A Glimpse at Traceability Technology Solutions for Food Safety

Dr. Nabil Georges Badr
Doctor in Business administration, PMP, CPHIMS
Lecturer and Research Associate- Higher Institute of Public Health-USJ

Introduction

Food safety is the practice that reduces the exposure to natural hazards, errors, and failures related to foodborne illnesses incidents, for example, by defining standard processes to keep food safe. This is a serious public health challenges as there are 600 million cases of foodborne illnesses across the world each year[ii]. Furthermore, according to the Food and Agriculture Organization of the United Nations, one-third of human food production is lost or wasted globally each year. While some of this is food waste on the consuming end, food waste due to compromise during the transportation and distribution portion of the supply chain contributes to 1.3 billion tons per year waste (estimate).

The World Health Organization defines food security as a time "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life." Food safety is an integral part of food security. With a population that will only increase in the coming years, the pressures to provide safe food and reduce waste will become more demanding.

The study of the food safety ecosystem relates to the understanding of the interdependencies. Everything is interrelated from farm to fork, and having knowledge of these relationships within the supply chain can lead us towards solutions that promote food safety. A recent study on factors affecting food safety[iii] reveals that through the coming years and beyond, food safety, in particular, will be impacted by several key factors (Table below). Environmental factors will shape our ability to provide safe food in several ways, especially as a cause for disruptions in the supply chain leading to exacerbated logistics issues. Additionally, consumer preferences and behaviors are evolving and so is the concept of increased food waste; finding responsible ways to avoid food waste will be important to providing the world's growing population with a steady supply of safe food. On the other hand, labor shortages often give rise to the use of seasonal untrained labor, which presents high risks of contamination and a shift in regulatory and policies can impact the level of scrutiny is applied to ensure food safety. Finally, the plethora of dis-information can make it difficult for consumers to gauge legitimacy. Whether a food issue is fake or not, it can be difficult to recover from consumer panic or reputation damage of a producer, for instance.

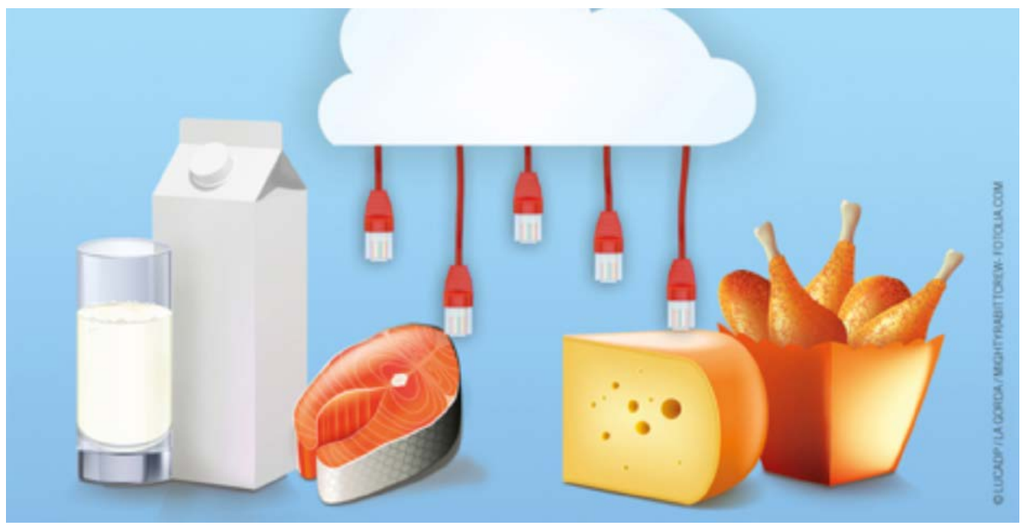

Image: Food Industry Unplugged - February 10, 2017 • By Keith Loria[i]

Table: Factors Affecting Food Safety (https://safetychain.com)

The Environment	→	Climate related (80% of reported incidents worldwide)
	→	Increase Crops and animal vulnerability to disease
	→	Limitations in water supply and increased risks of contaminated water sources
Logistics issues	→	Traceability issues and contamination during distribution
Consumer behavior	→	Increase food waste contributes to food safety risks.
	→	Pests occupy a share in the spread of contaminants such as salmonella
	→	Food handling safety awareness is key.
Labor shortages	→	Shortage of trained food handlers - Immediate impact on safety in production
	→	Both manual and mechanical labor present their own food safety risks; Mixing contaminants directly into the food supply.
Policy shifts	→	Immigration policies
	→	Food safety regulations
	→	Import export laws and tariffs
The Media - disinformation	→	Abundance of untrusted information – information overload
Technology Advancement	→	Potential to reduce waste, minimize problems leading to recalls, and improve safety, compliance, quality, traceability, yield, and productivity

Technology Advancement and impact on food safety

Around the world, food-processing facilities operate mostly, using paper-based records, which can impede the ability to move quickly in the food safety realm. In addition to enhancing processes within the food processing facility itself, technology improves logistics. Digital recordkeeping and improved efficiency of the global supply chain can directly address food loss on a global scale. While paper-based records are still industry standard, companies have a lot to gain by moving towards a cloud-based portal with sensors automatically streaming into the online database to not only cut down on labor requirements, but also reduce human error. Collecting data at different points of the food production system and analyzing it help prepare the resources for preventive measures that impact food safety. Data models derived from the field contribute to a proactive practice of food safety by manufacturers from farm to fork and develop agility for responding quickly to any issues that may arise. However, the way a facility uses digitalization can be daunting task within their plant, since newly introduced technology driven programs may require extensive training.

