



Technology Group International

How safe is your food? - How technology is used to ensure food safety.

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The world food trade is worth almost \$400 Billion, (FAO: [UN Food and Agriculture Organisation](#)) we live in a time with some of the best records for food safety. Gone are the days where there was no refrigeration, canning or preserving and the adulteration of foodstuffs is rare as the legislation involved with every part of food production ensures there are stringent controls to keep us all safe. How do food manufacturers ensure food is supplied fresh and safe from the initial raw materials through to the product on your supermarket shelf?

The history of food safety

Commercial refrigeration as we know it today did not exist until the late 1800's, before then people may have used ice harvested from frozen lakes and stored in insulated ice houses. Before then we had to follow our instincts to detect food which was spoiled and there was a limited lifespan for foodstuffs.

Food safety has Napoleon Bonaparte to thank for at least one innovation when he offered a reward to find a way to preserve food for his soldiers so that they could travel further to invade European countries. It was Nicolas Appert who came up with the idea of storing food in jars with sealed lids to contain cooked foods. It was unclear at the time how the process worked however it was the start of a process of providing manufactured foods.





One of the other issues was the adulteration of food by unscrupulous traders who would supply goods which were tampered with to increase profits, for example flour cut with chalk powder or chocolate containing ground up bricks. The first legislation related to food safety was the British Adulteration of Food Act of 1872 which made it an offence to sell food, drink, or drugs that were not of the 'nature, substance or quality' demanded by the purchaser. It allowed inspectors and private individuals to acquire samples of food for analysis.

In the US the original Food and Drugs Act was passed by Congress in 1906, the act prohibited interstate commerce in misbranded and adulterated foods, drinks and drugs and was a precursor to modern day legislation.

Now there are internationally harmonised food standards maintained by Codex Alimentarius a World Health Organisation body which controls international standards for food safety. They have created standards which ensure food is safe and can be traded worldwide. The 188 members have negotiated science based recommendations in all areas related to food safety and quality: food hygiene; maximum limits for food additives; residues of pesticides and veterinary drugs; and maximum limits and codes for the prevention of chemical and microbiological contamination. (Codex Alimentarius: [Codex Alimentarius](#))

Why is food safety important?

The US has one of the safest food systems in the world thanks to the work of the Food and Drug Administration and the legislation, however there are still issues with food safety.

We all realise how important it is to ensure the food we prepare in our homes is safe, ensuring basic cleanliness and good practice when cooking and preparing food, we have to trust the high standards we employ are matched or bettered by the suppliers of the food we prepare. In the USA there are approximately 5,000 deaths per year from food poisoning (National Institute of Diabetes & Digestive & Kidney Diseases: [NIDDK](#)) which equates to 13 people per day who die due to foodborne diseases or other issues.

When things go wrong with food safety they can have serious ramifications, a recent example involves the now defunct Peanut Corporation of America who were involved with a massive Salmonella outbreak in the U.S., during late 2008 and early 2009.

Case Study - Peanut Corporation of America

PCA was a large organisation which had annual sales in excess of \$25 million and processed 2.5% of all the peanuts in America. The 2008 food contamination incident



followed a long history of food safety and quality issues, there had been reports of issues with sanitation in the company's plants since the 1980's.

In 1990 it was found some of the peanuts supplied by PCA exceeded the FDA tolerance level for aflatoxin, a mold-derived toxin common to peanuts and they were sued by two confection companies they supplied.

In 2008 there was an incident of Salmonella contamination which caused the death of 9 people and over seven hundred people falling ill from food poisoning. The incident led to the largest food recall in US history which involved 46 states and more than 360 companies which had been supplied the peanuts to use within their own products. In the end almost 4,000 different products were involved including school lunch products and even emergency meals supplied following a massive ice storm in Kentucky.

In the court case that followed it was found the company had knowingly shipped contaminated peanut butter and faked results of lab tests intended to screen for salmonella. In total as well as the closure of the company and the imprisonment of the company owner for 28 years, it was estimated the incident cost over \$1 Billion in losses to the US Peanut industry.

Managing product traceability one of the major issues with food safety is not only ensuring that the manufacturer is following correct procedures but also managing the different raw materials used to make up products.

