



# Importance of Food Traceability in the Global Pandemic

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## Abstract

The recent corona pandemic has grown the need for effective and efficient traceability in Food Supply Chains. The estimated global population by the year 2050 will be

9.7 billion approx. considering such an amount attracts more than 60% demand in food production. Why mention the future? Because even in the year 2020 all food producers are still challenged to derive an efficient approach that should be suitable and less expensive for traceability and food supply chains.

As consumer demand has grown globally for food safety & standards, the compliance regulations being followed diligently by manufacturers and government agencies play an important role than ever. It helps in stopping or quickly recalls an affected product from the food supply chain, from manufacturer to consumer so that a threat can be removed for public health and food safety.

Every food manufacturing unit has to ensure that its traceability setup follows the highest standards and also in sync with the government agency's defined regulations. This helps to protect and strengthen its brand image in the Global or Domestic market accordingly.

**Keywords:** traceability; food fraud; consumer; security; corona pandemic

## Introduction

Traceability is defined as the method to trace back the product's history. When it comes to the food supply chain it becomes a method to track any food through all stages of production, packaging, and distribution which includes imports and retail too. Since its inception, it has helped in safeguarding consumer's health by providing healthy food products and also recalling unsafe ones from the markets across the globe.

The research and development of any method cannot be measured until it is challenged. Pandemics are rare but still, they happen and so are the outbreaks. An outbreak can be avoided using computer technology and engineering systems and methods in the 21st-century era. People who

are engaged in the food industry know that food traceability is the most important and challenging aspect of food safety.

Benefits and complications have surged higher with increased global trade each year for raw and processed food products across the continents. That's why continuous research to identify and tracing unsafe products will be the main goal. Because of the Corona virus pandemic, new norms have been implemented in the food supply system from farms to retail stores/shops.

Due to the Pandemic, a huge class of laborers has moved to their homes. This has created another problem for the small and mid-level farmers. They lost more than 70% percent of their revenue during this period. As in next season either they will have to wait until conditions improve or have to borrow more to rent out the automated equipment and technology. Because they are small and mid-level farmers cannot afford to buy automated machines and equipment.

So government regulators will be burdened with an extra layer of concern to maintain the growth of supply and demand in farm production. A chance of low quality food produce being pushed by tainted traders is a possibility. By forming dubious brands they will try to sell them to retail store and directly to customers too at cheaper price. The focus of the regulating bodies and the governments has increased vertically towards food safety due to the pandemic.

But over the past few decades percentage of recalls has significantly risen due to strict regulations and their implementations carried out by the world's government. For example, the Food Safety and Inspection Service (FSIS), part of the U.S. Department of Agriculture regularly carrying out inspections based on consumer complaints or any information received by producers or distributors. If issues are found it recalls stating the reasons. Manufacturers, distributors, and retailers receive the affected product recalls information. Information with other health alerts is shared with the public. [1]

All raw and processed food products for the consumer have to be safe. If unsafe, has to be removed from the market quickly which the consumer deserves. Based on this agenda the EU commission started Rapid Alert System. It's an outstanding example set by national authorities across

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Europe to overcome cultural and language barriers to work diligently towards a common agenda: To protect consumers against dangerous products in Europe.

In the last decade, IoT and Blockchain Technologies have revolutionized the way food traceability is developing and performing. The industry experts believe this may be the best combination available. The food items transportation from point A to B can be tracked by IoT which tracks malfunctions and technical issues.

On the other hand, Blockchain assists entities to look at the data recorded at all stages of the food supply chain. And the beauty of the combination is that the consumer can track the food item from its origin to his plate.

With IoT and Blockchain, another technology is added relatively to enhance their role in safety and compliance of food products i.e. Artificial Intelligence (A.I). In terms of food safety and assurance of quality, A.I. is dominating. These technological advancements used by the top Giants of the industry are proving that the food industry is moving towards automation.

## Recognition of New Trend Among Consumers During Pandemic

One major change that has been observed by major e-commerce food businesses in this pandemic is transformed consumer behavior towards their diet. The data which normally helps food e-commerce companies to identify the demand across varied demography according to the varied seasons has changed immensely during the pandemic. When fresh data was analyzed they found that Pandemic created a demand from consumers to order plant-based more diet than meat.

