REPORT FOR NATION

Importance of Authentication & Traceability in Indian Food Value Chain

Authentication Solution Providers' Association
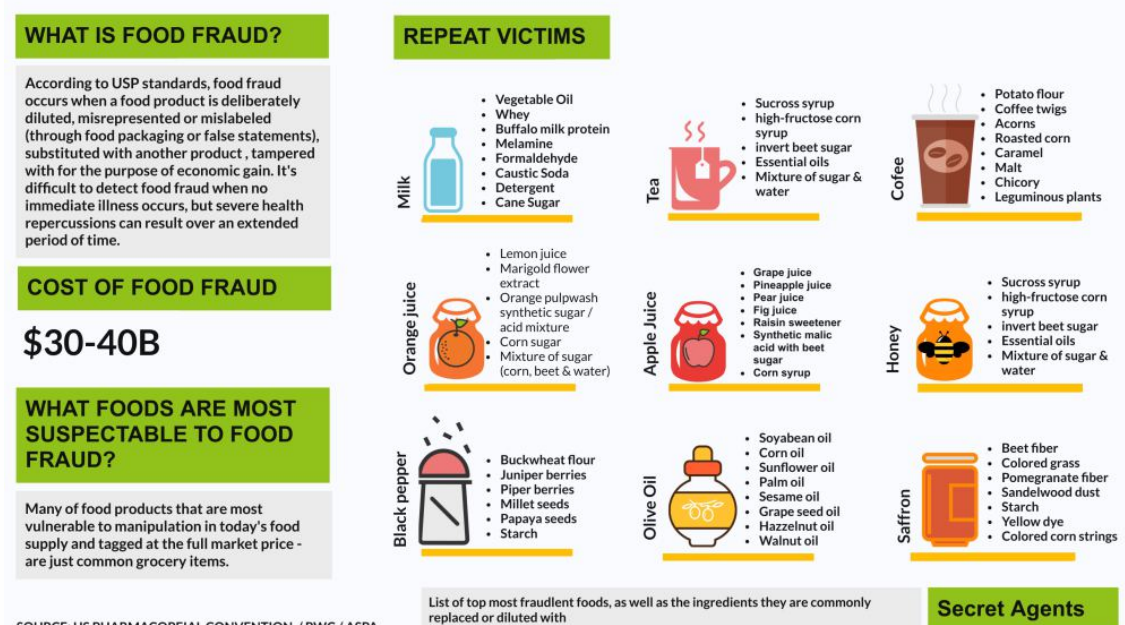**Fighting fakes since 1998**

Contents

"Counterfeit and substandard food and beverages can be found on the shelves in shops around the world, and their increasing sale online is exacerbating the threat that food crime poses to the public,"

INTERPOL's Director of Organized and Emerging Crime,
Paul Stanfield

1. What is food fraud?

Food fraud can be prevalent and far-reaching. According to the Food and Agriculture Organization (FAO), food fraud is defined as the "intentional adulteration of food for financial gain. This could include deliberate substitution, dilution, counterfeiting or misrepresentation of food, ingredients or packaging, or even false or misleading statements made about a product".

Criminals in the systems can cause public health risks (e.g. contaminated olive oil with common allergens such as seed oil), loss of consumer confidence, and market inefficiencies, where those providing genuine high-quality products lose out to those who only claim to do the same.

WHAT IS FOOD FRAUD?

According to USP standards, food fraud occurs when a food product is deliberately diluted, misrepresented or mislabeled (through food packaging or false statements), substituted with another product, tampered with for the purpose of economic gain. It's difficult to detect food fraud when no immediate illness occurs, but severe health repercussions can result over an extended period of time.

COST OF FOOD FRAUD

$30-40B

WHAT FOODS ARE MOST SUSPECTABLE TO FOOD FRAUD?

Many of food products that are most vulnerable to manipulation in today's food supply and tagged at the full market price - are just common grocery items.

