

Food Traceability and the Impacts of Emerging Technology

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Businesses in the food sector today are facing many complex drivers for food traceability and must adapt or find that they are no longer relevant in the evolving global markets. Many of these changes and impacts are due to emerging technology like social media, smart technology, blockchain and the 'Internet of Things' that is permeating all facets of our daily lives. All sectors of the food supply chains need to be aware of the potential impacts of the drivers for traceability and the emerging technology to their respective businesses and the food supply chains as a whole. Whether the drivers are ethical consumers, a mother wanting nutritional information before giving a snack to a child or the need for compliance evidence to meet government regulations, understanding the changing environment and having suitable plans to meet and leverage that change is essential.

What does traceability mean?

Traceability is generally used along the food supply chain in one of two ways, either for product recalls or to support a range of product claims. The recall of branded food products is generally managed through batch codes or production dates. For non-branded food commodities (strawberries, potatoes, etc) retailers and governments generally recall the product category to alleviate consumer safety concerns.

What traceability means is different to different groups. A consumer's understanding and expectations of traceability is very different to that of a retailer, an importer, the media or government. As a business you need to understand these different traceability drivers. Without understanding what each group wants both in terms of unachievable expectations and achievable deliverables, it is impossible to make correct technology decisions for the entire food supply chain.

Consumers have a number of drivers that impact their purchasing behaviour. There is consumer expectation that food is safe and that it is the responsibility of government to ensure this safety. Traceability is considered by many consumers as a 'given' as part of ensuring food safety.

Historically price and quality - including branding - were the primary drivers for consumer purchasing decisions. If you could afford high quality products, you purchased them, if not you purchased budget products. More recently personal values or ethics are also driving purchasing decisions. These individual values or ethics include production, processing and food claims related to health, nutrition, GMO status, growing or raising, religion (Halal and kosher), environmental, animal welfare, sustainability, region (local, region, state, country or trading block), fair trade, ingredients, branding and others. These collectively can be referred to as 'emotive' claims or drivers.

Traceability along the food supply chain is an underpinning tool for emotive product claims. If a food can't be traced, it is hard to have confidence that the food is organic, GMO free, free range, sustainably farmed, grown in a specific region or district, grass feed, etc.

A lot of contradicting information is available about consumer demands for traceability. Some reports show a high percentage of consumers demanding various emotive claims for food products including unrealistic traceability demands. Do consumers really want to see photos come up on their phones of all the cows that went into the burger they are eating? Probably not. A more realistic measure of consumer behaviour is what shoppers actually buy in supermarkets. At one end of the meat section is the high value, organic, free range, sustainably farmed and fully traceable meat, and at the other is the budget unbranded meat.

It is important to be able to see through the hype related to the many different and competing drivers for food traceability and emotive claims. Enter any grocery store in Australia and you'll see most of the space is taken up by budget or everyday meat products, rather than products that have emotive claims. However, if we take this information to indicate what consumers purchase, we can be misled. It is important to measure how often this high value product is marked down for a quick sale as it approaches end of shelf life dates. Marked down products are an indication the store is over ordering products and this occurs when demand is driven by perception not purchase.

The point is not to diminish the rights of consumers to purchase food that meets their expectation for emotive claims. If consumers want free range, organic, GMO free, grass feed, sustainably farmed product and are willing to pay a premium for that product, it should be available to them. What is important is to know the real demands for traceability and

emotive product claims. It is necessary to implement programs and systems along a food supply chain based on actual demand rather than hype.

What makes a food supply chain?

Every food supply chain is different, and each country and even regions have their own peculiarities and differences. To know what traceability and information claims are achievable requires knowledge of every step along the food supply chain and the technological capability of every step. For example, what if we built and deployed an app for farmers to collect traceability information on site, only to discover there's no phone coverage, and that the farmers won't take their phones on site because the environment destroys them? This isn't a hypothetical, it really happened, and this type of poor planning and waste of company resources happens very frequently.