That might be the effect of Covid-19. Every day some new news was only making the decision tough to rely on meat products for major consumers across the globe. Even countries where lockdown was not implemented initially started to see this same trend been coming into the picture slowly and thus stayed for long. And the moment meat-based products picked up the pace the new Covid-19 spread in few countries and again that reluctance became obvious.

Consumer suddenly after staying in a home for few months prioritizes their health. There was a sudden spike in knowing the food products they ordered. From origin to nutritional value they want to know the maximum about it. This is another challenge in the new age. Responsibility towards developing and sustaining their brand image by safeguarding the food traceability mechanism with advanced computer-based solutions in this digital age. It should be considered a positive sign for our regional and domestic markets as it will drive healthy competition among food industry players.

## Pandemic-New Safety Protocols for Food Industry

Even standing today in the January of 2021 Covid-19 is still a threat to the food industry. To quote an example major food

manufacturing units from cold-chain segments employee detected Covid-19 positive. Due to this various countries stopped or put ban until the situation comes to normal for the import of cold-chain products. In another incident, France in December 2020 placed 48 hour hold for British citizens to enter the country. Also, all the trucks/freight was asked to halt for the same time.

All this is happening not because food products got infected but it's the fear of the unknown which causing all this. Due to this, governments across the world have implemented stricter new safety protocols for the food industry. This is applied from farms, slaughterhouses, plant factories, etc to the delivery people responsible for delivery to the consumer.

These guidelines have to be followed by every individual from the food and supply industry. They have to follow social distancing, have to wear masks all the time, and wash hands as and when necessary along with other norms. Regular surface sanitization and daily temperature checks have to be recorded. Surveillance for food safety and regulations increased due to similar situations as mentioned above increased in the year 2020.

Countries are keeping a very close check using digital solutions in terms of imports of food products. A.I., IoT, and Blockchain technologies have been turning jobs quite easier in recalls for regulatory agencies and companies as and when necessary during these critical times. That's why the food industry's demand for advanced digital solutions has grown multifold during these past years.

Let's look at the importance of some the crucial digital methods for Food Traceability in this Pandemic.

## Radio Frequency Identification (RFID)

Here radio waves identify objects automatically which don't even need a line of sight to do this. RFID tags are used which has a microchip that stores data, an antenna that receives and transmits the data. Both components are encompassed in a substrate. It helps manufacturers, distributors, and retailers schedule product delivery efficiently as RFID provides real-time information.

RFID tech was used by Wal-Mart stores Inc. and also it was the first major company to implement this tech in supply chain management. In the following year (2006) BT Foodnet network which is an arm of the UK's British Telecommunications group launched RFID Network for its food industry. It developed an ecosystem that helped manufacturers and retailers 24\*7 to access synchronized product data of all stock items which are essential to the supply chain. This helped lower the cost of recalls. [2] RFID system contains 3 main components:

- 4.1 **Computer System:** First step CS performs is receiving information from the reader. The second step is to store and interpret data.
- 4.2 **Reader:** The third step transmits and receives audio frequencies. The fourth step involves the broadcasting

of radio signals which activate the RFID Tag to retrieve and update information.

- 4.3 **Tags:** As the name suggests data is transmitted on the tag's microchip by a radio antenna. It may be read frequently. It has read-only tag information (ex: serial number) which cannot be changed or read-write tag information that can be altered with or updated as per the need. Further in terms of power source tags can be classified into 2 categories Active/Battery powered and Passive/No Battery.

Battery tags are encompassed with a battery that powers the internal circuitry and antenna. These tags have a sensor that monitors various conditions (ex: temperature) and maintains a record. Its transmission range spreads up to 100m. These tags are expensive so far due to lower demand.

No Battery tags are powered by a reader's incoming radio frequencies which generate an electronic current to power the circuit and transmit a response. These tags have less transmission range up to 3m and due to that do not contain sensors. They last longer than active tags. That's the reason for them to be used extensively and due to this demand; they are cheaper in terms of cost. [3]

Following are the applications of RFID tech in food traceability:

- 4.1.1 Tagging of Animals.
- 4.1.2 Tagging of pallets, boxes, and items for Inventory Management.
- 4.1.3 Tags with battery for Temperature Control.
- 4.1.4 Modern days Apps providing Personalized Nutrition services that track macros when dieting.