SOURCE: US PHARMACOPEIAL CONVENTION / PWC / ASPA

REPEAT VICTIMS

Milk
- Vegetable Oil
- Whey
- Buffalo milk protein
- Melamine
- Formaldehyde
- Caustic Soda
- Detergent
- Cane Sugar

Tea
- Sucross syrup
- high-fructose corn syrup
- invert beet sugar
- Essential oils
- Mixture of sugar & water

Cofee
- Potato flour
- Coffee twigs
- Acorns
- Roasted corn
- Caramel
- Malt
- Chicory
- Leguminous plants

Orange juice
- Lemon juice
- Marigold flower extract
- Orange pulpwash synthetic sugar / acid mixture
- Corn sugar
- Mixture of sugar (corn, beet & water)

Apple Juice
- Grape juice
- Pineapple juice
- Pear juice
- Fig juice
- Raisin sweetener
- Synthetic malic acid with beet sugar
- Corn syrup

Honey
- Sucross syrup
- high-fructose corn syrup
- invert beet sugar
- Essential oils
- Mixture of sugar & water

Black pepper
- Buckwheat flour
- Juniper berries
- Piper berries
- Millet seeds
- Papaya seeds
- Starch

Olive Oil
- Soyabean oil
- Corn oil
- Sunflower oil
- Palm oil
- Sesame oil
- Grape seed oil
- Hazzelnut oil
- Walnut oil

Saffron
- Beet fiber
- Colored grass
- Pomegranate fiber
- Sandelwood dust
- Starch
- Yellow dye
- Colored corn strings

List of top most fraudulent foods, as well as the ingredients they are commonly replaced or diluted with

Secret Agents

2. What is the Extent of the food fraud problem?

Food fraud is not a new problem but quantifying the economic or public health impact of food fraud remains difficult; the challenges are like other measures of crime. While seizure data is anecdotal and may only reflect crime prevention tactics, an overwhelming set of incidents and case studies indicates that food fraud is a growing trend. The annual estimated cost of food fraud is $30 billion to $40 billion.

Understanding its seriousness, Interpol, together with Europol, is conducting operation OPSON since 2011 targeting fake and sub-standard food beverages. In the latest seizure conducted between December 2018 – April 2019, 78 countries took part and resulted in more than 67,000 checks carried out at shops, markets, airports, seaports, and industrial estates. In total, 672 individuals were arrested, around 16000 tonnes and 33 million liters of likely fake food and drink worth of Euro 100 million seized.

In the Indian scenario, the situation is not different. As per findings, the Food regulator analyses a total of 106,459 samples across the country and find over 15.8% food samples as sub-

standard, 3.7% unsafe, and 9% mislabeled during the year 2018-19. It is the first year the data has been compiled for unsafe, sub-standard and labeling defects separately. At least ten states in India are unequipped to ensure food safety, owing to scarcity of staff and food testing laboratory infrastructure.

A few years back, Harcourt Butler Technical University conducted research in Kanpur, Uttar Pradesh which is a big market for edible oil and supplies to various States. The report found that 70 percent of our mustard oil available in the market is adulterated. In such a situation, finding 70 percent adulteration in more than 120 samples of oil of 30 big companies is a dangerous sign. In 15 percent of the samples, mustard was less than 20 percent, that is, it did not know what oil was.

Table: Results of last five OPSON operations by Interpol & Europol#

OPSON	Year initiated	Country participated	Fake and substandard food (Tonnes)	Fake & sub-standard drink (million Litre)	Value of food seized in Euro million
VIII	2018-19	78	16000	33	**100**
VII	2017-18	67	3950	9.7	**$ 78.5**
VI	2016-17	65	13407	26.33	**235**
V	2015	57	-	-	**230**
IV	2014	47	-	-	**NR***

*Not Reported Source: https://www.europol.europa.eu/

1. https://www.pwc.com/gx/en/services/food-supply-integrity-services/food-fraud-vulnerability-assessment.html
2. https://www.livemint.com/news/india/10-states-unequipped-to-ensure-food-safety-fssai-11574708979786.html
3. Hindustan Editorial, September 08, 2017, Page no 10

3. What are the types of food fraud?

Existing research on product fraud and counterfeiting has defined seven distinct types of food fraud. These fraudulent incidents include tampering, adulteration, refilling, pilferage, diversion, and counterfeiting etc. etc.

