**Series F – Foundations : Leveraging ICTs for Increased Competitiveness**

# Is Kenya ready to Leverage Blockchain Technology in Horticulture Traceability?

*Christopher A. Moturi and Amos K. Kosgei*

## Key Messages

*Formulate Blockchain Technology frameworks, standards and policies*
*Establish appropriate mechanisms for training and skill enhancement*
*Conduct an assessment of the existing infrastructure*
*Create and implement mechanisms to motivate innovation among the employees and users*

## Context

Blockchain technology (BCT) can offer traceability in the food supply chain thus guaranteeing food safety, efficient transactions and reduced food fraud. This study sought to investigate the existing traceability systems in Kenya's domestic horticultural supply chain to assess the level of stakeholders' readiness to leverage the huge prospects BCT offers. The quality and safety of food in the supply chain has been of greatest concern to producers, regulators, distributors and consumers (Aung & Chang, 2014). The need for adequate traceability systems in the agricultural sector is motivated by food falsification and adulteration which have led to huge economic losses, wide-spread loss of consumer trust, and have become a persistent problem to all stakeholders in the food supply chain.

The expansion of horticulture the sub-sector in Kenya has attracted the attention of international organizations and consumers as well as food safety standards and certifications in its supply chain management (Ouma, 2010). The World Economic Forum recommends that traceability in the supply chain builds on transformative technologies. The ISO 22005:2007 Standard on Traceability in the Feed and Food Chain defines traceability of food as the keeping track of food materials and other consumable substances information through the processes of production, distribution and final consumption. Traceability is considered a fundamental of modern food security and has therefore become critical in the food supply chain (Aung & Chang, 2014, Saberi et al., 2019). The 2019 Kenya Government task force on Blockchain and Emerging Technologies recommended the use of emerging technologies BCT to streamline the food supply chain and enhance food security. BCT is suitable to track food products in the supply chain to remove the opaqueness that makes it hard for consumers to identify the source and the path which the products moved through (Kshetri, 2018; Saberi et al. 2019; Kamilaris et al., 2019). Industry giants, such as IBM, have done pilots on verification and validation of food products using BCT (Kamath, 2018). However, the rate of use of BCT is still low, yet it has a strategic business value (Carson et al., 2018). The level of e-readiness, the degree of preparedness of an organization to use ICT in enhancing the quality of services, is an important element in linking and organization's goals to its objectives (Kashorda & Waema, 2011).

## Approach and Results

The Network Readiness Index (NRI), an assessment tool widely used by World Economic Forum to rank how countries are doing in the digital world, was used to survey the use of traceability systems in the horticulture industry in Kenya. The respondents, comprising top management (18.9%), ICT workforce (26.4%), users (31.1%) and consumers (23.6%) were asked in January 2020, to respond on the four dimensions of NRI: Environment (regulatory and business environment that constitutes part of a conducive ecosystem of organizations to leverage on BCT), organizational readiness (technical, financial and expertise to assess how


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ready the actors are for BCT), usage (capability of organizations and actors to efficiently use BCT in their daily processes and transactions), and impact. The readiness levels were determined by use of the 5-point e-readiness scale developed by Aydın & Tasci (2005) which identified a mean score of 3.41 as the expected level of readiness. Key documentation was reviewed to establish the available horticultural traceability systems in Kenya.

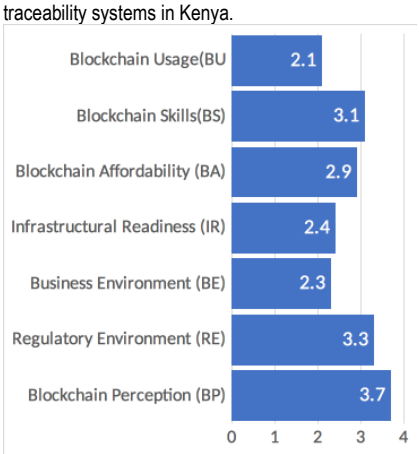


Figure 1: Summary of results on blockchain readiness

We report on the traceability technologies currently in use in domestic horticulture supply chain and the e-readiness status of the actors (policymakers, innovators, researchers, regulators and consumers) in relation to transition towards the implementation of BCT for full traceability in the horticultural sector. The study complements recommendations made by in the Blockchain and Emerging Technologies Taskforce Report and will contribute to the overall maturity of BCT in the horticulture industry in the East Africa region.

