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Empowering Farmers with Blockchain-based Transparency Throughout the Value Chain

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Majority of the Indian farmers growing diverse local crops and traditional cultivars are small small-landholding farmer. Lower yields and challenges to find a value chain are accentuated by the effects of climate change. Since 2003, a new provision has been made available to farmers to come together and form 'Farmer Producer Organization' and 'Farmer Producer Company', in which farmers themselves are shareholders and external entities aren't allowed to become investors. Currently, there are 7,000 such registered groups in India, and it's being hailed as a promising step towards farmer liberation. Many farmer collectives, especially Farmer Producer Companies, are eagerly adopting emerging technologies for their operations, scaling, value-chain integration, and marketing purposes. This paper will seek to explore a case study of India's largest farmer collective of fruits and vegetables regarding their usage of Blockchain technology in bringing transparency and efficiency across their integrated value chain.

Key Words: Blockchain, Farmer producer company, Farmer producer organisation, Traceability, AgroTrust

Introduction

Income earned by a small and marginal landholding farmer in India depends on multiple extraneous factors thereby making farming a financially perilous profession. Lack of infrastructure, less bargaining power, lack of storage facilities and marketing resources have been the prime challenges for the small landholding Indian farmer. Thus, economy of scale is becoming important for basic sustainability which can be enabled with collectivisation, more so for those intending to grow traditional specialty crops/cultivars. At the same time, modern consumers are also becoming health conscious and socially aware regarding farming practices and ensuring farmer equity.

But lack of transparency leads to food fraud which costs the global food industry an estimated $30-40 billion annually (PricewaterhouseCoopers 2016). Consumers want to know more about journey (harvest-to-shelf), freshness, authenticity, integrity and ingredients of the food they consume (Allied Market Research 2019). On the other hand, the small-landholding Indian farmer has always been operating in a domain where lack of transparency dictates nearly every facet of life, right from isolation from market trends till exploitation by middlemen. The initiative by Farmer Producer Companies to form integrated value chains to ensure that fair equity is ensured among the value chain partners is critical for betterment of the entire rural economy.

This paper will explore a case study of how Blockchain technology is being leveraged by one such Farmer Producer Company, Sahyadri Farmers Producer Company Limited, to bring transparency throughout the value chain from farmer till the consumer. The research questions to be answered in the paper are: (1) How can collectivization of farmers ensure better equity to the small landholding Indian farmer? (2) How can Blockchain technology be leveraged by farmer groups to bring transparency in the value chain?

Problems Faced by a Small-landholding Indian Farmer

Lack of accessibility to the benefits of mechanization, modern irrigation, and other investment-based technological improvements leading to suboptimal productivity. A perpetual debt cycle, post-harvest losses, exploitation by middlemen, increasing input costs, fluctuating supply resulting in price volatility, are some of

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the major problems faced by the Indian farmer. To help ease this situation, Government of India gives guidelines to buy 23 crops from farmers at a Minimum Support Price (MSP). But as per Shanta Kumar Committee Report 2015, only 5.8% of Indian farmers sell their produce to Government agencies at MSP (Food Corporation of India, Government of India (2015, January). However, benefits of MSP are not country-wide and is limited to some states and for limited crops (Tiwari 2020). In order to overcome these challenges, farmers are now coming together to form a collective, to aggregate their produce, invest in common infrastructure, minimize exposure to market fluctuations, reduce risks, and increase their bargaining power.

Farmer Producer Company/ Farmer Producer Organization (FPC/ FPO)

As explained by Ministry of Agriculture, Government of India, in the 'Policy and Process Guidelines for Farmer Producer Organizations', 'Collectivization of producers, especially small and marginal farmers, into producer organizations has emerged as one of the most effective pathways to address the many challenges of agriculture but most importantly, improved access to investments, technology and inputs and markets. Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India has identified farmer producer organization registered under the special provisions of the Companies Act, 1956 as the most appropriate institutional form around which to mobilize farmers and build their capacity to collectively leverage their production and marketing strength' Ministry of Agriculture, Government of India. (2013). A Farmer Producer Organization (FPO) or a Farmer Producer Company (FPC) enables every farmer to have equal voting rights regardless of their shareholding, thereby bringing democratization. Only farmers can become shareholders within an FPO or FPC, although an FPO or FPC can invest and hold equity in other organizations (Ministry of Corporate Affairs, Government of India, 2013). As per the latest information, there are more than 7000 registered Farmer Producer Companies in India, and the government is making policies and plans to boost their number.