In the PCA example the raw material of processed peanuts were sold on to many suppliers which caused a mass recall of a large number of products. It is vital that every ingredient and additive as well as packaging and processor can be clearly identified.

Therefore, it is vital that the manufacturing process includes a way to trace and record every item involved and that this information is available in the case of a recall. In modern manufacturing systems this is managed using a complex computerised system which manages enterprise resource planning.

Using software to manage process

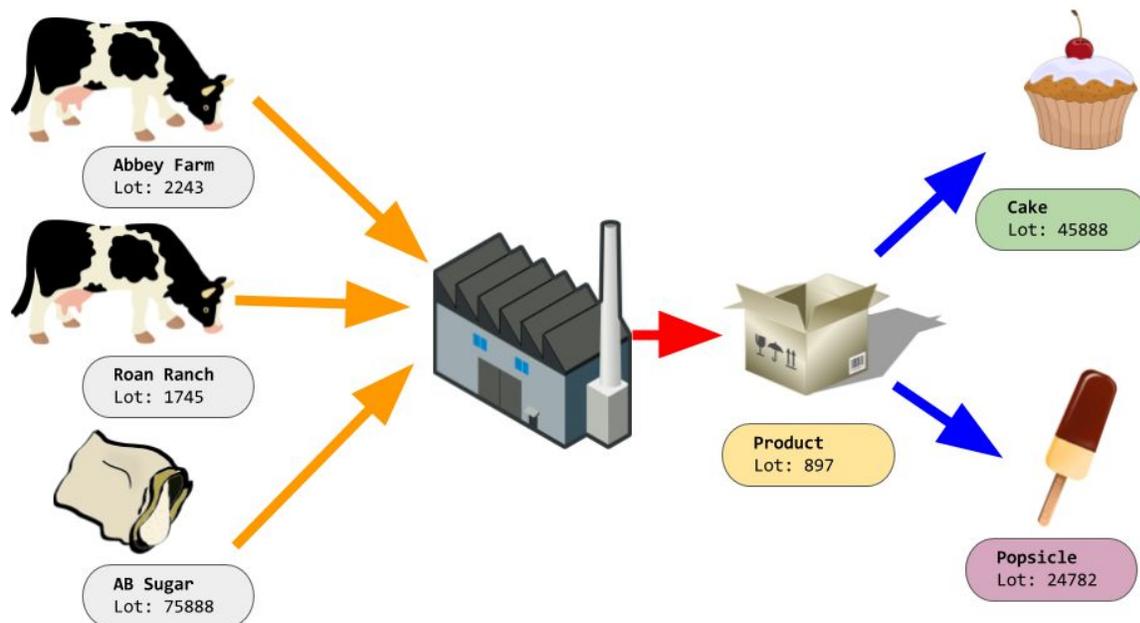
Enterprise resource planning (ERP) software is a suite of applications which automate the processes involved with manufacturing and provide a way to monitor every part of a company's operations based on a central database. It provides a way to easily monitor any element of the massive number of pieces of information involved with the processes. (TGI: [Five Critical Software Requirements for Improved Product Safety and Traceability](#))

The main tools involved with food safety management are:

- Batch traceability
- Automated quality control processing
- Product life management
- Recall management

Batch traceability

This is where the software records and tracks lot numbers from raw materials and suppliers information.



In the above graphic we can see that a manufactured product is made up of more than one raw ingredient from multiple suppliers. The finished product is part of a lot which this then itself used as a raw ingredient for other products.

If for example there was an issue with milk supplied in batch 1745 from Roan Ranch which required a product recall the ERP system would identify that this ingredient had been used within lot 897 supplied to an end user bakery in their lot 45888 and an ice cream manufacturer in their lot 24782. Without this traceability information there is a risk that all the products concerned could not be identified.



Individual elements are scanned either using bar code scanners or contact free RFID (radio frequency ID) tags.

