the setting of trade finance contracts. Reduction of risk and fraud were also reported as relevant benefits.

The implementation of blockchain traceability systems will require, however, a significant amount of up-front effort by all supply chain actors. All participants will need to digitize relevant data in a standardized, reliable and integrated way. This will involve the development of digital capacity-building among all supply chain actors. Furthermore, the adoption of complementary technologies such as smartphones, tablets, scanners, sensors, geospatial technologies, and electronic payment systems may be required to ease farmers' data input[12]. To meet all the above requirements, additional investment, support, and incentives will need to be put in place.

Accenture[12] recommends companies start blockchain developments at a point in the supply chain where there is already some degree of digital capabilities and where operations and financial incentives are well aligned. This seems to be what major grain traders are currently doing through the initiative Covantis[13], which initially focuses on the digitisation of post-trade operations (downstream).

Blockchain networks can be public, private or hybrid. While some blockchain networks, such as Bitcoin, are open to all and anyone can join and see any transactions, these networks require resource-intensive computations to prevent fraudulent transactions. A concern from companies when considering the use of shared platforms to manage information is that corporate data can be sensitive. Breaches to data security could indeed negatively impact markets and de-incentivize companies to participate in multi-stakeholder digital platforms. Blockchain platforms allow participants to set levels of permissions to determine which participants can access which data[12]. This requires effective governance and coordination between participant organizations.

Another aspect that needs special consideration is the cross-platforms interoperability among the digital systems of the different actors involved in each supply chain. Organizations will need to ensure there is adaptability into their systems' architecture to enable traceability applications to communicate with different platforms.

Finally, it is argued that supply chain digital platforms developed to facilitate the monitoring of sustainability parameters should guarantee an ethical use of the data they provide by preventing its misuse. Therefore, their development might need to go hand-by-hand with the establishment of specific public and private policies on data privacy and management.

This summary report captures the current context on barriers and opportunities to deploy supply chain digital solutions (specifically those based on blockchain) to enhance the traceability of soy supply chains. The next section introduces the limitations of blockchain for soy supply chains (section 2). It is followed by a description of a blockchain specifically designed to trace soy supply chains (section 3), a review of companies testing blockchain in agriculture supply chains (section 4), a review of digital solutions commercially available for food supply chains (section 5), contextual insights from soy traders (section 6), contextual insights from banks financing soy trade (section 7), and a concluding summary (section 8).

2. Limitations of blockchain traceability for soy supply chains

While the feasibility of implementing end-to-end blockchain traceability platforms has been acknowledged for other soft commodity supply chains (e.g. tuna and shrimps)[12], for the case of soy it is acknowledged that there are a series of specific barriers that could compromise both feasibility and effectiveness:

- Very wide variety of end products across many industries.
- Batches inevitably mixed unless segregated.
- Not all the farmers and intermediaries may be equipped to complete the required reporting.

- Lack of standardized understanding of data, labelling and units of measurement.
- Lack of incentives to share data.

However, while it is technically difficult to maintain traceability as the soy gets mixed and refined, tracing beans that remain whole until they reach the wholesaler is technically feasible. This could at least allow some Chinese soy buyers to confirm they are purchasing whole beans originated in farms that are compliant with specific standards. For instance, using blockchain to trace Brazilian soy with valid proof of Forest Code compliance and CAR registration could create an incentive for purchasers of whole beans to confirm that their soy is compliant, regardless of the form it takes after processing.

3. Detailed operation of a blockchain for a soy supply chain

This section describes the operation of the blockchain solution proposed by Salah et al.[3] for soy supply chains .

Each participant has a unique Ethereum address (EA) that allows them to define, use and manage smart contracts in the blockchain. Any images, data, and transactions are digitally signed and attributed to a specific actor which is considered the undisputed owner and therefore responsible for its accuracy. The total volume of soybeans sold between participants is logged and all transactions can be verified. Figure 1 represents the sequence of digital transactions involved in the selling and shipment of soy from end-to-end in the supply chain.

