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THE ROLE OF DIGITAL TECHNOLOGIES IN LIVESTOCK TRACEABILITY AND TRADE

KEY MESSAGES

- Animal traceability systems are vital to animal production, food safety and trade. Yet, in many parts of the world, they are missing or systems use inefficient methods to collect, record and share data.
- Digital technologies can improve farm-to-fork traceability with solutions that accurately identify animals and products, collect more data, integrate communication flows, share data quickly and securely in supply chains and analyze data to predict future outcomes.
- These technologies and new methods can enhance performance for monitoring and controlling animal disease, managing food safety and fraud risks, complying with animal production and food standards, facilitating trade and raising consumer awareness.

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Introduction

Traceability in agricultural value chains is an important component of food safety management and in facilitating trade. Producers cannot access international markets without sound traceability systems to ensure compliance with food standards in the importing country. Consumers also expect increasingly detailed information about the food they purchase, including its origins, details about growing conditions, inputs, animal welfare, and its composition and safety. Traceability relies on data and information that correlates to the product to be collected, recorded and shared throughout the value chain and between the different actors.

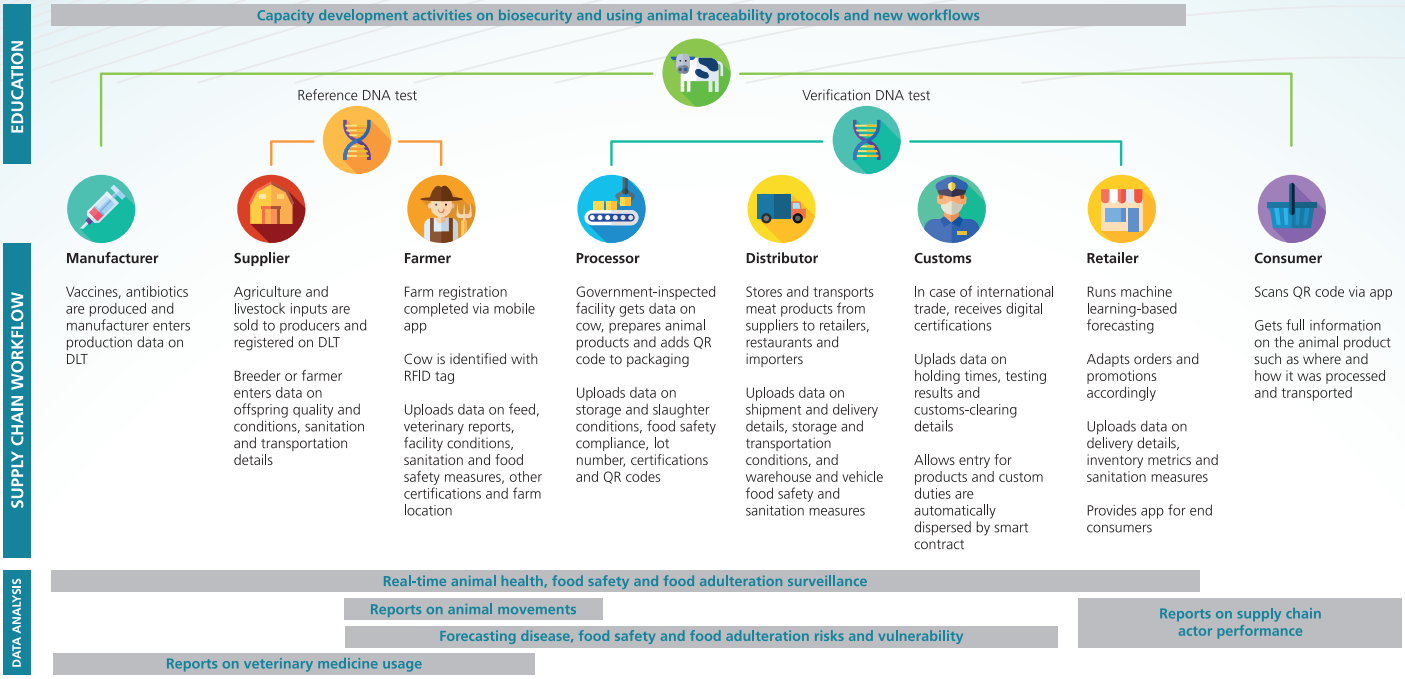
Too often value chains lack accurate traceability to ensure product quality and even safety. Food fraud has been estimated globally at USD 40 billion each year (PWC, 2016), never mind disease outbreaks, like the hundreds of millions of USD lost from the spread of the African swine fever (ASF). The challenges for traceability systems range from their complete lack; to inefficient systems like paper-based records and manual databases; and costly and error prone electronic systems. All of which maintain records and information flows in a fragmented manner.