Below is a table that contains the definitions and examples of each food fraud types.

Table: Types of food fraud incidents

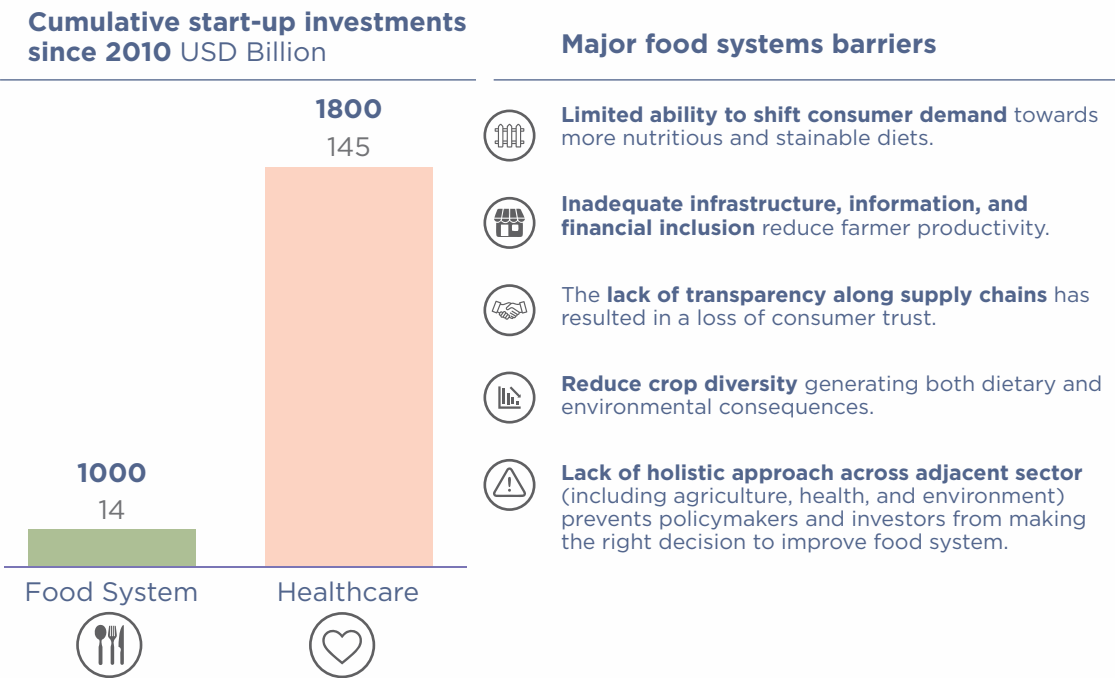| Term	Definition	Example
Adulteration	A component of the finished product is fraudulent	Melamine added to milk
Tampering	Legitimate product and packaging are used in a fraudulent way	Changed expiry information, product up-labeling, etc.
Over-run	Legitimate product is made in excess of production agreements	Under-reporting of production
Theft	Legitimate product is stolen and passed off as legitimately procured	Stolen products are co-mingled with legitimate products
Diversion	The sale or distribution of legitimate products outside of intended markets	Relief food redirected to markets where aid is not required
Simulation	Illegitimated product is designed to look like but not exactly copy the legitimate product	"Knock-offs" of popular foods not produced with same food safety assurances
Counterfeiting	Intellectual Property Rights infringement, which could include all aspects of the fraudulent product and packaging being fully replicated	Copies of popular foods not produced with same food safety assurances

Source: https://foodfraud.msu.edu/wp-content/uploads/2014/07/food-fraud-ffg-backgrounder-v11-Final.pdf

4. Why is the problem increasing?

Globalization, consolidation of manufacturing, urbanization, and other large-scale trends may provide insights into why food fraud is growing. Globalization requires more diverse and longer food supply chains to meet the demands of growing urban populations. Global economics enable criminal activity since remoteness and anonymity are often characteristics of such supply chains. All these features of the fraud opportunity contribute to why this emerging risk evolves so quickly. The very nature of this rapid and varied evolution creates further challenges in determining the extent of the food fraud risk. Researchers usually rely on historical incidents and on quantitative

analysis to identify emerging risks, which are then used to create early warning systems. But there is frequent evidence of creative fraudsters who seem to evolve constantly, to evade the most recent detection hurdles. While the exact probability or risk may not be readily identifiable, the vulnerability or fraud opportunities are more static. Many traditional food risk assessment tools are not holistically applicable for trying to quantify or predict food fraud incidents.