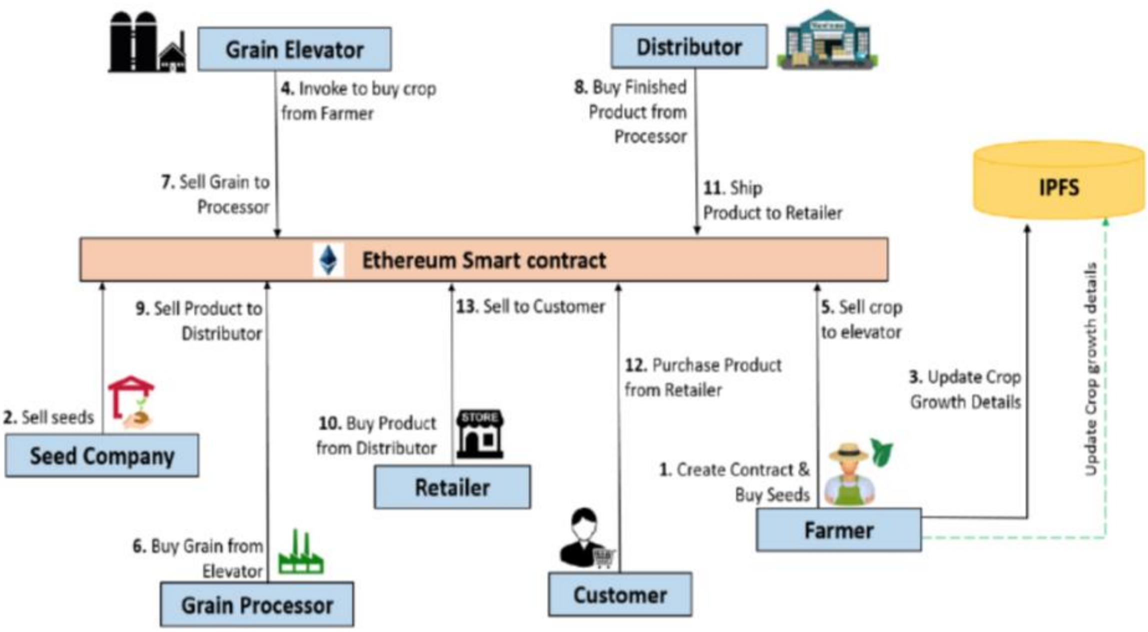

Figure 1- Soybean traceability using Ethereum Smart Contracts by Salah et al.[3].

The following paragraphs describe the steps involved in end-to-end soy trade through Ethereum blockchain.

When a seed company sells seeds to a farmer, a smart contract is created that includes attributes such as both parties' EAs and the quantity and characteristics of the seeds. The seeds sold are identified using standardized identifiers (e.g. the Global Trade Identification Numbers).

The farmer buys the seeds and carries out the farming. Details of crop production (plant and land conditions) are recorded by the farmer in a decentralized file system (IPFS) at regular time points until the harvesting stage. Cameras installed in the field can automatically take and store images in the blockchain. Each time an image is uploaded it is time stamped, its reference is stored in the smart contract and a notification is broadcasted among involved parties.

When the crop is harvested, there is an offline agreement between the farmer and the grain elevator to store the produced crop. The farmer is given the details about the moisture, humidity, weight of the grain stored in the elevator and the duration of storage in the elevator. The farmer agrees to it and sells the grain to store in the elevator through the corresponding Ethereum function.

The grain is then purchased by the processor which prepares the finished product. The processor activates the Ethereum function that requests a purchase (by introducing parameters such as the grain processor EA, the grain elevator EA, the quantity and the date of purchase). The grain elevator activates the sale confirmation. An automatic notification is then broadcasted to the involved participants confirming the parameters of the transaction.

The distributor buys the finished product from the processor in order to ship the products to potential buyers. The distributor would execute an Ethereum function to request the processor to sell them soybeans specifying the grain processor and distributor EAs, quantity and date of sale. An automatic notification is then sent to interacting participants.

After this point a distributor sells the products to different retailers. The distributor interacts offline with interested retailers and retailers participating in the blockchain request for the goods by executing the corresponding Ethereum function. The distributor executes the function that confirms the sale and another event broadcasts a notification to the involved participants about the sale of goods.

End customers can also buy products to retailers by executing an Ethereum function. Finally, the retailer confirms the sale by executing another function. The smart contract broadcasts the corresponding notification.

Figures 2 and 3 illustrate the sequence of transactions among actors.

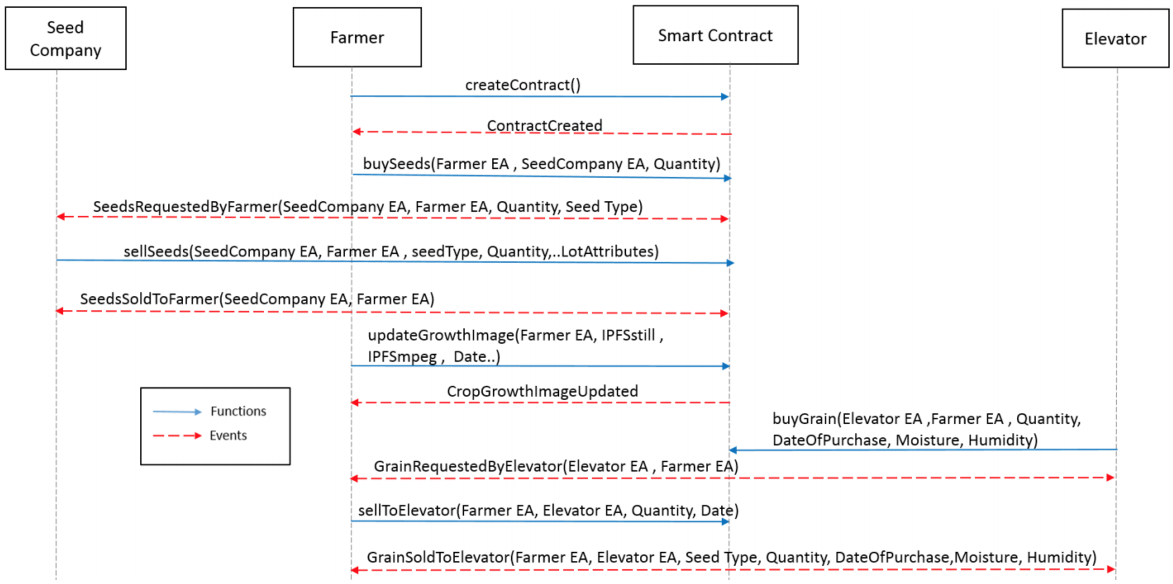

Figure 2- Smart contracts sequence diagram (part 1/2). By Salah et al. [3].