Blockchain can Mitigate Challenges Faced by Farmer Collectives

Despite a growing number of farmer collectives being registered as Farmer Producer Companies, not all of them are able to achieve sustainability. Primary reasons are (i) Losses due to huge wastage (>40% post-harvest food loss) and (ii) Lack of transparency (inadequate professional management, risk of frauds). Traceability (ability to follow the movement of a feed or food through specified stages of production, processing and distribution) allows farmers to get maximum leverage of the value unlocked at the retail end. There are documented cases where the small landholding Indian farmers haven't even received any renumeration for selling their produce as the middlemen unduly charged them with transport and rent to subtract from the prices. On the other side, the consumer has no way to discern how much actually ends up reaching the farmer. In such a scenario, a radical outlook towards maximum transparency can help both the farmers and consumers and help strengthen the fragmented value chain.

Blockchain to Enable Traceability and Transparency

In order to establish trust throughout the value chain from the small landholding farmer till the end consumer, it becomes prudent to achieve this through a Blockchain-based platform, as described in Fig. 1. The very properties offered by Blockchain ensures both trust over the data being trustworthy, or at least acts as a deterrent for any future misleading data entry owing to its immutability. The critical decision over here, is rather, non-technical; which parts of the value chain is one being transparent about? We explore this in the case study of Sahyadri Farmers Producer Company Limited.

Sahyadri Farmers Producer Company Limited (Sahyadri Farms) and Sahyadri Farms Sustainable Grassroots Initiative (SFSGIL-RU brand) Case Study

Sahyadri Farms was registered as a Farmer Producer Company (FPC) in 2010 under the provision introduced in Companies Act, 1956, Government of India. It's a collective that is owned and managed by farmers. It is India's largest Farmer Producer Company and has highest share of grape exports from India compared to any other. Majority of the farmers within the collective are small landholding farmers. Sahyadri Farms partnered with Emertech Innovations Pvt Ltd to onboard the value-chain allied activities on a Blockchain platform named AgroTrust, as described in Fig. 2. The project for Fruits & Vegetables traceability began in April 2019, and lasted