However, food system are decade behind other sectors in adopting technology innovations due to the complexities of sector

Cumulative start-up investments since 2010 USD Billion

Major food systems barriers

Limited ability to shift consumer demand towards more nutritious and stainable diets.

Inadequate infrastructure, information, and financial inclusion reduce farmer productivity.

The **lack of transparency along supply chains** has resulted in a loss of consumer trust.

Reduce crop diversity generating both dietary and environmental consequences.

Lack of holistic approach across adjacent sector (including agriculture, health, and environment) prevents policymakers and investors from making the right decision to improve food system.

1800
145

1000
14

Food System

Healthcare

Source: Pitchbook /Mckinsey
Fig: Major food systems barriers

5. What are the risks associated with food fraud?

Last year in December 2019, Delhi Police have busted a gang involved in the manufacturing of fake cumin operating from the previous seven years. The police seized fake cumin more than 450+ bags each containing 20 Kg of cumin made of stone dust, semolina and a grass paste. Food quality and safety have never been an urgent priority. In all these cases, the findings were shocking; they are mixing such things which, even if minor diseases, are also causing cancer cells in the body to grow without cause. They are also causing heart attacks. All this is happening in the branded items, for which you and we agree that while paying a heavy price, it would be good.

Three types of public health risks can result from food fraud:

- Direct

- Indirect

- Technical.

Direct food fraud risk occurs when there is an immediate or imminent risk to the consumer, such as the inclusion of an acutely toxic or lethal contaminant. Indirect food fraud risk occurs when the consumer is put at risk through long-term exposure, such as the buildup in the body of a chronically toxic contaminant through the ingestion of low doses.

Indirect risk also includes the omission of beneficial ingredients, such as preservatives or vitamins.

Technical food fraud risk is non-material in nature. For example, food documentation fraud occurs when product content or country-of-origin information is deliberately misrepresented.

Source: https://www.timesnownews.com/mirror-now/crime/article/fake-cumin-spice-factory-busted-by-delhi-police-inbhawana-5-arrested-gangs-kingpin-still-at-large/517309

6. What are the efficient food fraud countermeasures?

As food fraud is an economically motivated crime that can have public health risks, it is important to understand that mitigating the risks of food fraud requires a multi-disciplinary approach. Some of the useful disciplines, beyond Food Science, include risk assessment (Criminology), Securing Packaging and Supply Chain. Each of these disciplines provides insights for understanding the nature of food fraud and contributes proactive solutions to reduce food fraud.

6.1 Risk Assessment

Food fraud is an illicit activity that human actors perpetrate for economic gain. The field of criminology, which tries to better understand both criminals (i.e., why people offend) and crime events (i.e., the process to "create" crime), is, therefore, a useful platform for examining food fraud events and the food fraudsters themselves. For example, environmental criminology—which encompasses routine activity theory, the crime analysis triangle, and situational crime prevention—focuses on understanding and responding to the opportunity structures that make crime possible. In practice, numerous opportunities for reducing techniques have been shown to be effective in reducing various types of crime and disorder across many different communities. And the concepts that underlie these techniques (e.g., increasing the risk or effort of crime), as well as others rooted in criminology, may have the same potential for reducing food fraud.

6.2 Secured Packaging – Secure packaging ensures that the product is genuine and has not tampered.

Secured packaging reduces the risks of tampering and adulteration. It protects food, conveys product information, and adds functionality for consumers. Physical authentication solutions such as a tamper-evident hologram, holographic shrink sleeves, hidden text printed using security or magnetic ink solutions can be used which act as first deterrents to the counterfeiter. The hidden and covert features help a trained person in identifying fake products with genuine. Anti-counterfeiting measures protect both the manufacturer and the end-user from counterfeit or tampered products. Packaging can also provide anti-counterfeiting security features, enable product track-and-trace and pedigrees, and facilitate product authentication by consumers and law enforcement officials.

