Traceability in the Food Supply Chain in Brazil

Section 1: Summary

Use Case Summary			
Use Case ID:	IND-007	**Use Case Type:**	*Vertical*
Submission Date:	**March 29, 2019**	**Is Use Case supporting SDGs**	*Yes*
Use Case Title:	Traceability in the food supply chain in Brazil	**Domain:**	*Supply chain management*
Status of Case	*Pilot*	**Sub-Domain**	*Agriculture; Data processing, storage and management*
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Proposing Organization	*Fundação CPqD - Centro de Pesquisa e Desenvolvimento em Telecomunicações, simply called CPqD Foundation.* *Brazil.* *National registration number, C.N.P.J. in Brazil: 02.641.663/0001-10*		
Short Description	Pilot for beef traceability solution comprised of the integration of Safe Trace's food supply chain traceability system to a DLT in order to provide transparent, immutable and verifiable data to relevant stakeholders.		
Long description	This Pilot is the first step for providing provenance and quality information to all relevant stakeholders in the the food supply chain. The DLT-based system creates a digital identity for each asset being traced, which contains information that is needed for an end-to-end audit trail perpassing all stakeholders in the supply chain, from producers to retailers, that is both safe and reliable. For instance, if a disease in a given farm or region is detected, all by-products from those animals that may be contaminated can be traced back more efficiently and with lower costs due to recalls. The integration of DLT to Safe Trace's system provides transparency, reliability and immutability of data to all relevant stakeholder in the beef supply chain. Other characteristics that are also important to consumers, such as social and environmental compliance of farms, animal wellbeing and quality assessments throughout the supply chain, can also be part of the solution. In this Pilot, CPqD created the DLT-based network and smart contracts (aka chaincodes), as well as the services layer, which includes the integration APIs for legacy systems, which are also part of the network.		

	The development framework is Hyperledger Fabric, maintained by The Linux Foundation.
SDG in Focus (when applicable)	*SDG 2: 2.4* *SDG 3: 3D* *SDG 8: 8.6 and 8.7* *SDG 12: 12.3, 12.6 and 12.A* *SDG 15: 15.1, 15.2, 15.5*

Value Transfer:	*Assets (cattle)*	**Number of Users:**	*14 meatpackers and 1 retailer*
Types of Users:	*Farmer, Meatpacker, Retailer, Consumer, Traceability System Provider*		
Stakeholders	*NGO, Government*		
Data:	*Regarding what data are expected to be stored in distributed ledger in terms of types, record structure, privacy, etc:* ● *Identity of individual animals and animal batches.* ● *Hashes of transactions data (e.g. vaccines, weight measurements, sensor data etc), operations between participants (ownership transfers) and transformations of raw materials (e.g. cuts, wrapping pieces).* ● *No data is stored in the DLT, only hashes, thus allowing for all participants to share registers on the ledger without exposing sensitive information.* *Regarding how the DLT solution would interact with external data and other systems:* ● *Daaps are integrated to a DLT solution developed on Hyperledger Fabric and integration APIs are used by legacy systems, such as the one provided by the Traceability System Provider.*		
Identification:	*This Pilot does not work with pseudonyms. Full identification of relevant stakeholders participating in the network are required by the Traceability System Provider.*		
Predicted Outcomes:	The predicted outcomes of adopting new processes based on this system are: ● increased trust in a trustless supply chain that has players with conflicting interests. ● increased transparency of relevant food quality information; ● increased transparency of social compliance information (i.e. slavery conditions); ● increased transparency of environmental compliance information (i.e. deforestation and forest burning); ● reduce audit and compliance costs; ● decrease food recall direct and indirect costs; ● better risk management; ● produce data that may be relevant for aggregate analysis of the supply chain condition.		

Overview of the Business Problem or Opportunity

Since 2009, the Brazilian Federal Public Ministry has imposed a conduct adjustment term (TAC) to the meatpackers, where they commit to only buy cattle from farmers that are not related to illegal deforestation, by checking their suppliers with geomonitoring tools and crossing that information with the product invoice information and the animal transport authorization (GTA).

Despite Brazil having plenty of monitoring tools to avoid socio-environmental and sanitary risks, and the commitment of Amazon biome industries and national retailers to buy only deforestation free beef, Brazil fails to obtain greater value added to bovine meat by ineffectiveness of public policies to guarantee the sanitary and socio-environmental control of the production chain, resulting in production still largely associated with deforestation.

The business problem is to keep traceability records for beef supply chain, from the birth farms to the consumer, relating to this sanitary events, quality informations, and socio-environmental analysis related to illegal deforestation and forced labor.

