



## Brussels Policy Briefing n. 55

### Opportunities of blockchain for agriculture

Organisers: CTA, ACP Secretariat, European Commission/DG DEVCO, Concord, BMZ

**Wednesday 15<sup>th</sup> May 2019, 9h00-13h00**

**ACP Secretariat, 451 Avenue Georges-Henri, 1200 Brussels, Room C**

<http://brusselsbriefings.net>

#### BACKGROUND NOTE

##### 1. Context: Blockchain as an emerging digital technology

Business transactions in agriculture have been transformed by the digitisation of the value chain. The first big impact came with barcodes, which made it possible to track items through a value chain. Mobile data collection devices, more affordable sensors to track conditions, followed by the internet to transform links with consumers brought new applications. Mobile phones now take over many of these roles. Barcodes have been replaced with RFID and QR codes. However, there are still many challenges relating to the traceability of products and transparency in supply chain management, especially the fact that database systems managing transaction records were managed in isolation, not open to all the other stakeholders in the chain, making transactions difficult to secure. Blockchain is an emerging digital technology which intends to address these gaps.<sup>1</sup>

*A blockchain is a digital transaction ledger, maintained by a network of multiple computing machines that are not relying on a trusted third party. Individual transaction data files (blocks) are managed through specific software platforms that allow the data to be transmitted, processed, stored, and represented in human readable form. Every transaction is disseminated through the network of machines running the blockchain protocol and needs to be validated by all computer nodes. The key feature of a blockchain is its ability to keep a consistent view and agreement among the participants (i.e. consensus).<sup>2</sup>*

The company Goldman Sachs estimates that blockchain could facilitate global savings of up to US\$6 billion per year in business transactions.<sup>3</sup>

Known primarily for its connection to bitcoin and other cryptocurrencies and digital payments, blockchain has far more potential, especially for agriculture.

##### 2. Blockchain technology in support of agriculture

Blockchain technology offers many benefits, as it can provide a secure, distributed way to perform transactions among different untrusted parties. This is a key element in agriculture and food supply chains, where numerous actors are involved from the raw production to the supermarket shelf. The potential transparency provided by blockchains could facilitate the

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<sup>1</sup> In the way business transactions are performed today, there's a massive number of disconnected ledgers that exist across different industries, companies, and even within one company. Every company likely has at least one enterprise resource planning (ERP) system. And that ERP system is either unconnected or only partially connected to the ERPs of their customers or trading partners—for example, through Electronic Data Interchange (EDI). As a result, there's a lack of transparency as well as delays in processing transactions, and a significant amount of time is spent on reconciliation and validation activities. Blockchain could enable a common environment.

Andreas Kamilaris, Francesc Xavier Prenafeta-Boldú and Agusti Fonts work at the Institute of Agrifood Research and Technology (IRTA) in Barcelona, Spain. ICT Update. September 2018. <http://ictupdate.cta.int/2018/09/04/the-rise-of-blockchain-technology-in-agriculture/>

<sup>2</sup> Francesc Xavier Prenafeta Boldú IRTA Institute of Agrifood Research and Technology. The Rise of the Blockchain Technology in Agriculture and Food Supply Chain. September 2018

<sup>3</sup> ICT Update. [Exploring the future](#). 2018.

development of trading systems that are based on reputation, improving the behaviour of participating parties and increasing their reliability, responsibility.

It can increase overall transparency and facilitate real time on the field payments<sup>4</sup>, handling and storing administrative records, perform digital authentication and signature systems and smart contracts. It can track the movement of inventory from one warehouse to another; change in ownership in a title or property deed, intellectual property rights and patent systems.<sup>5</sup>

Blockchain application can improve logistics<sup>6</sup> and distribution of locally produced goods, strengthen traceability and certification providing information from farm to table to the consumer who can track products as they pass through a supply chain from the manufacturer and distributor, to the final buyer.<sup>7</sup> Whether it is applied to managing warehouses, silos, and supply chains more intelligently, or utilized in the field as a tool to transmit real-time data about crops and livestock, there are few aspects of an agricultural operation that wouldn't benefit in one form or another from blockchain technology.