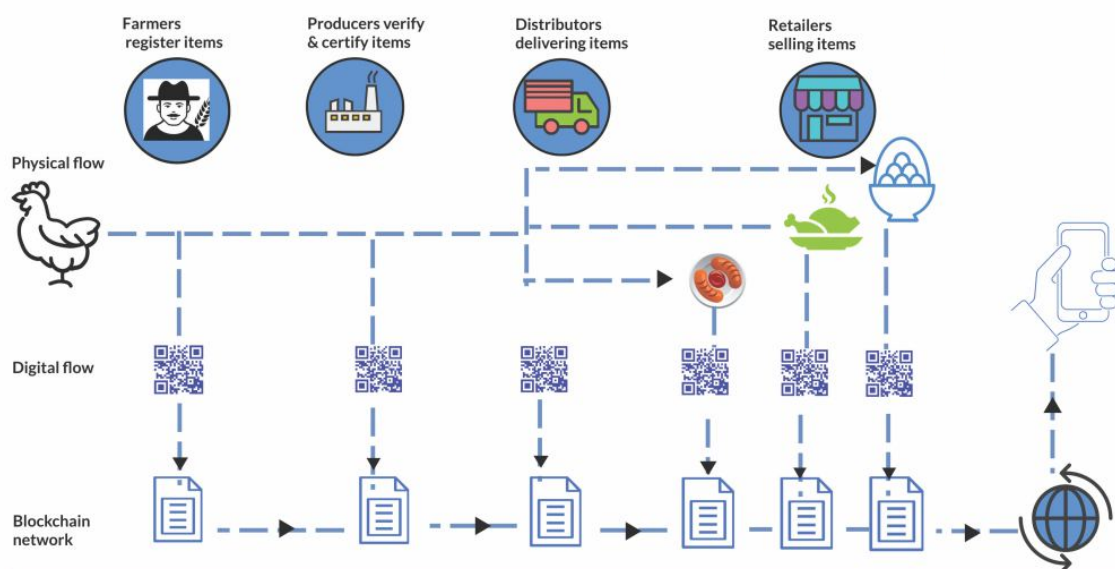## 6.3 Secure Supply Chain Management and procurement

Knowing the source and history of foods is important. Fraudsters can perpetuate their crimes through vulnerabilities in food supply chains. End-to-end visibility and supply chain transparency are critical management tools for food brand owners. Track-and-trace and product pedigrees, combined with market monitoring and testing, are key tactics for pro-actively mitigating food fraud risks. Soon, upcoming techniques such as Bio tracing, Nano sensor, GPS and GIS would be playing an important role together with digital authentication technologies.

7. What are the benefits of authentication & traceability solutions?

Fundamentally, India requires more development in current national food laws, as well as needs to adopt an effective traceability system to improve and change within the current food industry and food supply chain. There are various reasons which enforce the adoption of authentication solutions in the interest of the country; however, few important are as follows.

7.1 Minimizing the risk of food safety

Apart from food wastage, food safety is also a significant concern in India. The principal cause behind food safety is the discrepancy and uncertainty in the food safety monitoring system, for example, milk adulterants, the problem of antibiotic in honey, contaminated meat. Thus, there is a requirement to implement the effective traceability system in the FSC that can help in providing information about the product origin, ingredient and processing method. Some incentives are taken from India, such as food safety and standards authority of India give the suggestion and guideline to develop an efficient traceability system to identification/removal of unsafe food and preventing customers from harmful food in the market. Farm to fork traceability requires that the processes of internal and external traceability be effectively conducted.

Context: China has been affected by various food fraud scandals in last few year. 71% of population considers food safety to be a big problem.
Situation: A Chinese food provider aims to safeguard against domestic food fraud.
Solution overview: Tracking of content is facilitated with a unique digital identifier, such as RFID tag and sensors along the supply chain

Fig:Traceability initiatives can help reduce food fraud

Source: https://en.reset.org/knowledge/global-food-waste-and-its-environmental-impact-09122018.