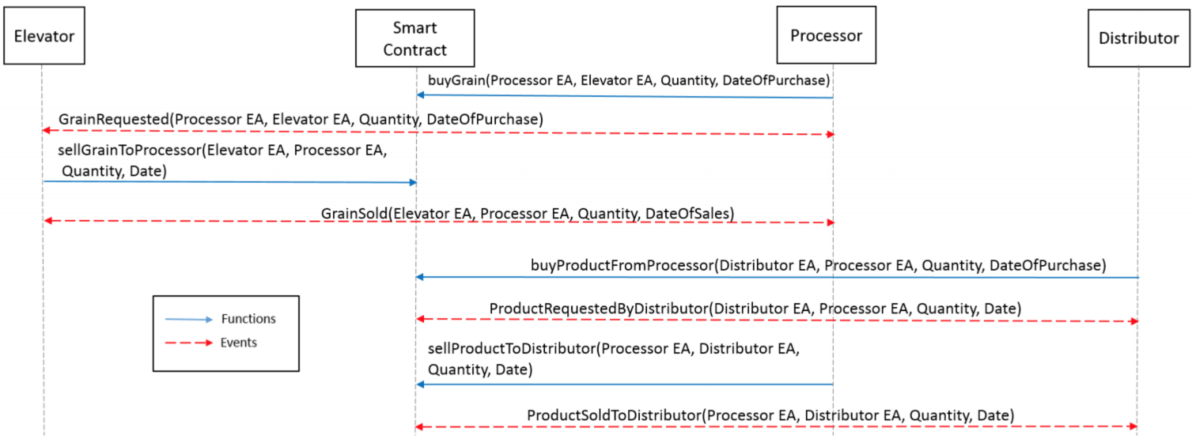

Figure 3-Smart contracts sequence diagram (part 2/2). By Salah et al. [3].

In terms of traceability, continuous monitoring is guaranteed by using traceable identifiers per lot. The conditions of the shipment can also be monitored using IoT-enabled containers and packages equipped with sensors, cameras, GPS locators, and 4G communication. The exact physical location of products and stakeholders can be traced by including the corresponding attribute (e.g. geotagging the location of products and stakeholders by means of GPS sensors) to the Ethereum smart contracts.

While it is possible for a participant to transact and record fraudulent data, all participants can, with 100% certainty, attribute this data to its owner and smart contracts can automatically invalidate shipments and impose penalties and corrective actions.

As a further development Salah et al. aim to integrate the solution described above with automated payments by means of cryptocurrency.

4. Examples of companies testing blockchain in agriculture supply chains

Nestlé[14] in partnership with the Rainforest Alliance aims to enhance the accountability, traceability and transparency of the Zoégas coffee in Sweden. The coffee is 100% Rainforest Alliance certified blend of arabica coffee beans from Brazil, Rwanda and Colombia. Buyers are now able to trace their coffee back to the different origins through blockchain-recorded data.

ING[11] joined forces with major trader LDC (Louis Dreyfus Company), ABN Amro and Société Générale to develop a blockchain prototype called Easy Trading Connect (ETC). It consisted of digitising the transactions required for LDC to ship 60,000 tonnes of soybeans from the US and sell them to a specific Chinese soy buyer (Shandong Bohi). Paper contracts, certificates, letters of credits and manual checks where digitised and data was automatically checked, which resulted in completion at five times the speed of paper-based transactions. Participants acknowledged that, apart from improved speed, with blockchain there were also improvements on easy data verification, reduced fraud risk, lower costs, increased safety, and the ability to monitor the trade's progress in real time. The transaction was completed using Quorum's technology, which uses private blockchains.

ING, Société Générale and ABN Amro, who were previously involved in the Commodity Trading Consortium focused on developing a blockchain to manage physical energy transactions, reported that traders' efficiency went up by 33% [5].