## 2.1. Some applications of blockchain in agriculture

### a. Blockchain for Food Traceability

While the investments in improving the sustainability of the food industry has been increasing, one of the challenges remains the traceability, accountability and transparency of supply chains. The blockchain technology can address this by connecting digitally the dots. It can help food companies mitigate food fraud by quickly identifying and linking outbreaks back to their specific source. Improved data traceability provided by an IBM platform reduced the time it took to trace a mango from the store back to its source from seven days to 2.2 seconds (Walmart).<sup>8</sup> Consumers can know where their food comes from, how it was produced and by who. Product provenance is particularly important, and it can increase consumers' trust and loyalty.

There are numerous examples of companies, start-ups and initiatives aiming to improve food supply chain integrity through the blockchain technology.<sup>9</sup>

**Walmart and Kroger** were the first companies to embrace blockchain and include the technology into their supply chains, working initially on Chinese pork and Mexican mangoes. The highest profile food traceability initiative is the **IBM Food Trust** which has grown into a global consortium with companies such as Dole, Driscoll's, Kroger, Nestle, Tyson, and Unilever. Transaction processing and storing blockchain data to trace products can be expensive. **OriginTrail** in Slovenia found a way to store only "fingerprints" of data on the blockchain, which reduces the cost to only cents per item. The team also understands that systems do not operate alone, and has created the **Trace Alliance**, a consortium of companies who are using blockchain for supply chain traceability (Deloitte, **HalalTrail**, Oregon Tilth, Phy2Trace).

**Cargill** traces their turkeys from the shop to the farm. The program allows consumers to visit the Honeysuckle White [website](#), enter a package code so they can trace their turkey back to a specific farm, view photos from the farm, and learn more about the farm's history. The program allows the consumer to receive a text with this information, as well.

**Coca-Cola** is creating secure registries for workers that can help prevent labour rights violations and forced labour.

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<sup>4</sup> Francesc Xavier Prenafeta Boldú, Agusti Fonts. [The Rise of the Blockchain Technology in Agriculture and Food Supply Chain](#). Institute of Agrifood Research and Technology (IRTA).2018.

<sup>5</sup>Atalia Maslova. [Blockchain: Disruption and Opportunity](#). Strategic Finance. 2018. AND Felipe C. Lago & Souhayel Tayeb. *Blockchain Technology: Between High Hopes & Challenging Implications*. 2018

<sup>6</sup> Chris Addison and Ken Lohento. CTA. ICT Update issue 88. [Unlocking the potential of Blockchain for Agriculture](#). September 2018.

<sup>7</sup> Francesc Xavier Prenafeta Boldú, Agusti Fonts. [The Rise of the Blockchain Technology in Agriculture and Food Supply Chain](#). Institute of Agrifood Research and Technology (IRTA).2018. Hau L. Lee, Haim Mendelson, Sonali Rammohan, Akhil Srivastava. *Value Chain Innovation Initiative*. 2017.

<sup>8</sup> ALLICIA NOEL. [Six Ways Blockchain is Being Used in Food and Agriculture Supply Chains](#). 2018.

<sup>9</sup> Alicia Noel. [Six Ways Blockchain is Being Used in Food and Agriculture Supply Chains](#). 2018.

**Carrefour** is using blockchain in its Quality Line (Auvergne chicken, Cauralina cored tomatoes, Loué farmhouse eggs, PDO Rocamadour cheese, Gillot milk, Norwegian salmon and Noël fattened chicken). Carrefour aims to have applied this technology to 100 Quality Line food products by 2022. In the chicken example, a consumer can see how each animal was reared, the farmer's name, what they fed the chicken, treatments used (for example, antibiotic-free), any quality labels and the slaughter location.