Those informations are collected from multiple databases from public and private sector, validated and converted in KPIs and scorecards provided to the demand side, bringing enhanced risk analysis and transparency.

Why Distributed Ledger Technology?

DTL improves current solutions by assuring provenance and quality information in a transparent way to all relevant stakeholders of the food supply chain, and in this Pilot the focus is cattle. The DLT solution created a digital ID for each asset that will be traced. It is with this ID that information regarding the animal, as well as production lots formations, movements, sanitary data, quality and transformations, are exchanged between different actors in the food chain - from production phase in farms and processing industry, to meat available to retailers, This creates an audit trail, safe and secure, of animal provenance.

*The main DLT features required for this solution are **transparency** and **immutability** of data, which, along with, **verifiability**, allow for all players to develop a safer food supply chain.*

Section 2: Current process

Current Solutions
Current solutions are dependent on siloed information from farmers, industries and retailers, having limitations to crosscheck information without an audit process.
In such solutions, farmers and meatpackers are responsible for inserting their own information in the traceability system, bringing only partial information to the beef supply chain.
Based on the information entered, the traceability system asks suppliers of geomonitoring solutions for evidence that the properties indicated by the meatpacker do not have reports of slave labor or illegal deforestation and then records this result, used in the performance indicators used by retailers.

Existing Flow (as-is)		
Step	**User Actions**	**System Actions**
1.	Farmer	In general does not inform any data. Only registers an Invoice (Nota Fiscal) and a GTA into the government database. In specific market chain programmes, may input specific sales information into the system, such as lot number or animal ID.
2.	Meatpacker	Register animal acquisition, socio-environmental checks and sales to retailers.
3.	Retailer	Verifies that data input was made by the meatpacker.
4.	Consumer	For specific meat lines that represent less than 1% of the market (e.g. premium cuts), may have access to the list for provenance farms that supplied the meatpacker in a given production date. In other cases, consumer have no access to information.
5.	Traceability System Provider	Gather information on animals acquired by meatpacker, socio-environmental checkings, production lots and its sales to retailers.

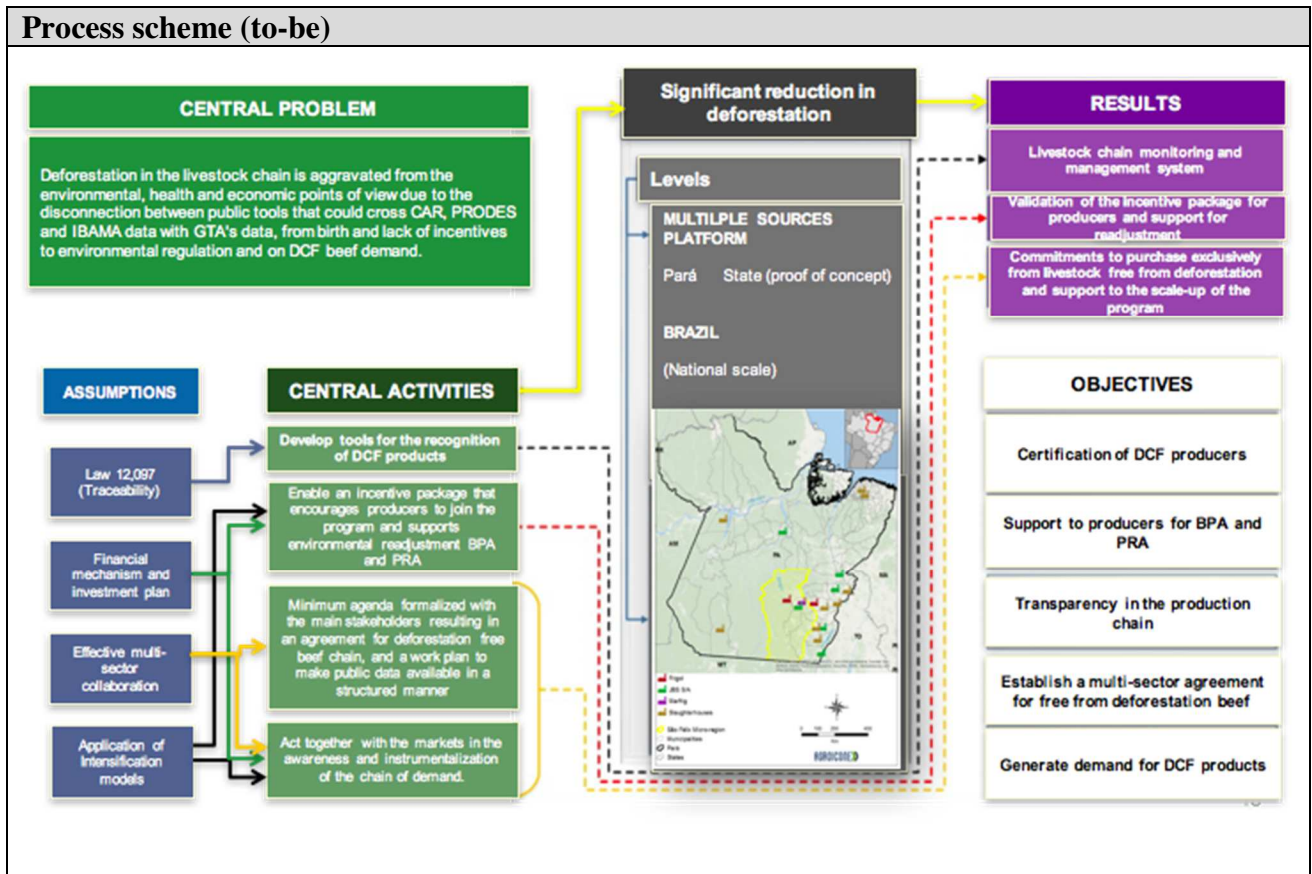| Process scheme (as-is) |
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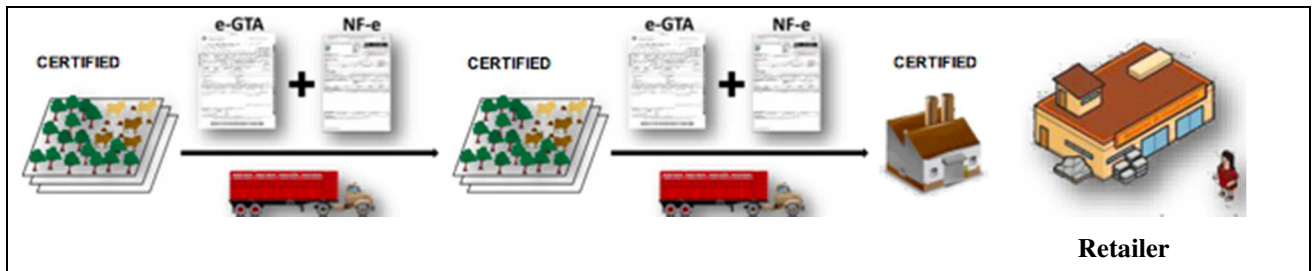| Data and information (as-is)		
Data	**Type**	**Description**
1	*Documents and supply chain data*	GTA, Invoices (buyer, seller), geomonitoring data, logistics data (boxes and pallets identifiers etc).

