Primority
CONNECTED FOOD SAFETY

White Paper

What Does Digital Food Safety Mean?

How FDA's 'New Era of Smarter Food Safety', COVID-19, and Artificial Intelligence are changing the Global Food Supply Chain.

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1. Introduction:

The food supply chain has become more complex as demand has grown for ever more diverse food choices by consumers. After all, who does not want wonderfully delicious, exotic, and healthy foods, on demand, at a fair price?

Ease of global trade facilitated by improvements in technology, transport and international travel have all played their part in generating new consumer trends with plant-based foods and 'lab grown food' in the spotlight recently. This results in many new challenges and risks.

On the digital technology front, blockchain and artificial intelligence (AI) have shown promise in traceability and other food supply chain applications. Everyone from IBM to Microsoft, Amazon and others are scrambling to exploit the opportunities that these new technologies present in a bid to secure their slice of the pie.

Furthermore, the COVID-19 pandemic has also re-shaped consumer eating, digital and social habits. The hospitality sector and its supply chain scrambled to survive by changing to delivery business models, introducing new risks as restaurants, hotels and other hospitality businesses change to new ways of operating their businesses.

Meanwhile, regulators like FDA, and certification bodies have been unable to carry out site inspections and audits due to COVID-19 restrictions, forcing them to carry out 'remote' inspections driving adoption of digital methods of testing compliance.

As the US continues to roll out the Food Safety Modernization Act (FSMA) there have been other impacts such as the Foreign Supplier Verification Program (FSVP) and new rules on Sanitary Transport, Produce Safety and Food Traceability. Taken together with regular, hard-to-trace E. coli 0157 outbreaks in Romaine lettuce in the USA we have a perfect storm of unprecedented pressures on industry.

The appointment of Blockchain guru, Frank Yiannas, as FDA Deputy Commissioner for Food Policy and Response at the end of 2018 sent a clear statement of intent to 'go digital'. The first item on the FDA's agenda was tabled in September 2020 with the announcement of FDA's Food Traceability Rule. This means that ***the food industry must digitize to survive, prosper, and protect consumers***. But what does this mean in practice?

This paper will discuss the implications of the above for food supply chains and provide insight into new developments in food safety, compliance, traceability and how technology can help. These myriad events should not be construed as events to react to but rather events to be planned for. The benefits of being proactive are very significant, providing better information for decision making, more protection against fraud and other losses, and improving overall transparency internally and externally on operating standards.

We will also discuss Primority's experience with these technologies to give you some early stage 'coal face' perspective of the new digital era of food safety.

2. FDA's New Era of Smarter Food Safety

On September 21st 2020 – FDA's Frank Yiannas announced on FDA's web site: '*Today, I am excited to announce an important, critical step forward in the U.S. Food and Drug Administration's efforts to bring about farm-to-table traceability in our food supply.*'

The FDA's New Era of Smarter Food Safety is billed as a game changer that can help harmonize the industry's approach to food traceability. The proposed benefit of this is to have a '***direct impact on preventing foodborne illness***.'.

The key strands to this plan are outlined in the FDA publication 'Food for Thought - Ideas on How to Begin a New Era of Smarter Food Safety'(1). Its key focus points are on the use of technology to improve:

- End to End Traceability in the Food Supply Chain
- Enhanced Foodborne Outbreak Response
- Innovative Communication on Traceability
- Root Cause Analysis
- Tech Based Data Analytics (Using AI to Scan External Information)
- Innovative Inspection and Compliance (E.g., Remote Audit)
- Focus on E-Commerce and Last Mile
- Promoting Food Safety Culture
- Smarter Consumer Food Safety Education

Any *one* of the above initiatives would be a major change for industry. ***FDA is going all in on the use of technology to get control over compliance with food safety standards in the pursuit of better consumer protection***. It is also evident from the above that this initiative is not just about traceability, as many assume.

Every food and related business involved will be impacted, ranging from farmers, processors, packers, importers, retailers, hospitality, and extending all the way to retail AND the consumer. Paying attention now will help prepare you for this new wave of change which has already started.

The impact of this initiative is likely to be huge, costly and take time to roll out. It is not possible to cover everything in the New Era of Smarter Food Safety here. Therefore, we will focus on Tech Based Data Analytics and the use of AI to scan external information.

Just as the FDA plans to use AI to 'scan external information' so it can focus its resources on areas of risk, it follows that ***food businesses will need do the same***. In this White Paper we will consider key concepts on how industry can do this and discuss how Primority used AI technology to successfully achieve much of what FDA are seeking to do.