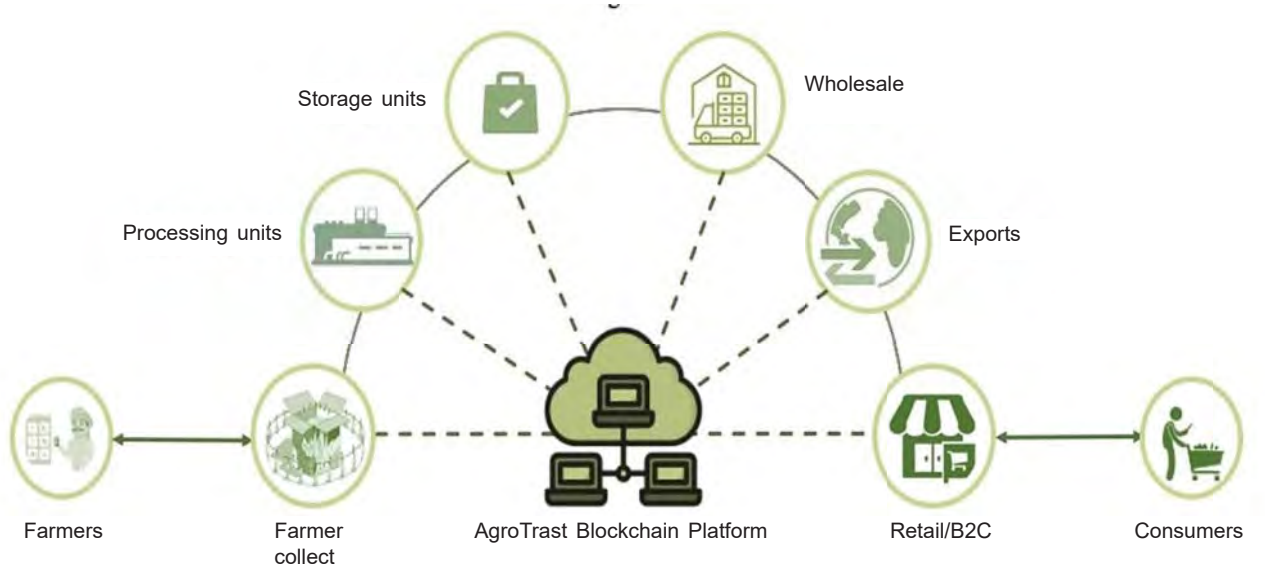

Fig. 1. Blockchain-based platform of a farmer collective

until June, 2022. A total of 5.2 million Blockchain-backed QR codes were printed during the project duration. The project for cotton-to-cloth initiative, under SFPCL's allied initiative of Sahyadri Farms Sustainable Grassroots Initiative Limited (SFSGIL) with the commercial brand name of 'RU', began its live operations in February, 2022 and is ongoing (at the time of submission of this paper), with over 35,000 Blockchain-backed QR codes bring printed on T-shirts.

Process Flow

For implementing this solution for fruits and vegetables for SFPCL, four attributes of every unit of produce needed to be transparently recorded at stock keeping unit (SKU) level across multiple operational locations: origin, pricing, provenance, quality & safety through certificates. Each location captured this information during operational processes and stored it onto the blockchain. Real life movement of produce necessitated a four-location design. The value chain began at cultivated plots called origins where the produce was harvested. Information about origins was recorded onto a blockchain verified registry of farmers and their fields. Harvested produce was purchased by Sahyadri Farms and transported to a production and packaging location that performed quality assessment. Critical information

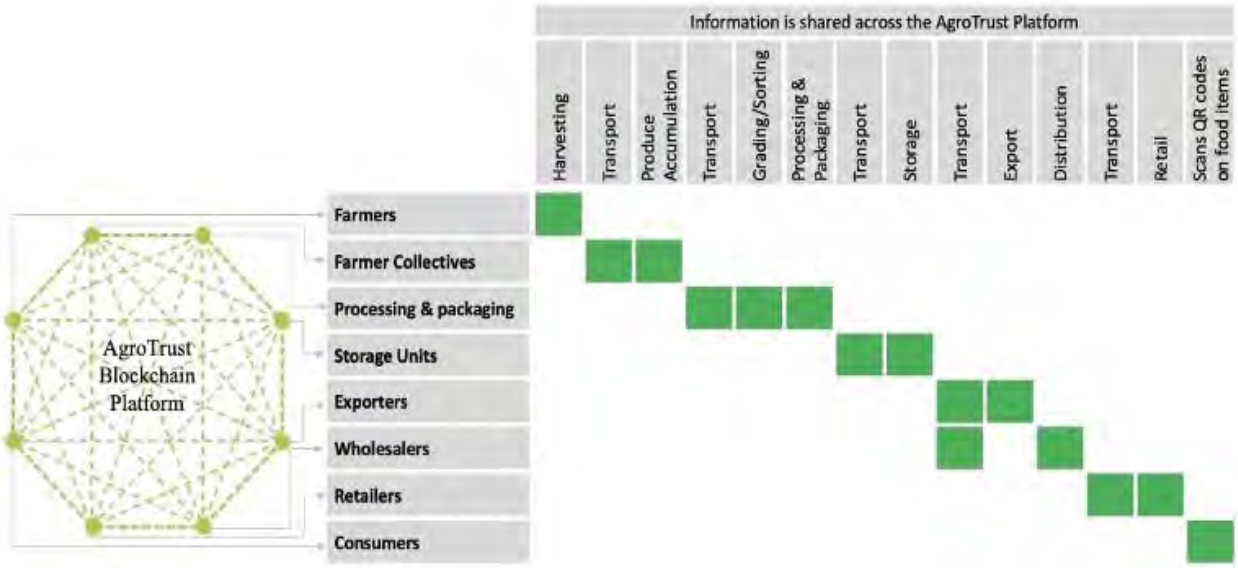

Fig. 2. Agro-Trust blockchain-based platform

about the price given to the farmers and transport timestamp was recorded onto the blockchain. Accepted produce quantities were then moved to assembly lines for production into freshly packaged SKUs (stock keeping unit). At this stage, information about the production costs and timestamp were calculated as per the weight of each SKU and recorded onto the blockchain. Finished SKUs were then dispatched to multiple distribution centers that serviced either physical retail stores or direct delivery to consumers in designated geographical zones. Transport timestamps and storage costs incurred by distribution centers and retail stores were calculated as per the weight of each SKU and recorded onto the blockchain. Due to the perishable nature of the products being tracked, it was extremely important that data was captured in real time or near real time, validated as per predefined business rules and committed to blockchain.