Participants and their roles (as-is)		
Actor	**Type/Role**	**Description**
1	*Farmer*	Generates invoices (Nota Fiscal) and GTA when a sale is made to the metapacker.
2	*Meatpacker*	Buys animals, verifies socio-environmental info, provides production traceability data.
3	*Retailer*	Put pressure on meatpackers to make them compliant to legislation and agreements with the Public Ministry.
4	*Consumer*	Transparency.
5	*Traceability System Provider*	Gathers information and generates evidences for auditing.
6	*NGO*	Supervises and demand transparency.
7	*Government*	Controls the generation of GTA and invoices (Notas Fiscais).

Other Notes
N/A

Section 3: Expected process

Expected Flow (to-be)		
Step	**User Actions**	**System Actions**
1.	Farmer	Manages its ID, inputs information on good production practices and monitors data on its risk level, calculated from sanitary and social-environmental information. Applicable to all production chain (farmer that sells animals to another farmer) and not only the farm that sells directly to the meatpacker.
2.	Meatpacker	Inserts the data of the purchase and the social-environmental analysis of the farm, which are validated in the blockchain in order to protect the identity of the producer.
3.	Retailer	Tracks KPIs about the level of risk in its supply chain and works to minimize these risks.
4.	Consumer	Access key data on traceability via QRcode.
5.	Traceability System Provider	Acts on the interfaces with users and systems, standardizing the data so that they are registered in the ledger.

Process scheme (to-be)

Participants and their roles		
Actor	**Type/Role**	**Description**
1	*Farmer*	Will provide more information and engage other producers that are not part of the sustainable food chain.
2	*Meatpacker*	Will provide more information and engage other meatpackers that are not part of the sustainable food chain.
3	*Retailer*	Will provide access to suppliers from other food chains.
4	*Consumer*	Will have access to transparent traceability from deforestation free suppliers.
5	*Traceability System Provider*	Will expand its clients number and ticket.
6	*NGO*	May become observer nodes.
7	*Government*	Government bodies may mandate stakeholder in the food chain to become part of this network. Government bodies may also participate in the network by providing information to all stakeholders, such as black list of slavery conditions, IBAMA, PRODES and CAR.