## Artificial Intelligence

This Pandemic brought a great deal of the population of the world Online through the Internet. This in itself is talking about enormous data that have made food-related applications and websites clear at a glance that customer needs have changed. So this demand has brought a new challenge. The challenge is to figure out the change in the preference and taste of the consumers.

It has to be defined early as that is considered Gold from a retail owner to the manufacturer. Artificial intelligence has taken data and its science which speaks through the computer in such an informative manner that it has become easier from boosting farm produce to bring it on the plate of the consumer with utmost safety and care.

Various existing and new companies are also researching A.I. capabilities in managing Food Waste. It will help to identify overproduction which in turn will suggest ways to manage the supply to the population where the demand of the food is needed the most.

This way will help in reducing the tremendous wastage of food. India is the best example when it comes to the

percentage of reduced waste per farmer from the produce of food grains especially. Without using any technology people from farms to cities are connected with such a network that a very low percentage of their rejected quality from the wholesale government-backed markets goes to waste.

In the first phase rejected grains are then bought by some other buyer who supplies to retailers in tier 2 & 3 cities. The last rejected lot is used and distributed for animals. Imagine the scope which can be created here if someone tries to develop and test an

A.I. based system to revolutionize this segment.

How A.I. is applied to our food supply chain can only be understood through various examples of industry-specific stages. They can be explained in detail here:

### *Food Market Analysis*

Here lies the Gold which is extracted using A.I. from the information scattered in huge consumer's behavior data towards food products. It helps to define consumer

demand at the pre-production level geographically. For example, Castograph A.I. after analyzing data at the pre-production level pinpoints the taste/flavor base for customers along with their preferences. Further helping in creating groups based on demography.

### *Boosting Farming & Agriculture*

A lot of A.I. based startups and companies are helping farmers to make informed decisions. Using drones which are encompassed with sensors collects data. With A.I. applied to data it helps to analyze the characteristics and biomass of a plant. Provide more information on irrigation and pesticide timing.

Further helping to determine when they will ripe and ready for harvest. A.I. has brought a new revolution in automated farming machines. It helps immensely to monitor temperature and other factors remotely important to the farming industry to achieve a better yield.

### *Automated Food Sorting*

This elevated the process of food sorting by reducing error percentage and labor cost. Also, it improved the standards of the yield during this cycle. A.I. -enabled machines to help a manufacturing unit to sort a fresh yield of potatoes as per its requirement. That majorly sorts them for chips and French fries.

### *Guiding Employees with Personal Hygiene*

Imagine, that in this pandemic, using A.I. in a restaurant; an owner or manager can be informed by software that which employees are not wearing head and face masks while in work-shifts. This has been made possible by one of the best companies of the

A.I. segment known as KanKan. It is a wholly-owned subsidiary of Remark Holding, Las Vegas that established a facial & object recognition system for 200 restaurants that fall under Shanghai's municipal health agency. [4]

## **Blockchain Technology**

It has not only improved traceability but tremendously reduced time for tracking a food product from the store to its source. The technology got its birth from the cryptocurrency Bitcoin. The benefits that it brings to an industry reflect in their production and management results year on year (YoY). This helped companies to quickly figure the stalled food supply chains and remove/recall food items immediately before they put consumers at health risk.

IBM brought major change with the early adoption of this technology. Famous companies such as Nestle, Wal-mart, Dole, Driscoll's, Tyson, Unilever, Alibaba, Consensus, Ardamurchan and many others joining to form a consortium that uses this technology for traceability to enhance more confidence and authenticity for their products among their consumers. Ways Blockchain applications can be implemented are:

### ***Food Traceability***

The major role Blockchain has played as an application is for food traceability. It makes the process more transparent and runs digitally. Blockchain consists of nodes/ends which are a representation of an individual/entity that has supplied the food item/s to the store/s. When a farm's produce gets affected, blockchain tech quickly pin-points the exact location where the farm's infected food item/s were delivered. The tracing process which used to take 5-15 days was reduced from few hours to even seconds. Thus this technology helps to prevent infected food item/s to be sold to end users/consumers.