7.2 Reduce product recalling cost

Food safety issues that trigger a recall are relatively rare but pose significant financial risks to the food industry. A survey of Grocer Manufacturers Association (GMA) companies found that 81% of respondents evaluated the financial risk from recalls as "significant to catastrophic". Of those surveyed, 58% indicated that they had been "affected by a product recall in the past five years", while 23% of those affected estimated the cost to be more than $30 million, which accounts for both direct recall costs and losses in sales.Authentication & Traceability could reduce the exposure to food outbreak risks by making it faster, more efficient and more feasible to identify a source of food contamination precisely, thus containing the impact. Currently, these processes are time-intensive and costly. For example, the 2018 outbreak of E. coli infections linked to romaine lettuce from the Yuma growing region took about three months to resolve and resulted in 210 individuals falling ill, 96 hospitalizations and five deaths.

Situation: A grocery company in the European Union imports fresh fruit and vegetables from smallholder farms in developing to develop a traceability system to efficiently identify and address any potential food-safety issues.

Context

Situation overview

Despite leading the world in food safety regulations, the EU still faces food safety challenges: in 2016, the EU's Rapid Alert System for Food and Feed (RASFF) found more than **700 instant of "alert notifications" that were "serious" in which "food feed or food contact material presenting a serious risk on the market [is found] and when rapid action is or might be required".**

E. Coil source

Trader —— Producer
Trader —— Producer
Distributor

Trader —— Producer
Trader —— Producer
Distributor

Trader —— Producer
Trader —— Producer
Distributor

Trader —— Producer
Trader —— Producer
Distributor

In most foodborne illness outbreak today, all of the producer's products would be recalled or moved from shelves; whereas traceability could make it possible to remove only the contaminated products.
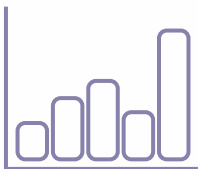
7.3 Reduce food wastage

Globally, approximately 1.3 billion tonnes, or one-third of all food produced, is wasted or is lost in the supply chain. Supply-chain inefficiency is a core contributor to food loss across food systems and is a particularly strong cause of loss in developing countries. For example, in Sub-Saharan Africa, over 35% of fruit and vegetable production is lost or wasted during post-harvest, processing, or distribution, whereas in Europe, less than 15% of production is lost or wasted during these same stages. As per the UN's Food and Agriculture Organization (UNFAO) report, India also lost 40% of its food during the supply chain. There is various reason behind the wastage of food in the present food supply chain

(FSC) system such as lack of storage space, improper postharvest management, inadequate transportation facilities, inefficient distribution, lack of infrastructural facilities, lack of refrigerated transport, lack of awareness, stock management inefficiencies, corruption, natural calamities and information regarding the production.

Promoting value-chain linkages

Mobile service delivery
increase farmer income by 3%-6% and reduce food loss by 2%-5%

Big data and advanced analytics for insurance
Farmer income could increase by upto 2%

Internet of things for real-time supply chain transparency and traceability
Reduce food loss by 1%-4%

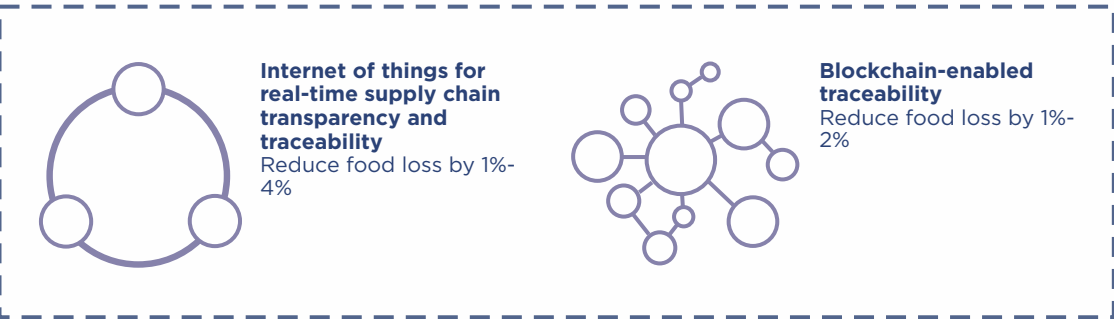**Blockchain-enabled traceability**
Reduce food loss by 1%-2%