3. Artificial Intelligence in Food Supply Chains

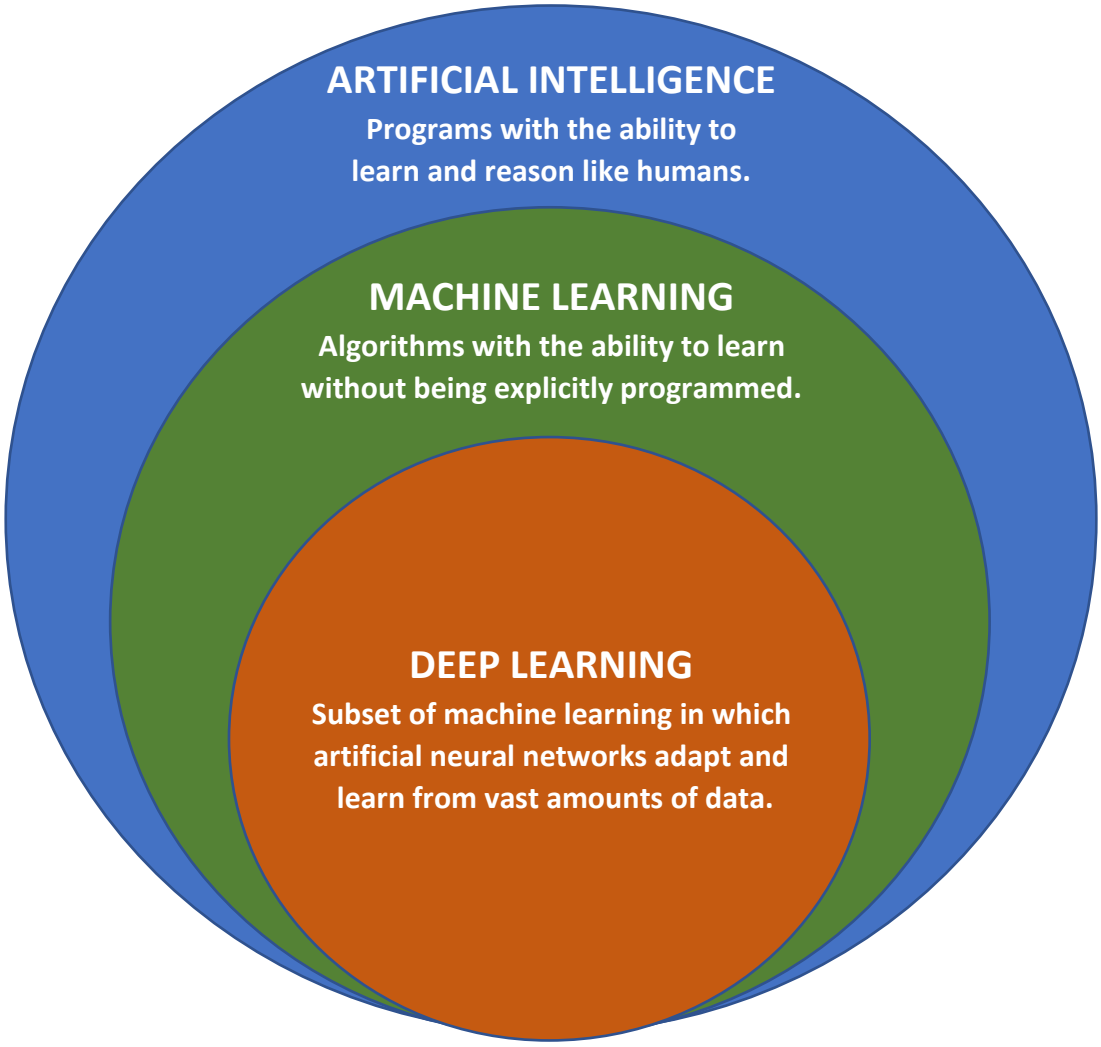
Before considering AI and its uses in food supply chains, it is useful to understand what AI is.

Investopedia defines AI as "*Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving*."(2).

This definition highlights the comparison between the 'intelligence' of machines and humans. Specifically, how computer software can replicate and exceed the logic and processing capabilities of the human brain.

This means learning like humans is a key goal in AI. Therefore, the ability to reason and solve problems by identifying patterns in large amounts of data is important.

Several layers of disciplines within AI have evolved as the technology has developed. These are shown below:



A brief explanation of each layer of AI is given below:

Artificial Intelligence: This is the umbrella term for technologies that can learn and reason like humans. This could be as simple as logical rules, e.g., in a computer system with a camera and a temperature measuring device a camera may 'look' at the sky and see a predominantly blue colour while the temperature probe senses a warm temperature. In this case the system might conclude that it is a nice summer day.

Machine Learning: This is the act of teaching the system to learn and involves feeding it enough data with existing answers or results so it can learn from those results. With this knowledge the machine can go on to predict the answers to problems that it does not have the answers to in advance. In this way, it replicates the kind of repetitive, experiential learning that humans experience. For example, on Amazon's "Products you might also like" AI is used to profile buyers based on age, location, the time of year, or even the upcoming weather pattern to sell, for example, a pair of nice warm gloves in winter.

Deep Learning: This is where a much heavier load of data is processed and typically a map of connections between the data is created by the machine, much like the neural connections in the human brain. The strength of these connections allows the machine to effectively become like a decision-making machine in the same way that humans can become highly skilled at certain tasks by massive repetition of certain behaviours, e.g., Golf professionals often take over 10,000 hours of practice to develop the necessary muscle memory get to Pro level.

AI technology can be very powerful at seeing patterns in data that humans cannot because they can work at very high speed with vast arrays of data, and they can do this 24/7 at low cost, easily outperforming humans. This makes AI a very useful productivity tool and, in the context of food safety and traceability, a potential source of intelligence on risks in food supply chains.