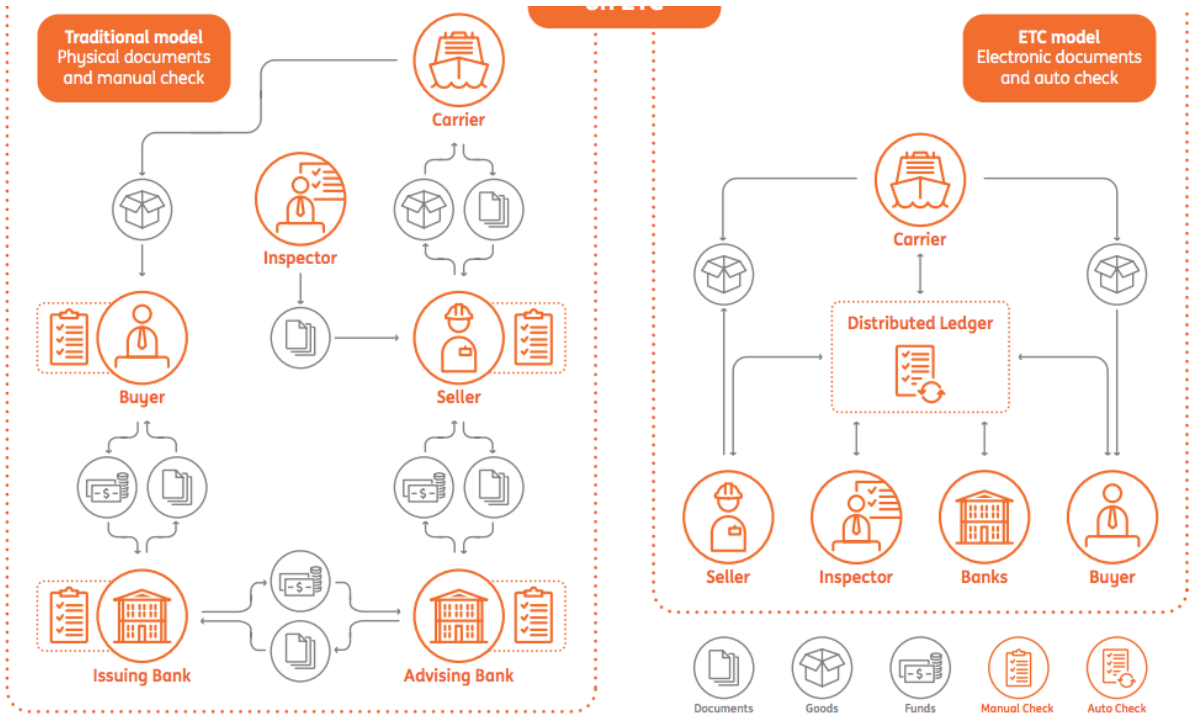

Figure 4- Traditional trade transactions vs digitisation with blockchain (by ING's ETC[15]).

Walmart, the Chinese retailer JD.com, IBM and Tsinghua University announced, in 2017, the launching of a Blockchain Food Safety Alliance collaboration to improve food traceability in China (initially of leafy greens like romaine lettuce and spinach)[16]. The initiative was designed to bring efficiency, transparency and authenticity to global agriculture supply chains mainly from a food security perspective[17]. It was then announced that companies such as McLane, Nestlé and Unilever (among others) joined IBM and Walmart for a major blockchain collaboration[18]. Nestlé and Carrefour, for instance, teamed up to use IBM's blockchain to trace mashed potatoes. Using the QR code on the product's packaging, consumers were able to use their smartphone to access supply chain information[19].

Multinational companies (Unilever, Sainsbury), financial institutions (BNP Paribas, Barclays, Rabobank), NGOs (IDH) and fintech firms, convened by CISL, developed a pilot to link preferential financing to verifiable sustainability claims in the Malawian tea supply chain[20]. Using virtual identifiers encoded on a blockchain, farmers provided standardised data (e.g. production practices, volumes, quality, and price) which became available to all parties with access to that blockchain. Financial institutions could then offer access to credit (with or without preferential terms) based on the evidence of sustainability supported by the blockchain. Blockchain-based supply chain services firms (Provenance and Halotrade) used smart contracts and algorithms to convert supply chain data into preferential pricing terms in banks' systems. Landmapp provided land rights documentation via mobile technology. Focafet foundation ensured open-source data standards were developed and used.

5. Examples of digital solutions commercially available for food supply chains

IBM's Watson Decision Platform[4] combines artificial intelligence (AI), analytics and predictive insights in a dedicated agricultural internet of things (IoT) to help agriculture supply chain actors make faster and better-informed decisions while enhancing transparency. It includes the capture and sharing of sustainability-related insights such as crop input optimization, yield optimization, energy consumption, land and water use, soil conservation, soil carbon content and greenhouse gas emissions. For producers, it offers production optimisation. For traders, it offers production details and predictability. For banks, it offers a better risk management.

IBM Food Trust[21] is a blockchain distributed ledger that creates a secure, shared, and permissioned record of transactions. It allows supply chain participants (producers, suppliers, manufacturers, distributors, and retailers) to securely upload, manage and access transactional data, ensuring sustainability claims are genuine. Additionally, it allows users to trace food products upstream and downstream and share inspections, quality certifications, and registrations. As Food Trust is a Software as a Service solution (SaaS), to run its applications participants only need a browser and access to internet. It is a permissioned network, so participants know with whom they are transacting and determine what data is seen by whom. Smart contracts are used to automatically execute contracts and build trust.

Proagrica[22] is a global provider of data-driven solutions for the agriculture and animal health industries. They implemented a solution which integrates electronic data interchange (EDI) within businesses' enterprise resource management (ERP) systems. It allows connection between partners and a complete overview of product histories[23]. All transactions are recorded, and all orders are traceable by their point of origin and manufacture date. A dashboard displays product histories and credit partners in real-time. They appear to have experience in helping agri-science businesses increase their productivity while enhancing biodiversity[24].

Additional digital tools and platforms for agricultural supply chains can be found on the list published online by the UK GCRF's Trade, Development and Environment Hub[25].

6. Results and insights from interviews with Brazil-China soy traders

Traders participating in a research on mechanisms to reduce deforestation in the Brazil-China soy supply chain[1] were asked a series of questions to explore whether newly developed supply chain digital platforms integrate the parameters and functions required to enhance the sustainability of soy trade (with a particular focus on deforestation in Brazil).

Digital tools traders currently use

Traders are already using or developing digital systems to gather and assess information on soy production practices (which seem to only cover directly sourced soy). In most cases they defer to digital services provided by a third party. They don't seem to use the same provider as a range of different platforms and technologies were mentioned. Such digital solutions are being developed to cover specific operations of specific parts of the supply chain rather than aspiring to cover and interconnect entire supply chains.

<u>Results</u>

TR1:

- Geospatial location of all their farms which are monitored through their own digital platform.
- Privately developed digital platform that monitors and assess information linked to the soy directly sourced from farmers. Public data is synchronised based on the government updates. The platform checks farmers' information against TR1's commitments and minimum requirements (labour, anti-slavery, IBAMA list, CAR information).