Nestle, one of the members of the IBM Food Trust, is expanding its luxury-segment coffee brand-Zoegas using the Blockchain initiative. IBM Food Trust acted heavily and responsibly with blockchain for various food conglomerates. In the Wal-mart scenario, initially in tracing the food products origin, it took 7 days and after applying blockchain it takes less than 2.5 sec.

Another challenge was to teach suppliers how to enter data in the app. That was covered by IBM which offers an orientation course to the users. A solution to that was explained by Molly Blakeman, the Wal-mart spokesperson. This futuristic approach has led existing tech companies and new startups to do more food industry-based research and develop more possibilities through blockchain which can enhance production and reduce human error.

Many new innovative start-ups, a few years ago, widened the global reach of blockchain-focused on traceability. Darren Wang, a Google alumnus, started OwlTing in 2017 that connected customers to buy the farm produce directly from the farmers thus fulfilling their food safety concerns with accurate traceability. Another company Ambrosus from Switzerland provides Blockchain-powered IoT ecosystems.

It is also leading global markets by delivering quality assurance for Food, Pharmaceutical and Chemical industries.

### ***Solution for Agri-Commodity Management***

With blockchain technology, this kind of solution was unthinkable until December 2016. A fintech company formed in 2015 known as AgriDigital from Australia executed the world's first-ever live settlement of a physical commodity on a blockchain between a grower and a buyer. The grain quantity was 23.46 metric tonnes. [5]

Moving into 2017 the company received a \$5.5 million Series-A funding to expand into North America and presently spread across various countries. Today more than 7000 participants that include farmers, bulk handlers and traders are using their services. They have transacted volumes of 27.33 MMT with \$3988 million in transaction value.

This section is distributed which makes it complex. And with the presence of multiple participants, it was a challenge for major food producers and exporter including others to complete a trustworthy deal in a lesser time frame. Due to this innovation through Blockchain, now it's possible to complete such transaction which normally takes weeks and reducing credit risk to farmers/growers.

Craving for competition and finding different approach for solving a problem bring definite results. It's a clear indication how new startups are geared up to bring new reforms to food traceability. Louis Drefus Company based out of Rotterdam in December 2017 sold U.S. soybeans to China. This whole trade/sale was also done using blockchain.

### ***Secured Networking for IoT Devices and Farm Management Software (FMS) in Agriculture***

A farmer or a large-scale farming company requires IoT devices to track the development of their crops. These devices also keep other equipment safe and secure. These devices gather the data based on weather, soil and plant conditions and store/records them. In recent developments, some devices can now forecast natural calamities. But these devices pose a threat even today of being hacked. In most of them, they are still relying on cloud-based services for storing the data which vulnerable to cyber attacks.

Farm Management Software (FMS) will be widely used soon. This software is developed to use the typical client-server model for operations. However, due to this loop, this is also quite sitting open to cyber attacks.

Blockchain if applied here in both contexts can provide a greater level of security to the entire system as it cannot be breached and copied to create a back door cyber- attack also to corrupt the data. Blockchain can safeguard FMS and IoT devices by inducing an impenetrable networking system. Another benefit will be the time and money it will save on final yield for both a farmer and large farming companies.



## Conclusion

A conclusion in this pandemic for such an immense topic cannot be concluded easily. It is just the beginning of a new era for revival from this pandemic. However, we should be thankful to everyone involved in researching the problems at every level of food production and distribution. Developing new software-based applications using new algorithms, A.I. machine language etc to find the solution to the problem. This paper analyzes the crucial technologies which are proving to be humanity's best friend in terms of traceability of food item/s. The most efficient are the ones that are using the combination of all three are Blockchain, A.I. and IoT. A.I. is impacting heavily to safeguard the production, especially during transportation. On the other hand Blockchain due to its adoption in recent years is still has a larger scope to be explored. Just imagine that if at infancy stage it's creating such a difference in tracing, what outcomes one can await to see in future.

However, Barcodes and Wireless Sensor Networks (WSN) are still used but they seem to be replaceable in coming years of growing demand and competition. Safety measures are now the responsibility of every individual from growers to

companies and governments to consumers. Whoever catches the infected or contaminated item/s or information should be responsible enough to bring it to the notice of the concerned authority. Yes, technologies play a huge role in the detection of such issues these days at an early stage. However, they help in reducing error but not eradicating it completely.

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