Existing Applications of AI in Food Supply Chains:
AI is being exploited in many ways in the food industry. Some examples include:

- **Food Authenticity – BriteScan**(3) "*uses state-of-the-art Computer Vision (CV) and Deep Machine Learning algorithms similar to fingerprint and facial recognition applications. Cloud-based AI software automatically evaluates all visual aspects of the [food product] images, including colour, texture, and size, even that which is not detectable by the human eye or even a microscope. Because it evaluates materials at a pixel level, it can authenticate species and tissue type, detect adulterants such as fillers and filth, both biological and non-biological*."

- **Crop Disease Control & Productivity** – **AppHarvest**(4) "*Uses camera sensing technology with AI-driven ripe detection to harvest only fruit that is ready using robotics and an indoor farming model that uses 90% less water and no pesticides. This leads to better yields, less food waste and contributes to sustainable farming to help feed a growing human population*."

- **Artificial Intelligence (AI) Imported Seafood Pilot program** – **FDA**(5) – "*The U.S. Food and Drug Administration has launched the second phase of its Artificial Intelligence (AI) Imported Seafood Pilot program. The pilot is designed to enhance and improve the agency's ability to quickly and efficiently identify imported seafood products that may pose a threat to public health. This is especially important since the United States imports upwards of 94 percent of its seafood supply*."

- **AI Powered Food Supply Chain Monitoring** – **Primority** (6) – "*Primority have built an AI Powered supply chain monitoring solution called AI Scan which gathers data on food safety alerts, incidents, and regulatory compliance issues. The system risk assesses and analyses the information using a combination of algorithms, AI and a unique technology called Anomaly Detection to spot supply chain issues*."

- **IBM's AI assisted e-tongue Could Fight Food Fraud – IBM(7)** – "*IBM Research is currently working on Hypertaste, an electronic, AI-assisted tongue that, researchers say, draws inspiration from the way humans taste. Because liquids contain many different molecules, IBM said it is therefore inefficient to identify each separate component. Instead, Hypertaste uses 'combinational sensing' – an approach that resembles our natural senses of taste and smell. A mobile app transfers the data to a cloud server, where a trained machine learning algorithm compares the digital fingerprint just recorded to a database of known liquids. The algorithm figures out which liquids in the database are most chemically similar to the liquid under investigation, and reports the result back to the mobile app*."

AI technology is being deployed to help solve a diverse set of problems related to productivity, food safety and quality, authenticity, food fraud and food supply chain risk management. The total AI technology market is growing at 16.4% pa and the industry is currently worth $325bn and set to top $500bn by 2024(8). As food represents most of the manufacturing worldwide, a very large portion of AI technology will be employed in the food sector and generate tremendous value.

4. Blockchain, Are We There Yet?

Blockchain is an incredible technology because it is a secure, immutable record of transactions. This is important as it makes it impossible to fraudulently change and manipulate data.

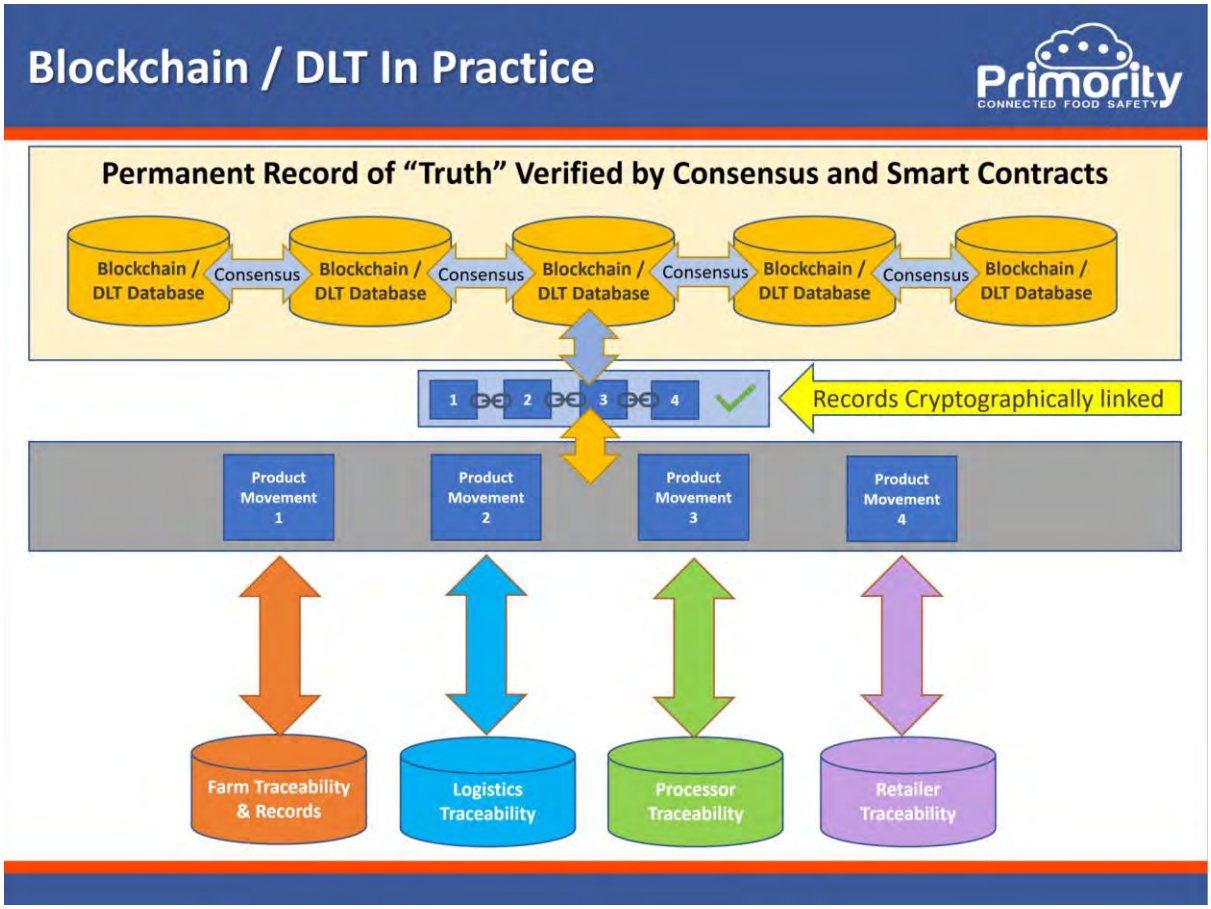
Some critics have doubts about the provenance of the data entered on a blockchain. Whilst this is a valid point there are technologies available which focus on this issue. For example, most people have digital identities, and a vast number of people, machines, computers, devices, and appliances have a digital footprint, even a digital fingerprint. Therefore, the identity problem with digital ledgers is universally solvable. Banks already solve this problem by using 2 factor authentication (2FA) when conducting financial transactions by relying on the digital identity of your personal cell phone.

