WORLD BANK GROUP Agriculture

COMMUNITY OF PRACTICE FOR ICT In Agriculture

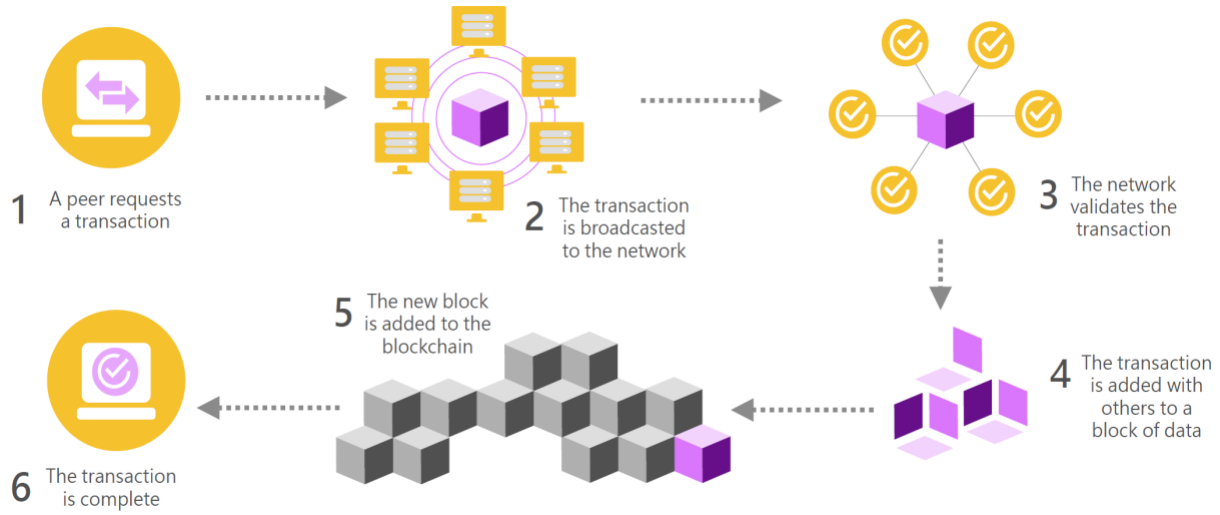
Technology Innovation Blockchain Lab

Tech4Ag Corner: Blockchain in Agriculture

What is Blockchain?

Blockchain is a secure, shared, distributed ledger technology that decentralizes any transactions process that transfers something valuable. In a blockchain network, if a participant, also known as a node or a peer, wants a transaction, it requests the transaction, which is broadcasted to all other nodes connected to the network. The transaction is validated by all other participants in the network, and once it is, the transaction is added as a "block" to the chain of transactions that is formed to date.

Figure 1. How does Blockchain Work (Source: PwC)



Blockchain is disrupting the way trust is formed and practiced, the indispensable element behind any form of transactions involving more than one party. Going back to the conventional definition, blockchain is considered disruptive because it essentially *decentralizes the authority of trust and distributes and shares the responsibility of trust to everyone in the network*. Because this trust is distributed, blockchain is believed to increase transparency and enhance security as transactions are made only by consensus among involved participants and cannot be tampered with. The improved trust, in turn, enables businesses, government, and society to reduce transaction costs and lessen the dependence on intermediaries along any transaction process. To sum up, blockchain has four main characteristics: transparent, consensus-driven, immutable, and trustless (trust is not necessarily a requirement)[1].

[1] World Bank Group Blockchain Lab

Blockchain in Agriculture

Blockchain can benefit the global food system by improving the process in which food is produced, delivered, and sold. In particular, blockchain is believed to have immense potential in three key areas of the agriculture industry: (1) provenance and transparency, (2) mobile payments, credits, and decreased transaction fees, and (3) supply chain transactions and financing[2].

For example, it can address the issues of food quality and safety as blockchain improves traceability and transparency within agriculture value chains. The improved traceability and the immutability of data can also help verify the accuracy of food production, certification, and food processing steps more easily and efficiently. Blockchain can also help reduce food loss and food waste costs since transactions can expedite and are less likely to be disputed in the process. Moreover, smart contracts—self-executing contracts run by a computer program that can be encoded to blockchain—enable involved parties transact without intermediaries, eventually lowering the final price of the product for the end-consumers. The ability to skip middle-men in agricultural value chains could be a potential to create and improve access to finance in the developing world[3].

Challenges

Despite the opportunities that blockchain could potentially introduce, it is still early in the stage to determine the viability and scalability of blockchain in agriculture and broader development sectors. The Center for Global Development (CGD) notes that privacy concerns for publicly shared data, operational and institutional resiliency, and governance as remaining hurdles to be addressed before applying blockchain to development challenges[4]. Also, as Agfunder points out, "connecting the technology to viable business models and compelling use cases" is the challenge for blockchain, and agtech at large. Last, but not least, blockchain adoption in agriculture would also require a significant level of technical understanding from farmers.

Going forward

There is much of a hype surrounding the potential of blockchain in the global development, including farming and agricultural sectors. The technology not just disrupts the business-as-usual but also requires a fundamental change in the way society works as well as the way we think. That said, it is worth continuing the discussion on blockchain's implications so we can harness the technology to solve the global food security challenges.

We would like to send special thanks to the colleagues at the WBG Blockchain Lab for their support in the process of preparing this note.

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[2] From Bitcoin to Agriculture: How Can Farmers Benefit from Blockchain? Aug 2016. AgFunder. https://agfundernews.com/from-bitcoin-to-agriculture-how-can-farmers-benefit-from-blockchain6380.html

[3] Ibid.

[4] Blockchain and Economic Development: Hype vs. Reality. July 2017. Center for Global Development. https://www.cgdev.org/sites/default/files/blockchain-and-economic-development-hype-vs-reality_0.pdf

Additional Resources:

Noteworthy Application Cases in Agriculture

- World Food Programme (WFP) is applying blockchain for cash transfer schemes to support Syrian refugees
- Ripe and Filament work to make secure transfer of crop and supply chain data
- Skuchain is leveraging its expertise in supply chain management to improve traceability of food supply chain by applying blockchain
- Provenance helps improve traceability of food and food origin across supply chain
- IBM introduced peer-to-peer network based weather application
- The Dutch Ministry of Economic Affairs, University of Wageningen, and TNO, introduced their proof of concept on blockchain application for the South African table grape supply chain: Watch demo video

Other resources:

- Try Satoshi Nakamoto's whitepaper on bitcoin if you want technical details
- News articles on blockchain and agriculture featured in this note:
    - Growing the Garden: How to Use Blockchain in Agriculture (Cointelegraph)
    - From Bitcoin to Agriculture: How Can Farmers Benefit from Blockchain? (Agfunder)
    - Blockchain: Beyond Bitcoin to Agriculture (Gro-Intelligence)
    - How Adoption Of Blockchain Technology Will Disrupt Agriculture: Understanding The Implications Of Blockchain Technology In Agriculture (Inc 42)
- Blockchain and Economic Development: Hype vs. Reality by Center for Global Development
- Check out Standford University's initiative to build the Master List of Blockchain Projects in International Development
- Listening to Podcast? Try Smart Kitchen Show's Blockchain for Food

Questions and Feedback

The ICT for Agriculture Community of Practice (ICT4Ag CoP) aims to promote and facilitate the effective use of ICTs and digital technologies in agriculture by functioning as a knowledge-sharing platform both within and outside the World Bank. Please contact David J. Nielson (dnielson@worldbank.org), Jeehye Kim (jkim15@worldbank.org) or Hyea Won Lee (hlee20@worldbank.org) for your questions and feedback.