Fig: Technologies affecting food systems, if scaled, could deliver significant impact by 2030

Source: https://en.reset.org/knowledge/global-food-waste-and-its-environmental-impact-09122018

7.4 Visibility & transparency in Indian products

In the last half-decade 2009-2013, the exports of India have risen phenomenally. Today, India has been exported many farming products such as mango, banana, onion, ladyfinger, pomegranate, and more to many parts of the world under the guideline of Agricultural & Processed Food Products Export Development Authority (APEDA), and Agriculture Marketing (AGMARK). Food Safety and Standards Authority of India aims to give a comprehensive view to food business operators in terms of the behavior of food recall portal, as well as how they should be carried out a food recall portal in order to develop an efficient rapid identification system, removal of unsafe food, and preventing customers from potentially hazardous food in the market. This is to take traceability as an integral part of food logistics.

7.5 Agro-terrorism threat

A disease outbreak in an agricultural system, which may affect financially by reducing the food supply and drive the food prices up in the market, is an outcome of agro-terrorism. In 2001, a foot-and-mouth disease outbreak severely affected Uruguay, resulting in costs of $243.6 million. With 3.8 cattle per capita, beef is Uruguay's second-largest export product. As a result, disease outbreaks like this pose a significant economic risk to the country. Traceability system plays an important to control such types of agro-terrorism activities. The prevention of the "agro-terrorism" can motivate and drive the FSC actor to implement the traceability system in their respective supply chain.

7.6 Certifications:

Food certification such as organic food certification, fair trade certification, and Halal certification. The prerequisite of these certifications is the product origin, ingredient, processing, and logistics and aligned operations in the documented form. Therefore, to obtain such type of information, a traceability system is required in the FSC. These certification schemes drive the FSC partners to implement the traceability system to achieve improved sustainability and gain a competitive advantage. Effective implementation of the traceability system may assure good public health, which can motivate the government in legislating laws to regulate the traceability system in FSC.

Source:
https://core.ac.uk/download/pdf/156624859.pdf

8. What are the recent developments?

8.1 Recent developments in India

Although India does not have any obligatory traceability system. Nevertheless, in recent years, Government has been started to work with private entities, state and central governments, which include FSSAI, APEDA, GS1 India, NABARD (National Bank for Agriculture and Rural Development), FPO (Fruit Products Order), ITC's eChaupal, and Reliance industry etc. for developing the traceability system within the Indian food industry and food supply chain.

Tea Board of India introduced Trustea and Rain Forest Alliance (RFA) certifications, which are mandatory for all tea manufacturers in order to set up the transparency, reliable supplier of tea and traceability in both domestic as well as overseas market. Punjab Agri Export Corporation (Pagrexo), decided to

deploy blockchain technology in potato fields from the rabi season. The project involved certification and traceability of seed potato right from the nucleus to the seed level (harvest). Under the project, the quality of seeds is checked before sowing and geo-tagged.

8.2 Recent blockchain-based global developments

The food authenticity and traceability market are being increased with the growing understanding of food safety among the consumers and government authorities.

Category	ICTs in India	Information	Source
Supply Chain Management	Logistimo	Uniquely suitable for rural markets, offers customers the ability to capture and share data.	www.logistimo.comAPEDA's
APEDA's Initiatives in Traceability	Hortinet/ Grapenet/ Anarnet/ Pomegranat/ Peanut.net	Web-based system for selected horticulture produces such as grape, pomegranate, banana, mango, ladyfingers along with their respective traceability system	www.apeda.gov.in
	Meat.net	System integrates stakeholders like State Animal Husbandry Departments, Meat Plants/Exporters and Labs to have real time information/ data on meat exports.	
Global Supply Chain	GS1 India	It registers to company and provides GCP and GTIN number for systematic and transparent and easy food supply chain across country	www.gs1india.org
Food Safety & Security	Rajasthan State Food & Civil Supplies Corporation	Focusing on food safety and notified to use a security hologram on daily household food items like tea, salt, pulses, Spices, and atta (wheat flour) etc.	