TR2:

- Agrosatelite[26] (analysis of remote sensing satellite images).

TR3:

- GIS tools [interactive mapping, geographic information system] and platforms such as Grain Bridge[27].
- *'we are building capacity for the different ways in which we are collecting data, some core central systems and getting those core systems talk to each other. If we're on a farm having a commercial conversation, that's an opportunity to collect information related to sustainability or product quality and yield or whatever. To make it easy, whether that's a handheld devices, it's all goes into*

*a common back-end, in which point we can overlay data and analytics, GIS tools and other mechanisms so that we have that sense of what's being produced where and under what conditions.'(*TR3)

TR4:

- Blockchain and QR codes (not with soy yet).

TR5:

- Covantis (blockchain in development). Other participants are also part of Covantis.

Extent to which supply chain digital initiatives embed sustainability considerations

Making Covantis work at the technical level seems to be the main priority for the next 3 to 5 years. At the operational level, the initial objective will be to digitise post-trade paperwork. However, as the initiative is developing the first trade-sector blockchain, and involves the main grain traders, it represents a good platform to coordinate future efforts on upstream traceability to the farm level. Covantis should promote the inclusion of more traders who, although might have smaller market shares, are part of the trade ecosystem and have a non-negligible role to play.

<u>Results</u>

- Most of the respondents mentioned Covantis as the most promising development from a supply chain perspective and recognised that for the moment they are not including sustainability considerations in the first stage:
    - *'the main objective [of Covantis] is to reduce costs, to optimise processes, to reduce paperwork, to make everything efficient and more timely, reduce labour. […] So it does have a positive sustainability impact, but that is not the main purpose of this project. And whether there's potential to insert some more sustainability focussed elements later on. Yes. But at the moment they're not considering that. Because the whole purpose now is to actually put it together and make it work.' (TR5)*

Unresolved aspects traders think digital technologies could help with

Traders recognised a series of unresolved challenges that digital technologies could help overcome (e.g. the lack of data accuracy, verification and ownership, the inability of many farmers to collect and share data, the unpredictability of deforestation displacement, the lack of full traceability, and the incompatibility among digital systems of different stakeholders). It is argued that blockchain could help resolve most of these challenges (see Section 3).

<u>Results</u>

TR1:

- The reliability of public data.

- TR1 checks official data and stated that they need *'to have a quicker process of validation of the official data'* and that *'the CAR is information that producers supply to the environmental agency but it has not been verified' […] 'I need from the government to have a more robust system in place'*. (TR1)

TR2:

- Better information on the sourcing municipality and farmer.
- More clarity on the origin of CAR's information.
- Facilitate the way farmers can provide the required data.

TR3:

> *'Ability to have much more granular information: where is conversion happening now and where might it happen next. That predictability is quite key.'(TR3)*

TR4:

> *'in a perfect world, […] to trace every soybean back to the farm and be able to provide evidence that each farmer complies with the Brazilian law and does not deforest since an agreed cut-off date in any part of his land holding. You know, that sort of degree of granularity of data to evidence that your supply chain is completely clean, everything is fully traceable and monitored and verified. That would be a great place to be. Sadly, we're not there yet.'(TR4)*

TR5:

> *'real-time monitoring data on the farm level, so we can monitor activity on the farm in terms of forest clearance'*(TR5).

TR6:

> *'it is always challenging when you gather information. In Brazil the legislation from each state is sometimes different. Thus, there's difficulty not only for us, but even for finance purposes or even for tax purposes to have everything on the same system.'(TR6)*

Traders' perceived barriers for digitising the traceability of supply chains

Traders mentioned a series of challenges for full digital traceability of supply chains. Some of them where generally applicable to traceability and could in fact be resolved with blockchain (e.g. the difficulties to link a volume of soy with a specific land location, or the difficulties to trace volumes traded among multiple intermediaries). Some of them were specific for digitisation (e.g. developers' need for a deep understanding of the soy markets, the compatibility required among the digital systems of thousands of actors, farmers' lack of access to required technology and ability to provide standardized data, farmers' resistance and lack of incentives to share data, an elevated cost of implementation for low-value commodities such as soy).

Results

TR1:

- Not all actors can develop the right approach as it is required a deep understanding of soy production systems and markets.
  - *'it really takes time […] I really don't see that happening different from that in the future.'* (TR1)
- Interconnectivity among the systems of all intermediates.

TR2:

- Farmers' access to the required technology.
- Farmers' resistance to greater transparency and the lack of incentives for them to share information.
- Difficulties to know if a specific tonne of soy comes from a specific piece of land.
    - *'satellite information can inform of the size of the farm, of whether there is deforestation or road construction activities in protected areas but you can't see if the tonne [of soy] the farmer is supplying to you, is really coming from that farm.' (TR2)*

TR3

- While there is good data and analytics on producers' land locations, it is difficult to know if the soy they provide originates where they say it has.
- Traceability of soy traded among traders.
    - *'it's not just about the direct supply that any soy trader has... there is trade between traders. Therefore, all need to develop in the same direction.' (TR3)*