Automated quality assurance processing

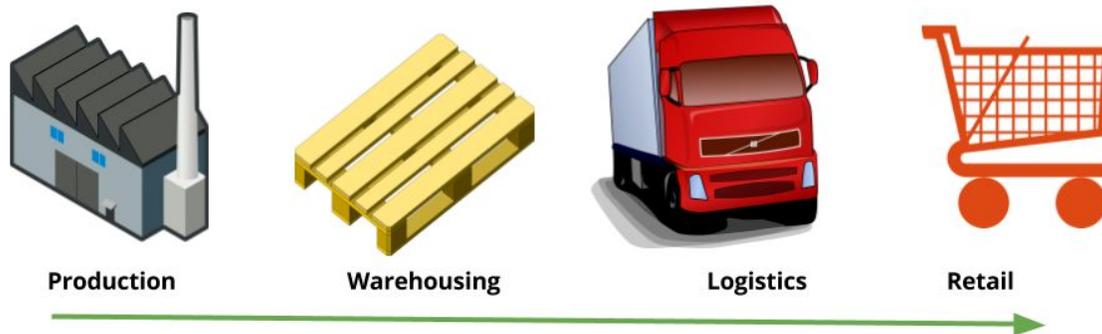
One of the vital elements of any food manufacturing process is quality assurance (QA). This is the process by which both raw ingredients and finished products are tested to ensure they meet acceptable standards for quality and food safety. These can include the following checks:

- Temperature checks - every batch of a temperature controlled product such as milk from the example above will be checked to ensure it arrives at the factory within an acceptable temperature range and it has been maintained at this temperature during the transportation process.
- Microbiological checks - to ensure bacteria levels are not harmful within the product or raw materials
- pH checks - ensuring that the product has the correct acidity or alkalinity
- Weight checks - ensuring the product meets the required weight before dispatch
- Chemical checks to guard against chemical contamination
- Metal checks to guard against contamination by metals, this is usually at the packing stage, using a metal detector
- Organoleptic checks to check flavour, texture and aroma by sampling the food product

If the product fails any of the tests it is removed and destroyed. The results of tests for each batch of product and each of the raw ingredients is recorded as part of the central software system to allow for reporting for management and licensing authorities.

Product Life Management

Perishable food products need to be delivered to the consumer to allow an acceptable time for the product to be used safely. Depending on the product this may be a time measured in months or days, however, whatever the product life it will have an impact on logistics throughout the product life cycle.



Managing the delivery of products to meet the rise and fall of demand will often require a period of warehousing as well as logistics and transportation to the retail store. Throughout this process the product lots need to be managed to ensure they arrive in the retail store with an acceptable amount of life remaining in order that the store can sell them without increased wastage.

Failing to manage the lifecycle effectively could see out of date food reaching the supply chain which could be a risk to public safety and would involve increased costs.

Recall Management

Despite rigorous testing of raw materials and finished products throughout the QA process there can be issues which are not identified until the product is already in the retail market or has been sold to the public. When these incidents occur the effective management of recalls is vital.

As we can see with the batch traceability graphic, the recall of a product may be considerably more complex than recalling a single item or batch. A problem with a raw material may have contaminated a particular batch of products produced which themselves could have been used as raw materials in other products. This is an issue which occurred with the Peanut Corporation of America where over 4,000 other manufactures products were involved.

It is vital that a manufacturer acts rapidly in the case of a recall and that they can clearly identify any product batches which could be involved and who these products were sold to. The recording of batch data in the central ERP system can be used to instantly identify



exactly which batches are affected and which customers have used these specific batches. This information can then be used by other manufacturers to identify ongoing batches of their own products and to put in place an effective recall. The process can be automated by the computer system to send reports containing information to all parties affected.

The alternative would be to require the recall of all products for all batches for a wide date range as opposed to being able to segment the recall only to items which are directly affected. Use of the computer systems allow for a considerably more cost effective and rapid recall process.

Maintaining a safe food process

There are a large number of legislative requirements associated with the manufacture of foods for public consumption (FDA: [Food Safety Modernization Act \(FSMA\)](#)) these require manufacturers to maintain safe systems and to maintain effective record keeping to ensure that standards are being effectively maintained. These records include every aspect of the manufacturing, storage and logistic process from source to the end user including temperature recording for materials throughout the process, the results of all laboratory results and product life data. Storing and managing such a quantity of data would be impossible without the software systems to manage the process, however this allows for effective management of food safety processes and reporting to licensing and regulatory bodies.

The power of ERP systems allows food manufacturers to manage their processes and food safety seamlessly ensuring that the next food product you select is safe.