Success in implementing a food supply chain traceability system requires very careful mapping of the whole process in fine detail. Once the food supply chain is mapped each segment needs to have all the pieces of information related to that segment defined. The information for each segment needs to be compared to identify incompatibility and inconsistency. It is very common to find that there is incompatible data in use along a food supply chain. Organisations that have been successful are often heard saying '*We are now all speaking a common language*'. These organisations have ensured that common information standards (such as a GS1 Numbering and barcoding) have been implemented along the whole supply chain. This results in the same piece of information having the same meaning to all the participants. As obvious as it seems, having consistent understanding of information along the food supply chain is very hard to achieve. There will always be historic practices and local terminology to get around. Even in simple situations, changing work cultures and embracing fundamental change is difficult for the average worker. A long term, successful worker who is now being told they are doing their job wrong won't easily accept change.

When all of a food supply chain facets are mapped, the information is known and everyone is talking a common language the next step in the process can begin.

What is the right type of model for the food supply chain?

Knowing what and how information can be collected at each segment of the food supply chain provides the basis for what technologies to consider. The planning process also needs to consider how suitable the environment is for technology and the skills sets of the people doing the work. Implementing a technologically heavy solution in the wrong environment will result in frequent break downs, increased maintenance staff, and unhappy operational staff.

Evolving technology can provide a valuable asset in automating data collection and streamlining the traceability process, however not all technology will be the right fit for a given situation. New technology has the potential to make our lives significantly easier, but it comes at the cost of a potentially steep learning curve and will take time to mature.

The Internet of Things refers to the phenomenon of everyday items being connected to the internet, for example a smart fridge that can tell you when you're out of food or buy it for you. The Internet of Things may increase the efficiency of a food supply chain with the automation of data collection. For example, an automatic barcode scanner that can upload data to a cloud database is an incredibly valuable tool, as long as the correct infrastructure is available. Blockchain is an example of relatively new technology in traceability systems that has the potential to increase the efficiency of a food supply chain, as well as the potential to make it significantly harder if the infrastructure isn't in place beforehand.

The ideal solution is technologically invisible to the users and provides key information to make their jobs better, while providing the information needed along the entire food supply chain. Often, a cleverly implemented, low tech solution is more valuable.

Be careful of promises that seem too good to be true and putting a solution into place just because everyone else is. Even if everyone is saying 'this solution looks really cool and uses leading edge technology,' that doesn't mean the solution is suitable for every business and food supply chain.

Building a smart phone app to be used by people who frequently use smart phones, in a smart phone friendly environment and with cheap and reliable internet access is likely to be a good technological fit. The same solution in a

location where the environment is not smart phone friendly, there is no internet coverage and no support services available for the user is likely to be a disaster.

There are four basic models for traceability that can be used along a supply chain, these are;

1. **Supply chain node systems and standards based data.** In this model information is collected, processed and reported independently by localised systems. The data is then passed up and down the supply chain using agreed trading or industry standards. This is the traditional model and often only provides a one up and one down view of information.
2. **Company portals for traceability and product visibility.** In this model information is collected by a localised system and key pieces of information are uploaded into a company portal. The company portal provides traceability and product information visibility along the supply chain. These types of systems are often driven by supply contracts where each supplier in the supply chain is required to upload relevant information for a food brand owner. This is usually a low cost and low technology solution used by the food supply chain participants. These systems will often have a consumer website or app where QR or other barcodes can be scanned to display product information, emotive claims and traceability information.
3. **Industry portals for traceability and product visibility.** In this model an industry portal is used by many different sections of the food supply chain to upload and download traceability and other product visibility information. These types of system rely heavily on industry standards to ensure the information along the entire food supply chain is consistent and compatible. The Information contained in industry portals is often non-commercial in nature to ensure no commercially sensitive information is held by a third party. These are low technology solutions where the process for upload can be as complex as automated computer to computer data transfer systems or as simple as emailing standards based text files to an automated email address. These systems will often have a consumer website or app where QR or other barcodes can be scanned to display product information, emotive claims and traceability information.
4. **Distributed ledger (Blockchain) for traceability and product claims.** This model is based on information being added by each supplier as a link in the food supply chain. The block is encrypted to ensure it is not altered along the supply chain but can be read by those authorised to do so. These blocks build up along the supply chain to represent all the information related to the supply chain, products and events. This is the most technologically complex solution and requires absolute compliance to agreed information standards along the whole supply chain. If any of the information added to the chain is ambiguous or the source identification is incorrect the resulting combined supply chain data is inaccurate and it is very difficult to resolve the errors. This is the newest emerging technology and will mature over time. Currently any implementation of blockchain along a supply chain appears as proprietary solutions. At the time of writing there are no large scale, open, industry standards based blockchain systems available for the food supply chains.