**Downstream beer**<sup>10</sup> in Ireland is the first to use blockchain technology, revealing everything one wants to know about beer, i.e. its ingredients and brewing methods. Consumers can use their smart phones to scan the QR code on the front of the bottle and they are then taken to a website where they can find relevant information, from bottling to the raw ingredients. Chinese online insurance company ZhongAn has developed a new GPS tracker for poultry called **GoGo Chicken**. The device fits around the animal's leg while sensors monitor information like the chicken's environment, what it eats, and how much exercise it gets. The aim of the company is to build trust by documenting the origins of the food.<sup>11</sup>

In January 2018, the **World Wildlife Foundation** (WWF) announced the Blockchain Supply Chain Traceability Project, to eliminate illegal tuna fishing, tracking fish from vessel to the supermarket, in the fresh and frozen tuna sectors of the Western and Central Pacific region to strengthen supply chain management.<sup>12</sup> A simple scan of tuna packaging using a smartphone app will tell the story of a tuna fish – where and when the fish was caught, by which vessel and fishing method. Consumers will have certainty that they're buying legally-caught, sustainable tuna with no slave labour or oppressive conditions involved. WWF-New Zealand, WWF-Australia, and WWF-Fiji have teamed up with global blockchain venture studio [ConsenSys](#), information and communications technology (ICT) implementer [TraSeable](#), and tuna fishing and processing company Sea Quest Fiji Ltd. to deliver the project in Fiji.

Belfast-based [arc-net](#) has incorporated DNA information into their blockchain platform. They begin by taking a tissue sample of an animal early in the supply chain and uploading part of the genetic code with other information being stored. When importers and others further along the supply chain receive the meat they can then test a sample and confirm that the DNA matches that which they were expecting.

[Provenance](#), a London-based blockchain company with an overt social and environmental impact focus, provides transparency for both food and clothing companies, allowing customers where the products comes from but also confirm that the people who helped make the product were fairly compensated and that it was made in a manner that is environmentally responsible. [BeefLedger](#), an Australian beef traceability initiative focused on exports to the Chinese market; the [Chai Vault](#), a UK-based wine initiative focused on verifying the provenance and authenticity of wines; [OwlTing](#) enables consumers concerned about food safety to buy directly from farmers; [TE-FOOD](#), focused on providing farm-to-table traceability in emerging markets; and US company [Zest Labs](#), uses sensors to collect data that enables companies to reduce food waste.

In the Caribbean, developed as an open-source project, **BreadTrail**<sup>13</sup> comprises a mobile app compatible with Android and iOS, and a backend system that uses the blockchain to provide immutable and transparent farm-to-fork traceability for everyone in the supply chain from farmer to consumer, especially bananas.

**Choco4Peace**<sup>14</sup> is using hyperledger blockchain technology to support smallholders in the cocoa sector in Colombia through a combination of decentralised phone applications supporting an inclusive economic network, which aggregates smaller-scale cocoa producers with chocolate makers, socially oriented investors and sustainable development service providers.

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<sup>10</sup> <https://www.down-stream.io/>

<sup>11</sup> Financial Times. 2018. <https://www.ft.com/content/03930bf2-2cb9-11e8-9b4b-bc4b9f08f381>

<sup>12</sup> WWF. [https://www.wwf.org.nz/what\\_we\\_do/marine/blockchain\\_tuna\\_project/](https://www.wwf.org.nz/what_we_do/marine/blockchain_tuna_project/)

<sup>13</sup> [ICT Update](#). Darien Jardine, Nirvan Sharma and Reshawn Ramjattan. September 2018.

<sup>14</sup> [ICT Update](#). Eva Oakes. Choco4Peace. September 2018.

**Farmshine** is attempting to rebuild the value chain infrastructure in East Africa connecting actors in the value chain on a fully transparent blockchain platform, providing them with a digital identity and fully traceable record of transactions.<sup>15</sup>

The collaboration between **FairChain** and **KrypC** makes Moyee Coffee from Ethiopia the first European coffee company to benefit from blockchain.

### **b. Blockchain in support of Land Governance**

In many countries, land ownership is an issue and land titling is a challenging process. Physical assets registered on the Distributed Ledger Technology (DLT), such as land titles, can be used as collateral. DLTs are a secure, fast, and immutable method to register land titles, providing greater legal clarity to land tenure systems, avoiding corruption and fraud, and unlock capital. Switzerland-based cybersecurity company **WISeKey** partner with Microsoft to help the Rwandan government develop blockchain-based initiatives. The first phase of the initiative includes digitizing Rwanda's Land Registry to aid authenticity – proving ownership of land and property in developing countries is a well-documented problem<sup>16</sup>.

