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THE FUTURE OF FOOD SAFETY



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Digital transformation of the food system

Mr Mark Booth, Chief Executive Officer, Food Standards Australia New Zealand, Canberra
ACT, Australia.

The modern food supply chain is increasingly globalised with food safety a worldwide responsibility of governments and the food industry. It is not uncommon for a food product to be produced in China, packaged in the USA and sold in Sweden, all under licence to a UK firm that is African owned.

Regulating global food systems presents challenges and opportunities. Government approaches must evolve and keep pace with food system developments in order to meet objective of ensuring consumer confidence.

Digital innovation and transformation in the form of big data and analytics, artificial intelligence and the internet of things (IoT) are trends that are rapidly disrupting businesses. These developments provide great opportunities to improve food safety by empowering the consumer and changing the relationships between businesses and government regulators. They also offer developing countries opportunities to improve their food safety programs and culture.

The complexity, fragmentation and global nature of the food supply chain is a key driver for use of digital technology in the food supply chain in order to provide enhanced traceability of food and safer food to consumers. The forward projections for population growth will place increased pressure on food production systems to cope with the demand for food, and in developing countries consumers are now demanding more processed and packaged foods leading to accelerated investment in process automation. Ongoing scientific advances, and technical innovations on a platform of digital technology have the potential to contribute to a wide-scale structural transformation of food systems. For example, Whole Genome Sequencing (WGS), promises to better identify, characterize, determine and respond to potential risks, and prevent and reduce hazards in the food chain. Other drivers such as increasing labor costs, occupational health and safety issues (from repetitive motions) and food safety and hygiene compliance, has led to automation in the form of robotics offering solutions to these issues.

These drivers all bring with them key challenges and also opportunities.

Challenges

Climate change, a growing and aging population, urbanization and increased affluence will create food safety challenges, and impact on the food sector and regulators to deliver food security. Therefore, governments need to move to implement digital policies and security measures in order to keep pace with these changes. However, there needs to be regulatory controls in place to protect intellectual property and data ownership, and the security of data.

An ongoing challenge for governments and industry is the ability to identify and handle emerging food safety risks, and then decide on adequate risk management measures. Therefore, digital policies and security measures need to ensure adequate traceability is inbuilt into digital processes so as to respond rapidly to new food safety issues. For example, Block chain technology, as a tool is being trialed by businesses in Australia and New Zealand to prevent food fraud and enhance traceability of food. However, to date, the amount of information which can be processed is limited, costs still need to be minimized (particularly for small and medium enterprises), confidentiality is still not ensured and more participation and buy-in by food businesses is needed.

The increasing trend of internet purchases of food could improve food safety by enabling companies with robust food safety systems to have greater reach to consumers; however, sufficient auditing must be in place commensurate with that in current systems. Digital labelling technologies provide consumers with information requirements that transcend the limits of physical labels.

Food safety needs to be an important consideration in the uptake of 3D printing and regulatory environments and food safety management systems will need to evolve to take into account advances in digital processing, e commerce and 3D printing.

Use of big data to improve food safety, quality and culture is endless; however, challenges remain in regard to getting sign on from industry to critically evaluate its needs for high risk foods; provision of sufficient training of scientists with expertise in food systems issues; and keeping costs for SMEs and developing countries to a minimum.

Opportunities

There are a number of opportunities the first being to connect the physical world (embedded with electronics, software, sensors, and network connectivity that enables objects to collect and exchange data) with computer-based systems, leading to automated data collection and analysis, continuous monitoring, remote real-time accessibility and digital record-keeping. Examples of this are: advanced sensors for data collection, monitoring, decision making and optimization, such as temperature, shipping times and signs of disease in livestock; and radio frequency identification (RFID) technology for identification and tracking compared to barcodes and responding to problems in real-time.

3D printing of food, has potential to create new combinations of ingredients, at higher normal water activities, reduced acidity or lower/zero levels of preservatives, or without a risk assessment needing to be undertaken. Personalised nutrition will be enabled by such technologies.

The creation of a big data culture in the food industry could facilitate advancements in global food safety, food quality and sustainability. For example, WGS and Geographic information system (GIS) being used in tandem to better detect outbreaks and their causes.

An opportunity exists for digital companies partnering with large food companies to share outcomes amongst producers, retailers, health authorities and regulators.

Implemented correctly and in a timely manner, digitalization may facilitate international trade with faster, more cost-efficient and less bureaucratic electronic certifications of internationally traded food products coupled with increased food safety and reduced vulnerability to fraud. This would be valuable for developing countries in particular, with limited resources and less mature food safety systems.

Laws, contracts and other regulatory documents can be converted into machine-readable format, allowing automation of auditing and compliance, leading to reduced costs and reduced human errors whilst improving surveillance and detection of fraud.

Conclusions and potential ways forward

All consumers have an intrinsic right to demand that food is safe and many increasingly want to know where their food originates. Therefore, governments and the food industry need to take an active role in leading and managing food safety issues.

Digital transformation of the food system is an important strategy that can be utilised to address current and future food safety risks. Technological innovations are leading to cheaper, faster and more efficient computer hardware, improved software and network connectivity, and advanced sensors that are yielding new applications in food safety. However, there are still a number of challenges to manage such as having the appropriate infrastructure available, intellectual property ownership, governance of the systems, data currently residing in “silos“ within food businesses and governments.

In considering the issues that have been raised in this paper countries may wish to consider the following initiatives in order to prepare themselves for future developments:

- Establishing mechanisms to allow advances in food safety techniques to be made available to developing countries that recognises the need to have an effective infrastructure available for effective dissemination of these techniques.
- Exploring challenges and opportunities for digitalization of food systems from the perspective of food safety impact, accessibility, equity for developing countries, and sustainability at a regional and global level, paying attention to preparedness of regulatory frameworks and acceptance by consumers.
- Seeking support for policies at the national and international level for digital platforms that enhance food production and safety.
- Consideration of E-certification with a view to reduce lengthy and cost-intensive clearances for official certification needed by food authorities, by streamlining processes and linking into food composition databases.
- Digital traceability of food by for example applying block chain approaches may offer faster and more efficient food safety risk management options globally. These developments together with the increased volume of food traded by E-commerce, may give developing countries and smaller businesses a better environment to participate in the global market place.