TR4

- The dynamic nature of the market where suppliers change, makes human intervention a requirement.
    - *'supply chains are not static (we will be buying from new people, we will stop buying from some of our established suppliers), the ability to handle all of that data and information remotely is difficult, there's a human element'*. (TR4)
- Monitoring thousands of suppliers requires a vast amount of resources.
    - *'getting all of the information from your entire supply chain we're buying from (thousands of farmers) and then being able to successfully monitor it requires initially huge effort.'* (TR4)

TR5:

- Soy is a low-value commodity and it is difficult to allocate the extra costs of blockchain across the supply chain.
    - *'because soy is such a low-value commodity compared to coffee, salmon, wild shrimps or cocoa, the cost of implementing a blockchain system, it's hard to claim it back from the clients. Nobody's willing to pay that premium at the moment.'* (TR5)
- Full traceability of soy supply chains is a particularly complex. Therefore, associated costs are huge, and nobody wants to pay.
    - *'the soy it disappears into millions of products, so it's very difficult to trace. The efforts you have to make to trace it all the way from the farm to the end product that is a tremendous amount of money that nobody wants to pay for. End-customers are not paying.'* (TR5)
    - *'in terms of percentage of our supply chain that can be claimed as deforestation-free, there is a high cost we have to bear, and we have no way to claim back [associated costs] if we want to audit our food supply chain against deforestation criteria.*' (TR5)

TR6:

- Difficulties to gather the standardised data from farmers due to a lack of ability to understand what is requested or a variety or understanding and interpretation:
    - *'we made a pilot to gather CO2 information at the farm level and it was really hard to have everybody responding the information in a standardised way […] even if you create clear templates everybody will interpret it in a different way'.* (TR6)

Data traders think they could share in supply chain digital platforms

While most participants stated that they were unsure of what data their companies would agree to share, they had a personal view on the kind of data they would like to share for the sake of sustainability (the origin and volumes of products, the contract conditions, associated certifications, a list of suppliers with evidence of compliance or otherwise grievance processes, and the percentage of traceable soybeans).

<u>Results</u>

TR2:

- potentially at some point the origin and volumes of the products, the contract conditions, if there is a certification scheme *'But I don't know whether we are supporting it.'* (TR2)

TR3:

- it depends on how it is shared as some information is competitive
- they already share heat maps of areas where they source soy, and heat maps of where conversion is happening or is likely to happen.

TR4:

- a complete list of suppliers, and evidence of their compliance or how grievance are resolved (As they already do with palm oil).

TR5:

- at the minimum, the percentage of traceable soybeans.

TR6:

- They currently share information on their own suppliers' compliance with the Amazon moratorium, and on sourcing to WBCSD's SCF (which then generate aggregated heat maps on *sourcing* areas and deforestation risk).

Traders' views on the potential of supply chain digital platforms to enhance the sustainability of soy trade

Most participants had a clear vision of how digital technologies can contribute to enhancing the traceability, the transparency, and hence the sustainability of supply chains. However, one was expectant to see proof of it, and another was openly sceptical.

<u>Results</u>

TR1:

- *'I think it is the future.'(TR1)*

TR3:

- 'I think it needs to be systematized.'
- *'we need to do more to understand what's happening on the ground, what's driving producers' decisions, what are the points of leverage that we have as opposed to a binary include/exclude producers. And digital technology is enabling us to look with much greater granularity.'* (TR3)

TR4:

- '*if the tech and the digitalization improve traceability as it should, that can only be a help and an additional tool in the advancement of sustainability credentials.' (TR4)*
- *'I think it will be very helpful. It will be complementary'. (TR4)*

TR5

- *'we are interested to explore blockchain as a digital tool to improve our traceability of commodities'. (TR5)*

TR6

- *'I don't know if digital transformation will help us have better information. Today I cannot say'. (TR6)*

Ways in which traders currently report their sustainability performance to banks

Most traders disclosed that the main way they communicate their sustainability progress to banks is through annual sustainability reports. These are varied in content, focus and nature of indicators. A standardised framework to digitally report progress on sustainability could be positive for both traders and banks. One trader also stated that they have more and more frequent face to face meetings with banks as banks want to ask specific questions. This is an indicator of a more proactive approach from banks to assess their customers' sustainability performance.

Results

TR1:

- Annual progress reports (which contain information audited by a third party).

TR2:

- CDP report (which contain information audited by a third party).
- They use GRI's definitions.
- They plan to use industry indicators (e.g. ABIOVE, or agreed among peers).

TR4:

- Annual sustainability report
  - *'I've been in this role now for about 10 years, and what I've noticed is that the frequency and the granularity of communications with banks has grown enormously.' (TR4)*

- *'I sit sort of face to face with most of our principal banks to go through our progress and to deal with some specific questions that they may have about our performance'. (TR4)*

TR5:

- Sustainalytics' ESG Risk Rating[28] (including traceability indicators which are monitored internally and audited externally). (TR5)

7. Results and insights from interviews with banks financing Brazil-China soy traders

Banks participating in a research on mechanisms to reduce deforestation in the Brazil-China soy supply chain[1] were asked to share their views on the development of supply chain digital platforms that integrate the parameters and functions required to enhance the sustainability of soy trade (with a particular focus on deforestation in Brazil).