IBM is working with **Ghana's** government to develop blockchain capabilities for land administration.<sup>17</sup>

In **Georgia**, GIZ has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ), to work with the Georgian Government to reform the legal system. Blockchain is playing an important role as a means for the national public registry to make land register entries available digitally. Integrating the entries into the data record chain verifies their authenticity. Around one million processes have already been registered.<sup>18</sup>

### **c. Blockchain and Financial Services**

The complexity of trade finance with many manual checkpoints, multiple disintegrated platforms, regulation leads to both payment and shipment delays and higher costs.

The banking industry have started to test the blockchain technology a few years ago with cryptocurrencies and other assets represented in a form of tokens that can be exchanged on blockchain directly without involvement of a third party that would normally charge for services.

Today we see major banks developing decentralized ledger technology (DLT) strategies and building a pipeline of blockchain projects. Blockchain secures and speeds up transactions, and is already affecting the way banks, credit card companies and investment funds operate.

Several banks joined the we.trade<sup>19</sup> project, a trade finance platform empowered by blockchain. Consortia are also being formed to develop standardized solutions suitable for multiple industry players. The more participants there are on a decentralized network, the more benefits can be harnessed from blockchain.

The use of smart contracts for processing insurance claims can improve turnaround time, reduce costs, and provide seamless claim processing experience.<sup>20</sup>

There are many other applications in trade finance and supply chain management that are in the process of testing their proof of concept, with the intention to pilot and scale thereafter. One example is a group of Dutch and French banks (ING, ABN Amro and Société Générale), partnered with Louis Dreyfus Co. (one of the biggest agri-food traders), to ship a cargo of soybeans from the US to China using a DLT. It is said to be one of the first fully fledged agricultural commodity transactions using the technology, which reduced the time spent on document and data processing to a fifth through digitising documents for the deal (including sales contracts, letter of credit, government inspections and certifications).<sup>21</sup>

<sup>15</sup> [ICT Update](#). Chris Mimm. Farmshine. September 2018.

<sup>16</sup> <https://trendwatching.com/trends/top-5-african-blockchain-applications/>

<sup>17</sup> Melanie Kramer. [Ethnews.com](#). July 2018.

<sup>18</sup> GIZ. [Blockchain technology simplifies land registration in the South Caucasus](#). 2018.

<sup>19</sup> e.trade, an innovative digital platform, where businesses and banks across Europe collaborate to create a transparent, secure environment where opportunities and growth come together. <https://we-trade.com/>

<sup>20</sup> Atalia Maslova. [Blockchain: Disruption and Opportunity](#). July 2018.

<sup>21</sup> Tripoli, M. & Schmidhuber, J. 2018. [Emerging Opportunities for the Application of Blockchain in the Agri-food Industry](#). FAO and ICTSD: Rome and Geneva

Another initiative, including a group of international banks (Barclays, Standard Chartered and BNP Paribas), large corporations (Unilever, Sainsbury's and Sappi) and fintech start-ups, has launched a project to use DLTs to track physical supply chains and unlock access to financing for sustainable sourcing.<sup>22</sup> The first pilot plans to test the technology to track tea and tea packaging materials from farmers in Malawi to the corporations. This pilot is one of the first initiatives to combine supply chain tracking with trade financing.

America's largest financial services companies have already made sure they'll get their piece of the blockchain intellectual property pie: Bank of America, Mastercard and Fidelity aggressively patented blockchain in 2017.<sup>23</sup>

#### **d. Transport - reducing barriers within the international supply chain**

Trade relies largely in the shipping industry where size continues to grow in complexity and cost. More than \$4 trillion in goods are shipped each year, and more than 80 percent of the goods consumers use daily, are carried by the ocean shipping industry. The maximum cost of the required trade documentation to process and administer many of these goods is estimated to reach one-fifth of the actual physical transportation costs. According to The World Economic Forum, by reducing supply chain barriers within the international supply chain, global trade could increase by nearly 15 percent, boosting economies and creating jobs<sup>24</sup>.