For example, animal traceability systems are vital for livestock production, i.e. managing animal health, disease control, food safety and the certification of exports. In many parts of the world, countries still do not collect or maintain any data on animal traceability whether in paper or electronic format, in which only 28 percent, 26 percent and 23 percent of World Organization for Animal Health (OIE) countries reported to maintain records on animal traceability, identification and movement, respectively (Beckham & Holmstrom, 2015). When traceability systems are in place, they often use inefficient means to collect, record and share data. Paper-based data management activities and reporting are still widely prevalent around the world (Beckham & Holmstrom, 2015), which is often used as the main method to record the change of ownership and linking products to animals after slaughter in animal traceability systems. Only 57 percent of OIE members that have available animal traceability data maintain them in electronic format (Beckham & Holmstrom, 2015). Despite progress in some part of the world, there is need for greater digitization and digitalization[1] in animal traceability.

Digital technologies for animal traceability and trade facilitation

Digital technologies, like internet of things (IoT), artificial intelligence (AI), machine learning (ML) and distributed ledger technology (DLT), drive more efficient, productive and traceable supply chains. They address the need for better methods to collect data throughout the production, processing and distribution processes; analyse data for predictive and data-driven decision-making; register and share data securely and immutably in a single platform; and integrate communication flows in supply chains. These technologies can improve methods for farm-to-fork traceability by strengthening animal disease control and prevention, better managing food safety and fraud risks, ensuring compliance with animal production and food standards, simplifying procedures, facilitating trade and raising consumer awareness (Tripoli and Schmidhuber, 2020).

1 Digitization refers to the conversion of analog to digital, while digitalization refers to the use of digital technologies to change a business model (Gartner's IT Glossary).



Source: Tripoli & Schmidhuber, 2020

The main challenge for traceability systems, particularly for aggregated and complex final products, is to maintain traceability throughout the production and food chain without losing the link between the original and final product. In animal traceability systems, unique identifiers are used for animal identification in order to track and record their movements and welfare throughout the supply chain. Once reaching the slaughterhouse, the link between the animal and products are often maintained via paper documents.

Despite advances in unique animal identifiers, there is still the need for cost-effective tools (known as product-process links) that establish an immutable link between the data (stored in a database or DLT) and the physical product to ensure product authenticity (Tripoli & Schmidhuber, 2018). If the objective is flawless farm-to-fork traceability, then technologies like radio-frequency identification (RFID) tags and DNA testing are the most secure and economically viable traceability methods available. Other identification technologies, like facial recognition, are being developed that could compete with RFID identifiers. The use of AI and imaging is a potentially cost-effective method to identify animals based on facial recognition, hide patterns, or other unique features. However, animal traceability systems would still require DNA testing to ensure the link from live animal to final product.

Traceability systems require a fast and secure digital database to record, store and share information throughout the supply chain. DLT is a shared database that allows secure and immutable data exchange for supply chain actors to record animal production data. The data collected on DLT provides an audible production history to prove regulatory compliance, populating digital documents and promotes consumer awareness. It also provides a secure platform to exchange digital documents, which can improve trade facilitation. TE-Foods is one DLT company that provides farm-to-fork traceability and is using its DLT traceability system to combat the ASF in eastern Asia by establishing direct communication between regulators and supply chain actors for data collection, assessment and response (TE-Foods, 2019).

Vast amounts of data can be collected on the farm and throughout supply chains with remote sensors like IoT sensors, robots and biosensors, as well as manually through mobile devices. In addition, data can be crowdsourced and be distributed and accessed through the internet. The accumulated on farm data can be used to monitor animal health status, animal welfare, optimize farm management, prevent and control animal disease, manage food safety risks and certify exports. Data collected on farms and through the internet can also feed AI and ML analytical models to predict future outcomes in supply chains, and be used as a monitoring tool to predict and detect disease outbreaks, food fraud, contaminated food products or noncompliance with international standards (Tripoli & Schmidhuber, 2020). For example, a new e-tongue detection tool is being developed that uses AI and electrochemical sensors to test the taste of liquid food products for fraud and adulteration (Ruch, 2019).

What needs to be done:

- Strengthen human capital to understand, develop and implement digital technologies in animal traceability systems.
- Create new protocols for using technology in animal traceability systems, incentives for stakeholder buy-in and regulations that enable the adoption of digital technologies in livestock value chains.
- Facilitate public and private investments to improve digital and physical infrastructure and support farmers and startups in livestock value chains.
- Ensure farmers in low-income countries, namely small-scale producers, have access to and benefit from digital technologies.

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