Banks' views on the potential of supply chain digital platforms to enhance the sustainability of soy trade

Most bank participants were able to identify positive aspects from the potential use of supply chain digital platforms (e.g. faster access to key information; faster and better-informed decisions; better reporting; enhanced traceability and traceability; and less inefficiencies, human errors and bias). One participant stated that, within banks, while real-time access to information might be particularly useful for Sustainable Finance departments (who might need to monitor their customers' progress more often) for Risk departments they do not think it would add value as they just make annual checks. However, it is argued that, regardless the frequency of their customer assessments, the possibility to consult the most updated data would considerably help reducing banks' risk as their customers' sustainability performance can change from month to month. One participant doubted the cost-effectiveness of supply chain digital platforms if they were developed solely for voluntary sustainability purposes. It is argued that digitisation of supply chain processes would not only provide better access to information but also resource optimisation and therefore the reduction of operational costs.

<u>Results</u>

FI1:

- it could definitely help in terms of traceability.
- *'if that [digitisation] means that it will be easier for clients to prove lenders they comply with requirements then probably, yes [it would help increasing the volume of sustainable trade finance].' (FI1)*

FI4:

- *'it just kills inefficiency, potential human errors, and bias... It just kills uncertainty, so it is helpful for us and our audits'. (FI4)*

FI6:

- It can help enhancing transparency.

- *‘there's a difference between the opportunities for the Sustainable Finance unit (within the business development area) and for the risk unit. From the risk side, I don't think we're ever going to get to a stage where we're doing constant monitoring of our customers unless there's some kind of remediation going on (we'll always be doing annual checks, and our customers make sure that they are compliant with our policies and local laws). When it comes to sustainable finance, where there's the need for that kind of ongoing monitoring to check against KPIs, then such technologies I can see being used more.’ (FI6)*

FI7:

- It can help getting more information faster and therefore allow banks to make faster assessments and faster disbursements to farmers and other clients.

FI8:

- *‘To do just that [promoting sustainability], I don't know if the cost-effectiveness would be that good. It would have to be a whole sector doing this or a government requirement, but as a voluntary initiative I don't think it would have much effect.’. (FI8)*
- *‘But obviously, if there was some kind of an open platform that everybody could use. Yes. That would be better for everybody.’ (FI8)*

FI9:

- *‘Such artificial intelligence or blockchain data would streamline the process [customers’ due diligence], you wouldn't need to ask [individual questions] because you would have this data’. (FI9)*

Banks’ involvement in initiatives for supply chain digitisation

Only two bank-participants were aware of their banks being involved in some sort of supply chain digital or blockchain initiative. These initiatives focus on hard commodities rather than on soft commodities. However, the case studies reviewed in this report found that a few banks have already been involved in pilots using blockchain for the trade of soft commodities. Banks with local presence in Brazil were familiarised with digital services their banks contract to access data on their customers’ land use (these digital services integrate data from TRASE, Agroideal, Global Forest Watch and the Brazilian Government).

<u>Results</u>

FI1:

- Have been involved in blockchain initiatives for hard commodities (metals).

FI4:

- The participant didn’t know.

FI6:

- *‘our global trade and receivable finance teams have started using blockchain with their customers, but not necessarily aimed at the soft commodities right now’. (FI6)*

FI7:

- Mainly individual digital systems that are not open or connected to other actors' systems.
- They use external digital tools such as the ones provided by the Brazilian Government, Agroideal and the Global Forest Watch to inform their decisions.
- They have contracted an external company to aggregate the information of public tools in layers for the bank to consult information related to a specific.

FI8:

- Not awareness about involvement in supply chain digital initiatives or blockchain.
- Through an external company they have access to instantaneous reports that integrate data from TRASE, Agroideal (they verify loans from satellite photos together with government database) and the Brazilian government. But it is not a shared digital platform and does not use blockchain.

FI9:

- *'Some teams are working or thinking about how they can use artificial intelligence together with sustainability data. But that's really a work in progress.'(FI9)*
- *'I haven't been involved in that, but I think there is certainly some potential for that. It's just you really need to define what sort of data you need, for which purposes.'(FI9)*

Bankers' perceived barriers for digitisation of supply chains traceability

Several interviewees could not have an opinion on the topic as they were not familiarised with digital technologies. Those who could think of some potential barriers for the development of supply chain digital platforms (and banks' participation) mentioned aspects around accessing and verifying farmers' data and with protecting the data of banks' customers.

<u>Results</u>

FI1:

- Data reliability and verification at the farm level.

FI7:

- Banks cannot disclose their customers' identity so they cannot contribute to traceability in that way.
- *'producers are resistant of sharing information as they have the perception that the more they share the more they are asked to share.' (FI7)*
- *'we must not do the the job of the government (so an inspection and see if this farmer is in compliance with the legislation). There are some things that the government must do.'(FI7)*

FI9:

- *'I think it's just difficult from a data protection point of view because obviously you have to protect your clients, so nobody should know who are your clients and what data you are exchanging. Clients may want to keep some information secret from their competitors.'(FI9)*

Unresolved aspects banks think digital technologies could help with

Banks were asked what unresolved issues they think digital technologies could help with. Aspects such as the access to sustainability-related data, a better supply chain transparency, a better connectivity between supply chain actors, an easier access to data collected by farmers, an easier access to data provided by the Brazilian government, and the link between specific deforestation activities and specific supply chain actors.

Results

FI4:

- Access to sustainability-related data.