For the ongoing project (at the time of submission of this paper) with SFSGIL, there are integrations with 'Farm Setu', SAP, and solution by Vesatogo initiative which are used to bring attributes to traceability on T-shirts. The project seeks to incrementally add more information to the QR codes with subsequent integrations and development of new modules. AgroTrust blockchain transparency solution is a consortium blockchain network based on the principle of 'One Crop, One Blockchain'. It is implemented using the Multichain protocol which is a built by taking of Bitcoin client and enhanced for permissioned blockchains. Consensus mechanism used in this protocol is a randomized validation based on distributed agreement between permissioned block validators similar to PBFT. Multichain allows fine grained permissions control at address or node level and implements streams which are on-chain key-value data stores with timestamps and publisher identity. Streams are used to record and retrieve immutable data onto a blockchain.

Consumer Transparency Service and impact

Upon scanning the QR code of the item, customer can see - Know Your Farmer, Know Your Money, Know Your Journey and Know Your Food, along with Sahyadri Farms brand logo and 'Why Blockchain?' content for making consumers aware about the technology. A cropped sample of a real QR code scan of an SKU is provided in Fig. 3., in which one can see the amount received by the farmer with respect to how much the end consumer is paying for the final product. Owing to the nature of the data availability and data capture, the QR codes could show varying degrees of information. Transparency regarding how much money goes to the farmer defined per SKU is a first of its kind initiative in India. Consumer awareness and consciousness is now being channelized by offering them visibility of what happens in the journey of the food that they consume. The rising awareness, along with maintenance of food quality and safety standards, leads to more consumers for the farmer collective which in turn enables the collective to offer better prices to the farmers. As of 28th June, 2022, more than 5.2 million QR codes have been printed with a range of 5000 to 24,000 QR codes depending upon supply and consumer demand of fruits and vegetables. For SFSGIL-RU brand, over 35,000 T-shirts are equipped with a Blockchain-backed QR code. The successful implementation has been covered by the mainstream media for Blockchain-based traceability and transparency (Wadke 2020).

Action Points for On-farm Conservation of Genetic Resources

1. The campaign of bringing small landholding and marginal farmers under Farmer Producer Companies/ Farmer Producer Organizations is a promising step

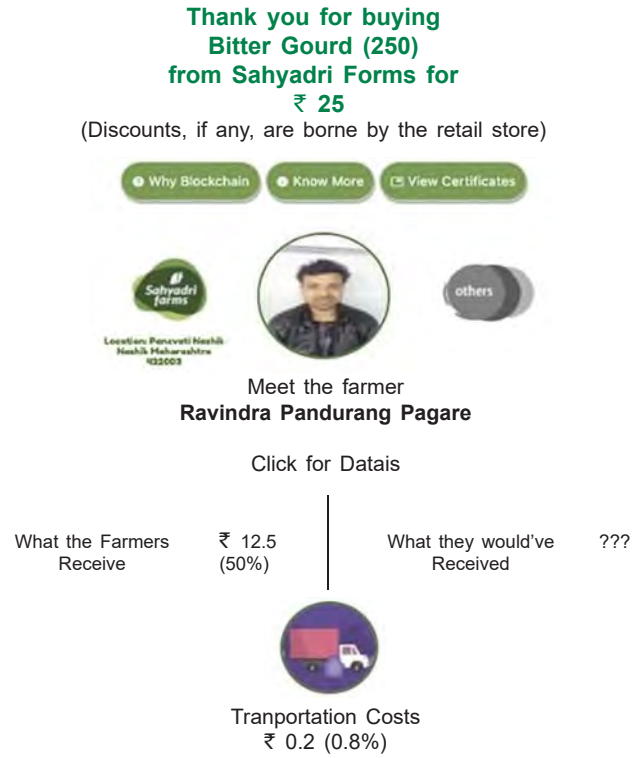

Fig. 3. Agro-Trust blockchain-based platform

towards ensuring a life of dignity and sustainability.

2. The adoption of technologies in agricultural practices is also proving to be a boon. Among these, the use of Blockchain in providing radical traceability and transparency throughout the value chain can help highlight the crucial aspects of the value chain.
3. It is the domain experts, who make Blockchain a relevant and saucerful solution. Therefore, pilot projects must be launched as a collaborative effort between farmer community-NGOs-genebank

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