Danone infant milk program in China

Recently, Danone launches its new traceability service "Track & Connect" for its infant formula in China, followed by other Asia-Pacific markets as well as Australia and New Zealand throughout the year. There are two unique QR codes, one outside the packaging which can be scanned any time before purchase, and another one inside the packaging. The QR codes are printed in-house and laser marked on their infant formula packaging in its production facilities. The objective is to leverage this dual-QR code packaging innovation to introduce customized after-sale support and services – such as health and nutrition apps and information, useful 'how to' parenting videos and access to customer helplines or online e-commerce services. The Track & Connect service will also allow Danone and its distributors and retailers to more easily forecast consumer demand and consumer preferences. This new service is powered by blockchain, serialization and aggregation technology, which, Danone said, offer a safe and secure method of storing data and information on the movement of baby formula products through the supply chain.

Cargill Blockchain based developments

Cargill, one of largest food manufacturer, also debuted a blockchain pilot program that allowed consumers to track were their turkey originated. In the program, consumers in select markets were able to enter an on-package code at HoneysuckleWhite.com to access the farms' location by state and county, view the family farm story, see photos from the farm, and read a message from the farmer. Cargill is also making progress by increasing traceability across their global palm oil supply chain. In the last year, Cargill announced that its going to build a 100% traceable and sustainable supply chain of the palm oil in India by 2020, whereas recently started the food safety awareness program across the country under the Surakshit Khadya Abhiyan.

9. Conclusion

In developed countries, traceability is not only a value-added practice for the supply chain, but it is also a law. In the European Union, since 2005, the traceability system has been obligatory for all food businesses. In the U.S.A, the Bioterrorism Act includes a similar requirement regarding tracing "one step forward and one step back" throughout the supply chain. The issue of food safety has been the leading cause for adopting such regulations. Implementation of the traceability system by industry can be both voluntary and compulsory. The mandatory reason comes from legislation that ensures the establishment of security in the food chain. The voluntary one arises from the will of an organized and improved organization. However, developing country such as India faces significant obstacles in achieving enough traceability standards. They lack information and proper infrastructure to implement an effective traceability system that they perceive as costly.

The industry and policymakers in the food industry can take references and benefit from tested solutions adopted by another industry sector, including Beverages, Liquor, and Pharmaceutical industry. Regulations on authentication and traceability are here to stay and the sooner enterprises in India start implementing a system for traceability the better it will be for them in the long term. Determination of food authenticity is a vital part of quality control. After all, authenticity is also a quality criterion and validation for food and food ingredients.

Notes

"As a nation, we now face a serious threat and challenge from the illicit economy.

Illegal activities slowed industrial growth, thus affecting producers, and stunted revenue, hitting job growth. Consumers were the ultimate victims of counterfeiting, smuggling, and piracy as they paid excessive prices for substandard products that also increased exposure to health and safety risks.

To fight the crime of the 21st Century, the involvement of all stakeholders is important and therefore, we must maintain all that we can do to prevent it. A hand is what is required to come out of the and this is where we prove our responsibility".

JOIN US IN FIGHT AGAINST FAKES!

About

ASPA
Authentication Solution Providers' Association
Diverse technologies, common goal.

The Authentication Solution Providers' Association (ASPA) is a self-regulated, non-profit organization of authentication solution providers.

Formed in 1998 with the objective to curb counterfeit products in various sectors, it is the only association of its type in the world primarily focused on the adoption and advancement of authentication technology and solutions for brand, revenue, and document protection. As an industry body of authentication solutions providers, ASPA encourages its members to adopt best practices, standards, and usage of advanced technology in providing cost-effective anti-counterfeiting solutions against counterfeiting. ASPA members protect over 15,000 brands worldwide through the identification of genuine products and documents. ASPA works closely with global authorities such as International Hologram Manufacturers Association (IHMA), Counterfeit Intelligence Bureau (CIB), FICCI-CASCADE, CSIR-NIIST, ACMA, CII & other industry bodies in India.

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