Blockchain offers opportunities to address such constraints. Maersk, one of the largest shipping companies in the world, partnered with IBM applying blockchain to improve trade and digitise supply chains<sup>25</sup>. The aim of the new company TradeLens<sup>26</sup> is to offer a jointly developed global trade digitization platform built on open standards and designed for use by the entire global shipping ecosystem which can simultaneously access information about a shipment. It will address the need to provide more transparency and simplicity in the movement of goods across borders and trading zones. By Maersk's own estimates, blockchain will reduce shipping costs by one fifth, and boost international trade by 15%.<sup>27</sup>

The attributes of blockchain technology are ideally suited to large networks of disparate partners. A distributed ledger technology, blockchain establishes a shared, immutable record of all the transactions that take place within a network and then enables permissioned parties access to trusted data in real time. By applying the technology to digitize global trade processes, a new form of command and consent can be introduced into the flow of information, empowering multiple trading partners to collaborate and establishing a single shared view of a transaction without compromising details, privacy or confidentiality.

#### **e. Public sector**

Governments can improve efficiency in such areas as contract execution, social services, customer service and experience, risk management, transparency, and fraud. Blockchain enables a wide variety of transactions, including collecting taxes, delivering welfare benefits, issuing documents, and recording properties.

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<sup>22</sup> Wass, S. 2017. "[Banks to Pilot New Concept for Blockchain-based Supply Chain Finance](#)." Global Trade Review.

<sup>23</sup> <https://blocklr.com/blockchain/industries-blockchain-change-forever/>

<sup>24</sup> World Economic Forum. Enabling Trade Valuing Growth Opportunities. In collaboration with Bain & Company and the World Bank. 2013. <https://tinyurl.com/yxmtfs8b>

<sup>25</sup> Maersk and IBM form joint venture applying blockchain to improve global trade and digitize supply chains. 2018. <https://tinyurl.com/y25ynt8d>

<sup>26</sup> IBM and Maersk began a collaboration in June 2016 to build new blockchain- and cloud-based technologies. Since then, multiple parties have piloted the platform including DuPont, Dow Chemical, Tetra Pak, Port Houston, Rotterdam Port Community System Portbase, the Customs Administration of the Netherlands, U.S. Customs and Border Protection.

The joint venture will now enable IBM and Maersk to commercialize and scale their solutions to a broader group of global corporations, many of whom have already expressed interest in the capabilities and are exploring ways to use the new platform, including: General Motors and Procter and Gamble to streamline the complex supply chains they operate; and freight forwarder and logistic company, Agility Logistics, to provide improved customer services including customs clearance brokerage.

<sup>27</sup> IBM- <https://www.ibm.com/think/fintech/maersk-and-ibm-form-joint-venture-applying-blockchain-to-improve-global-trade-and-digitize-supply-chains/>

In April 2018, 22 European countries signed a declaration on the establishment of a European Blockchain Partnership. The [EU Blockchain Observatory and Forum](#) launched by the European Commission aims at sharing knowledge that can help accelerate blockchain innovation, explore blockchain uses by EU governments, raise awareness, and provide training.

### **3. Going forward**

While blockchain solutions in production are still relatively limited globally, it's clear that there's greater interest in—and a better understanding of—blockchain and its benefits. Multiple proofs of concepts are completed already or are in progress, and some solutions are already in or close to production release. Companies and other organizations are putting more effort into development of the technology every day, and governments have started to take adoption seriously. In addition to the progressive adoption of blockchain by enterprises, efforts to standardize blockchain platforms are happening.

However, there are still some challenges and limitations to a wide adoption of blockchain: (i) a lack of common understanding among policy makers, technical experts and value chain actors on the use of blockchain technology; (ii) insufficient investment in research and innovation, as well as in education and training by the government; (iii) mass adoption requires interoperability and a certain level of standardization; (iv) blockchain platform has to partially or fully replace existing legacy systems which requires time and resources; (v) regulatory and legal frameworks are needed to guide the use of blockchain technology in food supply chains (i.e. avoiding effects of speculation and significant price fluctuations) and possible security risks, even if blockchain offers advanced security (ensuring trusted data is entered in the system).