Data and information		
Data	**Type**	**Description**
1	*Documents and supply chain data*	GTA, Invoices (buyer, seller), geomonitoring data, logistics data (boxes and pallets identifiers etc).
2	*Government databases*	Relevant information from various government databases related to social-environmental aspects.

| Security and privacy |
|---|
| *1. Information is available only to participants in a given business transaction in the supply chain. i.e. other players that are not part of such transaction have no access. Only hashes of the data are in the ledger, allowing for any player that have access to that data may verify its authenticity.*

2. TLS, secure storage of PKI, OAuth2.

3. The Traceability System Provider should provide mechanisms for data integrity control and access control. |

4. DLT should be available 24/7/365.

Main Success Scenario + expected time line

DLT-based solution that registers events that occured in any given time, throughout each step of a food supply chain, in a reliable way.

Main success scenario comprises the ability of any participant organization to register signature data of an asset (i.e. the identifier of a cattle or a batch), in order to allow for traceability of information throughout the network, such as, but not limited to, transactions data (e.g. vaccines, weight measurements, sensor data etc), operations between participants (ownership transfers) and transformations of raw materials (e.g. cuts, wrapping pieces), and also the verification of the authenticity of registered data.

The architecture below is already implemented and running in a Pilot.
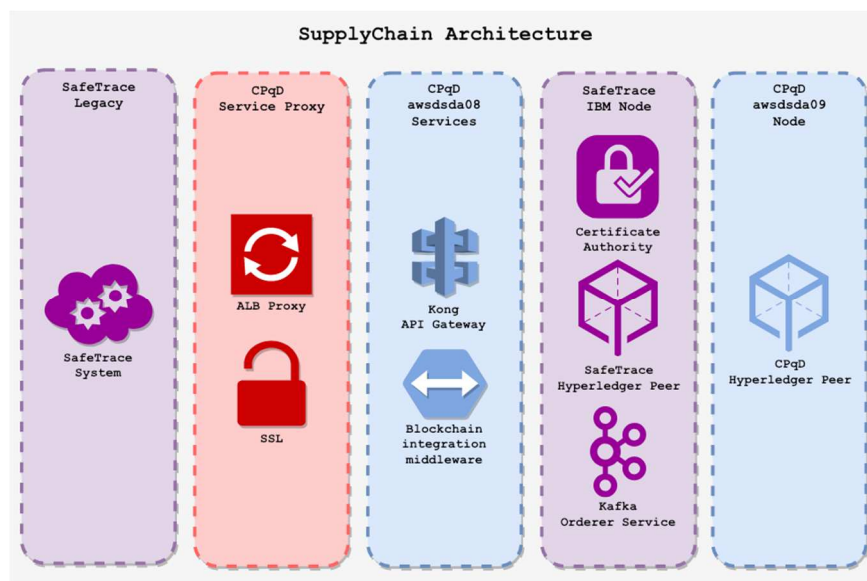
Current work is focused on performance, scalability and resilience with real data until May/2019.

Based on results, future work will be focused on further requirements brought by relevant stakeholders, specially retailers, in order to create a second version of the solution.

Conditions (pre- or post-)

1. The Traceability System Provider must have established a financial contract with relevant stakeholders.

2. Relevant stakeholders must be registered in the identity solution and enabled to read/write hashes of transactions data (e.g. vaccines, weight measurements, sensor data etc), operations between participants (ownership transfers) and transformations of raw materials (e.g. cuts, wrapping pieces).

3. No data is stored in the DLT, only hashes.

4. Other products in the food supply chain should be easily included in the solution, such as coffee, fish etc.

5. Chaincodes and integration APIs must be deployed.

6. All relevant parties are connected to DLT-network and be compliant with a governance framework.

Performance needs

Due to the high volume of data registered by the users, the solution may have to comply with 800 TPS or more.

Interoperability needs are related to native multi-cloud support, in order to allow for the infrastructure diversity used by organizations, such as on premises data-center or clouds services.

Reliability and availability should be met using a fault tolerant microservices architecture, such as downtime in any organization that are not part of a given transaction being processed.

Legal considerations

1. The legal basis for using the DLT-based solution as an official version of facts in case of a legal dispute.

Risks

1. Legal risks, including regulation of legal basis of data validated in a DLT-based solution;

2. Security risks;

3. Relevant stakeholder do not accept to be part of the network;

4. Difficulty in having stakeholder develop and comply with governance framework;

5. Immaturity of DLT.

Special Requirements

N/A

External References and Miscellaneous

Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.

Rules for the protection of personal data inside and outside the EU.

Other Notes

N/A