Blockchains, otherwise known as Digital Ledger Technology (DLTs), are a secure database technology made up of cryptographically verified and locked 'blocks' of data. Any kind of data can be stored, or referenced, in a blockchain and the data itself is used to create a cryptographic key. This cryptographic key (crypto-key) means that if the data in a 'block' was changed then the crypto key of that data would not match with the data itself. This simple concept means that the data is secured by its crypto key and because the crypto key is extremely difficult to crack it becomes impossible to change data on a DLT, thus, its immutability.

The blocks of data are then 'chained together' using their crypto keys, thus the name blockchain. This means that if one block of data was changed, the block before and after this block would also need to be changed. This makes the entire chain of data unchangeable as you would need to de-crypt the entire chain of data, making it an impossibly long and difficult task to complete. It is like having to crack the code of every safe in the world at the same time just to steal the money inside the safe which you are trying to break into.

Computer code called Smart Contracts are used to validate blockchain transactions by validating the entity which submitted the data. Smart Contracts are also used for a variety of tasks, like verifying data to be added is valid. This is called Consensus and it helps ensure that the data stored on a blockchain is accurate, verifiable, and propagated throughout the digital ledger to all its copies.

The diagram below illustrates how a DLT blockchain works in the context of traceability:



The above represents the concept that Frank Yiannas (then at Walmart) pioneered together with IBM in their pilot of Food Trust, enabling traceability of Mangoes and Pork throughout the supply chain and reducing the time to trace products from days to seconds.

Moving anything from paper-based systems to digital systems will get this kind of speed improvement, blockchain or not. The main point is that ***the length of time taken to trace where a product came from, and went to, is highly correlated to hugely increased costs and consumer damage***. In other words, the longer it takes to trace an adulterated product the higher the cost of recall and the health effects. The average direct financial cost of a food recall in the US was estimated at $10m by the GMA (9), and this was in 2011.

What is different about DLT blockchains is that they cannot be easily tampered with whereas a database or piece of paperwork can be easily changed and manipulated by unscrupulous parties. This is important if food supply chain data is to be trusted and is why blockchain technology has value.

With food fraud costing the world economy a minimum of $15bn pa (10), trust on its own can be risky. This is especially the case when buying food products, ingredients, and packaging from the other side of the world and you may receive fake, adulterated products, ingredients, or raw materials.

Digital Ledgers therefore have solid use cases for traceability, movement of money and goods and are set to be a major factor in the digital revolution. Many solutions are already available and making significant impact on global food supply chains. Here are just a few examples:

- **IBM Food Trust™** – "*IBM Food Trust™ is a collaborative network of growers, processors, wholesalers, distributors, manufacturers, retailers, and others, enhancing visibility and accountability across the food supply chain. Built on IBM Blockchain, this solution connects participants through a permissioned, immutable and shared record of food provenance, transaction data, processing details, and more*."

- **Ripe.IO** – (12) – "*Ripe.io uses blockchain to increase transparency in the food supply chain. The Ripe.io blockchain ecosystem has a variety of tools to map the food journey, including supply chain tracking, secure data aggregation, brand quality verification and sensor and IoT integration*."

- **GreenFence** (13) – "*The Greenfence platform uses ledger technology to authenticate and trace all actors in the food chain-of-custody process. The software identifies and certifies the people, locations, distributors, equipment and anything else involved in the farm-to-table process to ensure that quality standards are being met every step of the way*."