With 444 million unique mobile subscribers in sub-Saharan Africa, according to the [GSMA 2017 report](#), the possibility that farmers could harness blockchain technology does not seem too far off. However, for farmers' transactions to be uploaded to the ledger, they still need access to the internet and only 38% of mobile users in sub-Saharan Africa were connected to mobile broadband in 2017. Despite current limitations in terms of digital infrastructure, progress is heading in the right direction and by 2025 the GSMA expects 87% of mobile users in the region to be connected to mobile internet. There is evidently still a long way to go in terms of building the human and infrastructural capacities to harness the full potential of blockchain technology in the food system, but the industry has already begun to embrace the possibilities and invest in developing agricultural solutions using the technology.<sup>28</sup>

#### **Objectives of the Briefing**

To improve information sharing and promote networking, CTA, the European Commission (DG Devco), the ACP Secretariat and Concord organise since 2007 bimonthly briefings on key issues and challenges for agriculture and rural development in the context of EU/ACP cooperation. BMZ joins us to organise this Briefing bringing different views and experiences on the potential and applications of blockchain technology for agriculture.

#### **Target group**

More than 140 ACP-EU policy-makers and representatives of EU Member States, embassies of ACP countries, civil society groups, research networks and development practitioners, and international organisations based in Brussels.

#### **Available material**

Input and comments before, during and after the meetings will be included in the Briefings blog: <http://brusselsbriefings.net/>. A short report and a Reader in printed and electronic format will be available after the meeting.

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<sup>28</sup> Mamo Panel. Can Africa's agribusiness sector unlock blockchain's full potential? January 2019



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#### PROGRAMME

8h15-9h00 Registration

9h00-9h15 Opening of the Briefing: *Isolina Boto, Manager, CTA Brussels Office*

**Introductory remarks:** *Patrick Gomes, Secretary-General, ACP Secretariat; Wim Olthof, Deputy Head of Unit, Rural Development, Food Security, Nutrition, Europeaid, European Commission; Andreas Pletziger, Senior Policy Officer, BMZ; Michael Hailu, Director, CTA*

#### **9h15-11h00 Panel 1: Blockchain technology in support of the agrifood sector**

This panel will provide an overview of the opportunities and challenges in adopting the blockchain technology in agriculture and the agrifood industry across several sectors.

Chair: *H.E. Prof. Kaire Mbuende, Chair of the ACP Committee of Ambassadors, Ambassador of Namibia to the EU*

##### Panellists:

- Opportunities and challenges for blockchain in the agri-food industry  
*Mischa Tripoli, Economist, Trade and Markets Division, FAO*
- Key areas of interest of blockchain applications for ACP countries  
*Chris Addison, Senior Expert, Data4Ag, CTA*
- Blockchain supporting food systems: private sector perspective  
*Louis de Bruin, Blockchain Thought Leader Europe, IBM Global Business Services*
- Blockchain legislation: the case of Uganda  
*Alice Namuli Blazevic, Expert Blockchain and AI, KATS, Uganda*
- Critical views on blockchain development: control and sovereignty  
*Pat Roy Mooney, Founder, ETC Group*

11h00-11h15 Coffee Break

#### **11h15-13h00 Panel 2: Best practices in blockchain technology adoption**

This panel will look at specific examples of successful applications of the blockchain technology of interest to the ACP countries.

Chair: *H.E. Mrs. Sheila Sealy Monteith, Ambassador of Jamaica to the EU*

##### Panellists:

- Potential and successes of Blockchain for the agribusiness industry  
*Anthi Tsilimeni-Archangelidi, Business Analyst, EMEA Business Applications, Cargill*
- Opportunities of blockchain for farmers in Africa  
*Theo De Jager, President, World Farmer's Organisation (WFO)*
- Increasing price transparency through blockchain in the coffee chain in Ethiopia  
*Sander Govers, Moyee Coffee "FairChain", Ethiopia*
- IBISA: Inclusive Blockchain Insurance using Space Assets  
*Annette Houtekamer, Expert in Inclusive Insurance, Ibisa*
- Blockchain applications in food safety  
*Árokszálási Erik, CEO, TE-FOOD International*

#### **Concluding remarks**

13h00 Networking Lunch