Each of the above four models can be the right or wrong solution for a specific food supply chain depending on many factors. What might have been a correct solution at one period of time may not be the right solution during another period of time.

There are also biological traceability technologies available that are significantly more accurate and less expensive. The biological traceability technologies do not generally collect information but can prove where a specific food came from. DNA finger printing technology has been available for many years, and as well as being a very low cost program for livestock traceability it was in use for high volume commercial traceability for beef in 1999. Isotopic and trace element technology has also been in commercial use for many years. Isotopic and trace element technology is used by law enforcement agencies for determining the source of drugs, and has even been able to identify which side of a specific hill some fruit or vegetables were grown. It is commonly used for processed food commodities such as honey, wine, tea as well as fresh fruits, vegetables and meat.

Who pays for traceability?

The consumer always pays the costs for growing, processing, transporting and retailing food products. Brand differentiation for food products can also be considered an emotive claim. If there is brand loyalty or perceived higher

product quality, there can be a price premium associated with the brand. Food products that meet the minimum quality, traceability and food safety requirements set the base budget price. Any additional traceability and costs to meet emotive claims will increase the long term average price of a food product. There is always a price value demand curve. The more costs associated with delivering traceability and ensuring emotive claims are true, the higher the retail price. This higher price results in a lower demand compared to the lower cost similar food products. Price differentials can be a competitive advantage for some businesses if the market can withstand the higher price. Over time consumer expectations continue to change in terms of what is acceptable as the minimum requirements for quality, traceability and food safety. Retailers, brand owners and government slowly respond to these changing minimum acceptable consumer expectations and pass the costs to consumers. Understanding the costs for the different traceability models as well as the demand price curve for a specific food supply chain is very important. A company is unlikely to succeed if they choose to implement a traceability model that will result in a cost higher than the market is willing to pay.

What is the right solution for my company, organisation or supply chain?

As food supply chain participants become more technologically capable, environments become more device friendly (supporting the Internet of Things to switch to automatic data collection) and information standards adoption becomes more common, the quality of food supply chain traceability information will become better.

Companies, organisations and industries don't just implement one model, solution or technology that will then work from that day forward. The process is a long road that changes direction over time.

A well planned and implemented solution considers the entire food supply chain, the changing environments and the changing skills of the workforce both now and into the foreseeable future. The best programs always start small and build on each success while abandoning those technologies, solutions or models that don't deliver a good outcome.

There is seldom a revolution with technology, it is often an evolution made over many small unnoticeable changes. People quickly forget the length of time involved and assume some technology happened overnight. The smart phones we use today have not be a revolution, but rather an evolution that started more than 45 years ago. In 1973 a Motorola researcher used a mobile phone to call, on the public telephone network, a fellow researcher at Bell Labs. Since that time there have been a staggering large number of small incremental changes all the way through to the smart devices we have come to depend on today.

The right technology for your company, organisation or supply chain, is the technology that is compatible and complimentary with the short and long program plans of the company, organisation or supply chain. In short, know your supply chain in minute detail, speak a common language along your supply chain and use the right tools to answer the real traceability questions being asked by consumers, retailers, wholesalers, processors, importers, exporters and government.

About the author:

Des Bowler has been consulting to government, industry bodies and corporations for more than 20 years in the areas of food traceability, food supply chain information technology and food data analytics. He has been directly involved with the development of a number of Australian and internal meat industry programs for traceability, eating quality and animal health data along the whole meat supply chain. He has published and present papers around the world on food and meat traceability at the request of government and industry bodies.