- **OriginTrail** (14) – "*OriginTrail is an ecosystem dedicated to making supply chains work - through championing standards supporting a universal data exchange (interoperability), connecting rather than replacing legacy IT systems (interconnectivity) and ensuring data immutability by utilizing the blockchain technology (integrity).*"

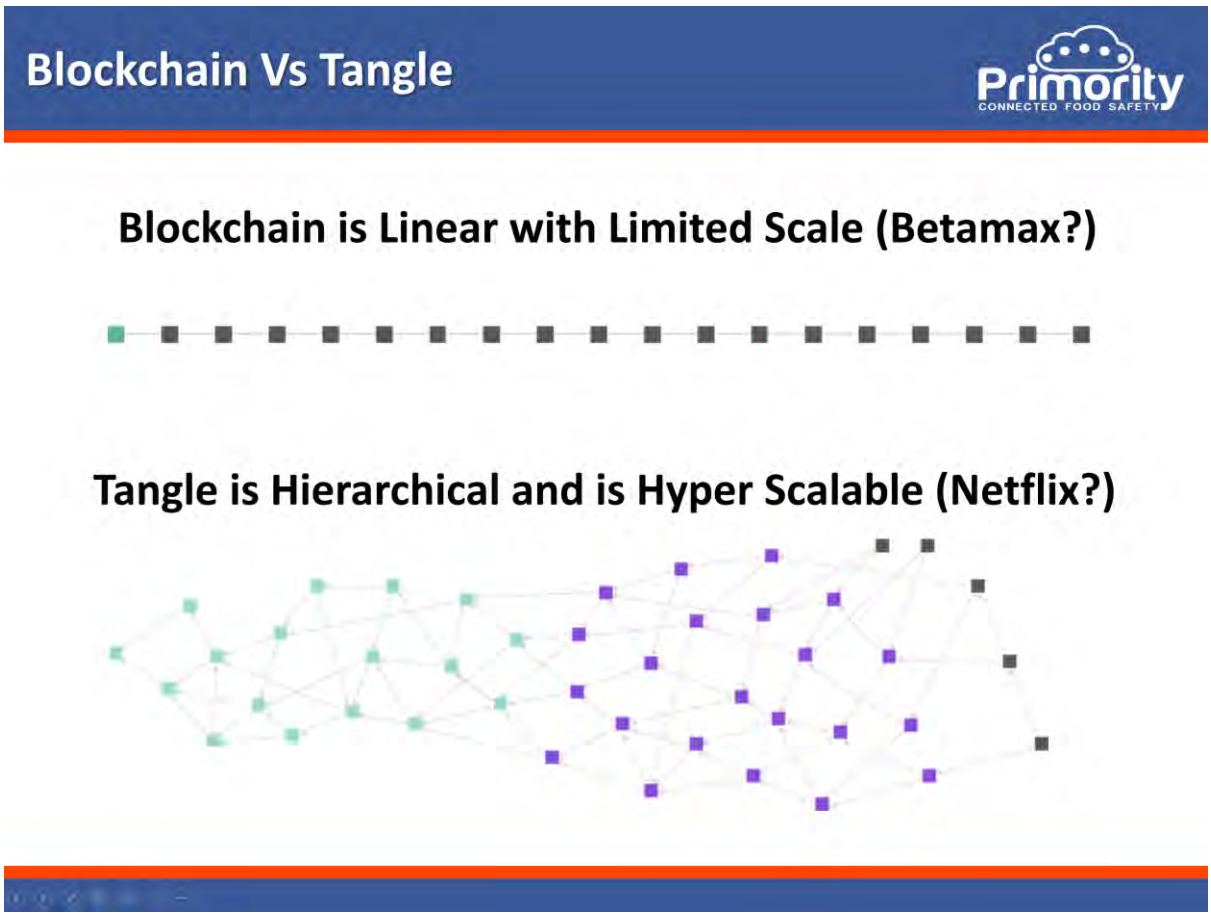
- **Ambrosus** (15) – "*Ambrosus is a public permissioned blockchain ecosystem with more than 500 decentralized node operators securing the network. Robust and scalable by design, the Ambrosus blockchain is optimized for interconnectivity with IoT devices, sensors, existing ERP systems, and other enterprise management softwares.*"

Not all blockchains are the same and can be broadly classified into two types at present; Linear blockchains and Tangle's.

The main differences between the two blockchain technologies are that Linear blockchains hold data in a Linear chain, whereas Tangle blockchains can store information in a hierarchical (and directional) way. In principle, a hierarchical Tangle blockchain would be a better fit for the hierarchy of a food supply chain, whereas linear blockchains are potentially limited to 'straight lines' of data. Tangle based DLT's therefore have greater possibilities for the complexities of food supply chains.

Nonetheless, all current blockchain technologies are silo'd due to a lack of interoperability. They are the equivalent of Betamax technology in the movie industry. Just as Netflix evolved

to largely destroy the VCR, DVD, Blue Ray, and Cable TV markets. The same is likely to happen with existing blockchain technology as it is still early in its evolution.



The urgency and disruption of COVID-19 may have dampened the hype around blockchain and DLTs a little as the world focuses on the important and urgent COVID-19 pandemic but DLT blockchain technology has not gone away. DLT companies are working in the background building traction, becoming mature and gaining acceptance. It is therefore highly likely that the wider food industry will be interacting with them more very soon.

5. Staying Afloat in an Ocean of Data and Dealing with Data Silos

Big data has been with us for some time but its use in food supply chain compliance is only beginning. There is an ocean of data available on the internet, within your company and in specialised database applications behind paywalls. The first challenge is finding the data that is useful for you. The next challenge is transforming the data into a useful configuration for your use case. Then there is the problem of ensuring that the data is accurate, up to date and of high quality. These are all very significant problems.