Traceability technologies, like sensors and tracking devices, are making it possible to track the movement of food and supplies from farm to fork. This enables us to respond to food safety incidents swiftly, while also

potentially reducing food loss. Machines throughout production facilities are sources of rich data. Data can be studied for trend analyses, used as decision-making support, for creating safer, more quality-driven, food practices. Mechanized sensors also help food safety companies access key insights in real-time.

Traceability made possible by "Internet of Things" (IoT) technology

A sensor, internet connection and the ability to communicate are the ingredients that make up the Internet of Things technology. IoT is gaining rapid steam, with companies such as global giants, Ericsson, IBM and CISCO, making projections of as many of 50 billion devices connected by IOT by 2020[iv]. One way in which many facilities have already begun to leverage technology is by accessing the "Internet of Things" (IoT) data[v]. Food companies are utilizing IoT technology for the ability to closely monitor food safety data points, which in turn helps reduce the risk of a food illness outbreak[vi]. An IoT system can also track equipment sanitation, maintenance and repair records, streamline communication between departments and create records for audits and government regulators[vii]. IoT-based sensors connected to cameras help in the documentation of food safety with quality checking and detection of irregularities, temperature control for longer shelf life, production standards, and location of food. These sensors also predict the maintenance needs of machinery used in the food industry.

Smart labelling with "Radio-Frequency Identification" (RFID)

Food labelling mechanisms that incorporate strips (smart labels) with digital information on the path of a certain produce through the supply chain, could provide valuable consumer protection measures. Food packaging tagged with sensors, such as radio-frequency identification (RFID) transponders, and linked to a supply chain-spanning network, would provide tracking information on the impacted produce to fields, packaging companies and stores[viii]. With the help of RFID transmitters and GPS (Global Positioning Systems), the distribution chain can be effectually monitored all along the whole storage and shipping course at the sales points or stores. This also enables companies to be acquainted with the preferences of customers, better reply to market requirements and decrease surpluses to reduce waste[ix].

"QR codes" a digital record aimed at Consumer Awareness

The integration of QR codes in the labelling of food items, provides a level of consumer awareness that was not available a few years ago. Smartphone scanning of QR codes can give customers information on the content of packages, shelf life, food grade packaging, crop or meat quality, freshness of meat and vegetables, how the meat was treated, ingredients in the processed food, precautions taken in harvesting, time and location of manufacturing, FDA-certified food and much more.

The promise of "Blockchain" as a transparent ledger

Blockchain is a decentralized public ledger, which allows the involved parties to store, append, and access information, and is reliable due to approval of entry to the database[x]. Blockchain technology can be instrumental in keeping a continuous record of item history for traceability and add a layer of transparency as it becomes more widely used. Blockchain technology can function if all parties use it, but making sure everyone becomes technology savvy is difficult.

Summary

Technology is revolutionizing all industries, with food and beverage being no exception. One of the most positive changes in the realm of food safety is technological advancement. Technology can be instrumental to reduce waste, minimize problems leading to recalls, and improve safety, compliance, quality, traceability, yield, and productivity. Traceability technology coupled with processing technology, packaging innovations, and biology-based dynamic modeling formulation systems help improve the systems thinking capabilities of food industry professionals[xi] and induce a more proactive approach to food safety.

i- https://www.foodqualityandsafety.com/article/food-industry-unplugged/2/?singlepage=1
ii- https://www.who.int/news-room/fact-sheets/detail/food-safety
iii- https://safetychain.com
iv- https://www.foodsafetynews.com/2017/03/4-ways-iot-is-supporting-the-food-industry/
v- https://iot.eetimes.com/5-ways-the-food-industry-can-improve-food-safety-with-the-iot/
vi- https://www.ibm.com/blogs/events/think-2018/think-2018-presents/improving-food-safety-internet-things/
vii- https://www.manufacturing.net/article/2018/08/internet-things-could-be-key-food-safety-0
viii- https://internetofthingsagenda.techtarget.com/feature/Internet-of-Things-Food-safety-apps-set-to-emerge
ix- https://www.comparethecloud.net/articles/how-internet-of-things-transforming-food-industry/
x- https://www.dataversity.net/how-blockchain-and-iot-tech-will-guarantee-food-safety/
xi- https://safetychain.com