## Horticultural Traceability Systems in Kenya.

The systems are still in their infancy, with only three main systems available to serve the needs of the sector (small-scale producers, value chain, food safety-minded consumers, governments and other interested stakeholders). **eProd** has been commercially available since 2015. the system allows tracking and tracing of produce from seed to the market through the creation of comprehensive farmer profiles, registration and monitoring of internal farm operations and productivity, management of credit systems for inputs and finances as well as compliance and impact measurement. The system seems best suited for large producers in the value chain. **Farmforce** is a mobile service used by organizations in large-scale contract farming arrangement with small farmers. The system allows tracking of produce from farm to market through registration of individual or groups of farmers, records of internal production practices, management of harvest and tracking of produce from farm to markets. Finally, the **National Horticulture Traceability System** aims to introduce increased transparency and visibility of horticulture supply chain activities through electronic registration of export horticulture growers and critical supply chain processes, from farm to distribution. The system enables stakeholders to rapidly record, retrieve and share information on the farm origin of products to enhance traceability. The NHTS system, though very promising for uptake by the domestic sector has, however, not been implemented by value chain actors in the domestic market and its awareness level is low.

## Level of Blockchain Readiness.

To establish the level of readiness in the sector, a mapping was done on each of the eight top-level indicators of NRI onto the scale used, ie, Stage 1: 1-2.6 (unprepared); Stage 2: 2.6-3.4 (not ready needs some work); Stage 3: 3.4-4.2 (ready but need improvement); Stage 4: 4.2-5.0(prepared). The results (Figure 1) shows that on average, the stakeholders were; above stage 3.0 (perception, skills, regulatory environment), above stage 2.0 in (affordability, business usage, government usage, business environment, infrastructure) and below stage 2.0 in individual usage. BCT perception was ranked the highest indicating that the value of the technology was considered significant by actors. However, the infrastructure was inadequate, the business environment was not conducive and usage of the technology low. The study indicated that 7 of the 8 readiness factors were below stage 3.41 implying that the level of readiness of BCT in the horticultural sector in Kenya is low. The key gaps identified in the low acceptance of BCT in Kenya's horticultural sector are the lack of a regulatory and policy framework, deficiency of knowledge, and inadequate collaboration among actors. It was noted that the KS1758-2:2016 Code of Practice/Standard aims at providing rules for safe and sustainable production and supply of fruits and vegetables in Kenya for both export and domestic markets.

For *Perception of Blockchain in Horticulture*, the respondents had a unanimous agreement that the future value of the technology in the industry is significantly high. For *Regulations and Policies*, there exist no policies and regulations to guide the usage of BCT among the actors in the horticultural sector. This gap can be attributed to the lack of common agreement on policies and regulations between policymakers and technical experts on BCT. For *Business Environment*, the organizations had units for innovation, but there was disagreement on the existence of BCT-based innovations. Under *Infrastructure*, most of the organizations had infrastructure that was considered to be of low inter-operability for BCT. Considering *Blockchain Affordability*, actors could commit finances on the technology but spending on R&D of BCT was low. For *Blockchain Skills*, 53.8% of the actors had no BCT related skills. Among those who possess the skill, 64.2% were basic (ability to use), 21.6% intermediate (ability to support and maintain), and only 14.2% advance level (ability to develop and deploy). Finally, considering *Blockchain Usage Level,* usage of BCT by stakeholders for individual, business and transaction of government horticultural services were all low.

# Policy Recommendations

## Short-Term

- Formulation of BCT frameworks, standards and policies
- Establishment of appropriate mechanisms for training and skill enhancement
- Conducting an assessment of the existing infrastructure
- Creating and implementing mechanisms to motivate innovation among the employees and users

## Medium to Long-Term

- Championing BCT use. Use cases in the agricultural sector have been identified by the Blockchain and Emerging Technologies Taskforce Report
- Actors in the region and beyond require to invest in traceability systems
- Consumers may soon source horticulture products only from suppliers whose produce they can trace. If such systems are not in place, disruption of business operation is likely to occur.
- Governments at various levels (county, national, regional) should facilitate the full implementation of the National Horticulture Traceability System.

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