In almost all cases the data we need for food safety compliance is stored in multiple places, in different formats, and languages and none of these data sources 'talk to each other'. These data silos are the most significant issue, and these barriers slow down the rate of digitisation. The table below provides examples of these silos and some of the problems this causes:

Data	Location	Problems
Raw material specifications	Supplier, Company emails, spreadsheets in network folders, separate systems	• Data might change and third-party holders of data may not be aware of critical changes, e.g., allergen risk. • Data is locked up in email and network folders and valuable information is hard to extract, e.g., List of materials with ingredients that have a certain Country of origin.
Traceability data	Supplier, your Company, email, spreadsheets, paper, network folders, separate systems	• Time consuming to carry out trace back or forward leading to higher recall costs and risks.
Supplier / raw material approvals	Your Company, email, spreadsheets, paper, network folders, separate systems	• Data is locked up in email and network folders and valuable information is hard to extract, e.g., List of suppliers who are approved for use with certain customer products.
Supplier alerts and recalls, import alerts and border refusals	Various regulatory databases throughout the world, e.g., US FDA, UK FSA, Canadian CFIA, Australian ACCC, EU RASFF.	• Data is in different formats on public web sites and hard to access. • Interpreting and understanding multiple data sources is difficult as there is no standard to how alerts and recalls are described. • Suppliers may not be named so it is difficult to know if you are affected. • Analysing the hazards and supply chain risks from multiple data sources is a very big task and not feasible for most companies to do.

		• No globally used method of food categorization making it hard to analyse.
Regulatory / Certification inspection data	Regulator website, e.g., FDA Dashboard, Standards owner website, e.g., BRC, SQF.	• Most regulators do not share inspection data (FDA being a notable exception). • Where information is available there is no standard format and no easy way to access and analyse this data.
Internal food safety and quality data	Documents and spreadsheets stored on individual PCs, network locations or a siloed software management system.	• Data may be captured, costing time and money, however little value is realised as the data is not easy to analyse, being locked up in individual files spread throughout the business. • Trend information is not real time as staff only capture snapshot information and cannot join it with other data to see the big picture and to spot trends which can be arrested before problems occur. • Automated alerts, notifications and escalations are not implemented, defaulting to human responsibility which results in unwanted but preventable problems.
Corrective action data	Typically captured on spreadsheets or a siloed software solution.	• NCRs, Corrective and Preventive Actions are not related to suppliers, internal processes, people, documents, and customers leading to poor tracking and trending. • Little management engagement or visibility of workload leading to important issues not being dealt with and causing problems.
Risk data	Spreadsheets and third-party systems.	• Risks are logged in spreadsheets but rarely reviewed over time to establish changes in risk. • No single view of risks across the supply chain or business means it is hard to prioritise resources where they are needed to minimise risk.

The examples above provide a glimpse into the problems with big data and show that a major barrier to digitization is disparate, scattered data sources like Excel spreadsheets, Word documents and multiple, individual applications. ***Interoperability is therefore the real problem which needs to be solved to <u>really</u> get on top of supply chain compliance and risk***.

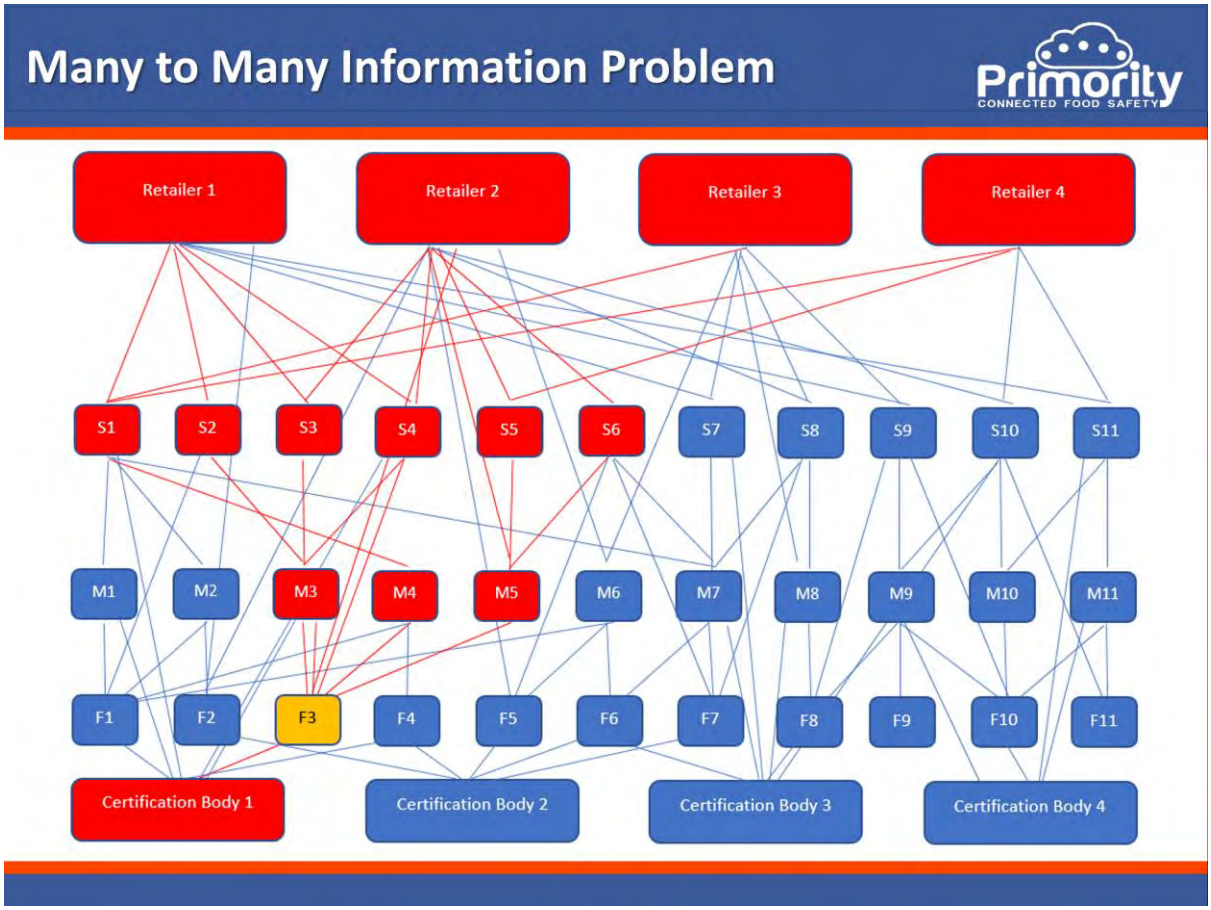
Organisations like GS1 see themselves as key to this problem but adoption of GS1 standards by smaller food firms is not trivial and presents a barrier to adoption due to the costs and IT technology resources involved.