FI6:

- Better visibility of impacts linked to supply chains (forced labour, human trafficking, illegal wildlife trade).
- More robust supply chain connectivity.
- *'I can see over time how technology can help us address those kinds of things.'*

FI7:

- Brazilian farmers, traders, everybody must have a licence to operate, but this information is not public in one platform. You need look for it at the municipality environmental agency of each state.
- 'we need to have one big platform with information on all actors' licenses to operate'. (FI7)

FI8:

- Access to information on how many of a traders' suppliers are deforesting.
- *'When you use Trase it's hard to attribute deforestation to a particular trader. But the most difficult part is to actually get data as to whether they are actually buying soy from farmers that are not deforesting. Again most likely the traders are doing things correctly. But that kind of data is the most difficult kind of data to obtain.' (FI8)*

FI9:

- *'I think at the moment, the biggest problem is that there is not enough transparency on the flows of the soy'. (FI9)*

Data banks think they could share in supply chain digital platforms

None of the bank-participants could think of any kind of data they could legally share in future supply chain digital platforms. Some stating that they see banks' role more as that of a passive user rather than that of an active contributor to these digital platforms.

Results

FI1:

- *'It's difficult to say because there are different legislations for bank secrecy. I would need to check with my legal department or my compliance department,* *if sharing specific data goes against the Brazilian central bank or the European bank regulator.'*

FI4:

- *'The bank might not share anything. We are not allowed to share anything as a starting point.'(FI4)*
- *'It's about banking regulation, banks will not share anything unless clients share it'. (FI4)*
- *'the question is, what do we want to achieve? If there is a very clear benefit that everybody can agree on, regulation could be reviewed. But if it is sharing for the sake of sharing, I think it might be a bit difficult to justify.' (FI4)*

FI6:

- *'I don't see why banks would necessarily need to put in sensitive data. I can see them being more kind of operating the platforms, really.' (FI6)*

FI7:

- I can't say the name of any client, I would not be able to say from whom each information is.
- I can't think about anything right now.

FI9:

- *'I think it's just difficult from a data protection point of view because obviously you have to protect your clients, so nobody should know who are your clients and what data you are exchanging. Clients may want to keep some information secret from their competitors.' (FI9)*

8. Concluding summary

Digital platforms that facilitate and record any transactions among supply chain actors, have great potential to enhance end-to-end transparency and traceability. In the specific case of soy, traceability can be easily guaranteed in the stages where soy is handled in the form of whole soybeans. However, once soybeans are mixed, processed and converted into a different product, traceability becomes more complex from a technical and operational point of view.

Technologies such as blockchain designed with fit-for-purpose algorithms could enable the tracking of transactions involving volumes of product that were manufactured with specific volumes of soybeans (all of them digitally tagged with a unique ID assigned from the instant it is sourced at the farm). The key for success, apart from a very granular and tailored design, is a high level of participation among the actors involved in a specific supply chain.

Existing pilots developed for commodity supply chains suggest that the digitisation of transactions across supply chains results in time, resource and cost efficiencies. However, its implementation require great up-front investment, training and adaptation. Multi-stakeholder initiatives involving entire sectors across supply chains could facilitate the transition by allowing the sharing of costs and the co-design of solutions that take into account both the individual and the collective needs.

Through interviews with traders and banks we aimed to explore the current context in terms of supply chain digitisation with sustainability considerations in their sectors.

Some of the main insights arising from the interviews with traders were:

- While major traders have recently joined forces to digitise post-trade operations, the scope of their current work does not include enhancing the traceability and transparency of supply chains for sustainability purposes.
- Most trader participants employ cutting-edge technologies (e.g. satellite imagery, multi-layer digital information or GPS locators), which are generally contracted as a service at the individual company level.
- Traders recognised the potential of digital technologies to overcome a series of existing barriers to enhance the sustainability of supply chains (e.g. the lack of data accuracy, verification and ownership, the inability of many farmers to collect and share data, the unpredictability of deforestation displacement, and the lack of full traceability).
- Traders envision their role as both users and contributors who share data (e.g. the origin and volumes of products, the contract conditions, associated certifications, a list of suppliers with evidence of compliance or otherwise grievance processes, and the percentage of traceable soybeans).
- Trade participants also mentioned a series of barriers for implementation:
    - Developers of digital solutions need a deep understanding of soy supply chains they might not have.
    - Digital systems of thousands of actors will have to be compatible.
    - Farmers lack access to the required technology and knowledge to provide standardized data.
    - Farmers are reluctant to collect and share data.
    - Farmers lack of incentives to collaborate.
    - The cost of implementation is high, particularly for low-value commodities such as soy.

Some of the main insights arising from the interviews with banks were:

- Most bank participants could think of positive aspects arising from the potential use of supply chain digital platforms:
    - Faster access to key information.
    - Faster and better-informed decisions.
    - Better reporting from their customers.
    - Enhanced traceability and transparency
    - A reduction of inefficiencies, human errors and bias.
- Banks see their role as that of a passive user rather than an active contributor as they stated being unable to share any data due to legal restrictions.
- Bank participants had little or no involvement in supply chain digital platforms, but those with local presence in Brazil were very familiar with existing digital services to access data on their customers' land use (TRASE, Agroideal, Global Forest Watch and the Brazilian Government) which they use and contract individually rather than as part of a broader supply chain platform.

While participants from both sectors shared their interest and awareness of the added value supply chain digital platforms could offer, none of them were involved in the design or development of an existing pilot. The good news is that as blockchain solutions for agriculture supply chain are still in development, sustainability professionals have the opportunity to influence their design by promoting the inclusion of sustainability parameters (e.g. indicators on biodiversity impact, on socio-economic impact, and on CO_2 emissions) that facilitate their monitoring and measurement.

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