GFSI benchmarked and other standards like SQF, BRC, ISO22000, AIB and others attempt to solve these problems by taking a standardised food safety management system approach. Complying with these standards takes results in a lot of work, effort, and hidden cost by food businesses. However, the standards themselves often encourage a silo'd approach, by implicitly specifying different standalone 'modules', like supplier management and traceability, and failing to advocate a digital and data centric approach to the problem.

GFSI benchmarked standards urgently need to review this approach to help modernize the food sector by encouraging an integrated approach to food safety management through digitization. The FDA's New Era of Smarter Food Safety is set to be a catalyst for this change as their influence with GFSI is significant.

6. The Many to Many Problem

One root cause of many inefficiencies in the transfer of supply chain information, is the 'many to many' problem. The best way to explain this is that suppliers in the food supply chain are required to send, or submit through an online system, the same information to many customers. When a food safety problem occurs multiple levels of communication are required to try to trace the source. This is not always easy as traceability standards vary and products are mixed in the process, e.g., Romaine lettuce. The diagram below illustrates this:



The 'many to many' problem is driven by using a 'one up one down' traceability model, as is the industry standard required by regulators and GFSI standards alike. It creates significant duplication of effort which adds to the overall cost of compliance and ultimately results in higher costs and food prices. This duplication takes the form of:

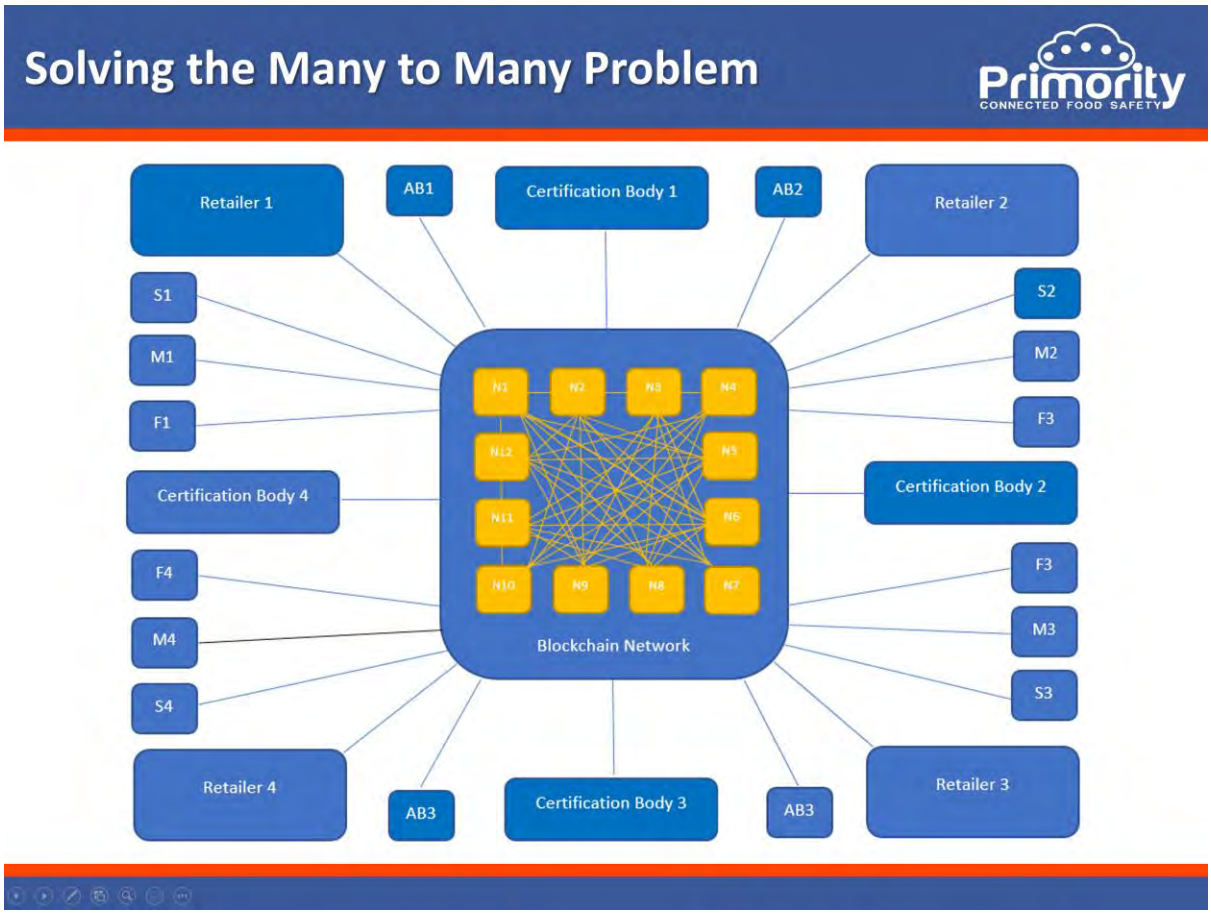
- Supplier Approvals
- Material Specifications
- Certification
- Supporting Documents, e.g., HACCP plan
- Certificates of Analysis
- Traceability Information

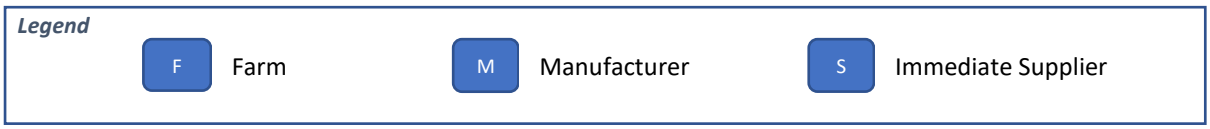
This problem creates additional work, and costs, for suppliers and customers. Suppliers then find it difficult to track the information they sent to customers and vice versa. The risk is that changes can easily happen in the supply chain without customer notification, causing unwanted, costly recalls, product rejection and consumer harm.

This problem could only be solved if everyone used a common solution to send their trace data and documents. In the real world this will never happen without regulatory pressure. Therefore, the FDA's New Era of Smarter Food Safety represents a big step in the right direction, but it will take a long time to come to fruition.

Meanwhile, blockchain and DLT are making limited inroads to the 'many to many' problem through solutions like IBM Food Trust and other block chain solutions. However, silos remain due to IBM working with mainly large retailers leaving smaller producers out of the opportunity due to their limited IT budgets.

A global, centralised system like the one shown below would be effective but it would need to be very low cost to ensure that most of the food supply chain is able to get on board with it voluntarily.





The ideal solution would be a blockchain network in which all parties to the supply chain could engage and share their trace records, documents and required information. Each party would

need to be in control of who could access their information with mechanisms to verify the identity of each party and the authenticity of the information being shared.

It will take a critical mass of the world's food facilities, something akin to a Facebook moment, before the world's food facilities engage in this way.

7. Our Experience Building AI Scan

In June of 2019 Primority set out to build an AI powered food supply chain monitoring tool called AI Scan as part of an Innovate UK funded project in collaboration with the University of Portsmouth. When the project started, it was clear that there was an opportunity to access data about the food supply chain. This data was freely available under Creative Commons or Open Government licensing from various trusted sources.

More than 50 international data sources were identified. It was decided to focus on the largest and most credible sources as follows:

- US Food and Drug Administration
- UK Food Standards Agency
- Canadian Food Inspection Agency
- Food Safety Authority of Ireland
- Food Standards, Australia & New Zealand
- EU Rapid Alert System for Food and Feed (RASFF)

The main challenge was that the data was stored in different formats in each data source. There was no standard way of describing a food safety alert which made it difficult to read and interpret this information. This is where AI (Artificial Intelligence) became useful. After gathering and cleaning the data from each of the sources it was transformed into a format which AI could work on.

AI machine learning was used to 'read' the information and identify company names, product names, brands, and food safety hazards. Through an iterative process, machine learning was used to increase accuracy of entity identification to more than 90% in most cases.

Having identified the names of the companies involved and the food safety hazards other information of interest, such as import alerts and regulatory notices, was captured. The resulting data was compiled into a database of the world's food companies so that the compliance history of each organisation could be analysed, and risk assessed. Only then was it possible to analyse hazards in the food supply chain.

A configurable risk model was then created that could be used to benchmark risk across a food company's suppliers. This made it easy to identify supplier performance over time. This is important because risks constantly change in the food supply chain, as does regulation, ownership of businesses and environmental factors like war, famine, drought, and politics. All of which can have an impact on food supply chains.

To implement a configurable risk management system, it is important consider the risk appetite of the customer. After a detailed analysis, key factors were identified on how to create a risk scoring model that was flexible and created a consistent view on supplier performance. To do this the following were assessed:

- Number of food safety events over the past 5 years
- Number of allergen events over 5 years
- Number of import refusals over 5 years
- Number of regulatory actions over 5 years
- Expired Certification

Other factors considered were:

- The impact of the actual event on our customers business
- How long ago the event happened (more recent is more important)
- What factors are important to the customer (weighting of risk events)

Using the information gathered a risk scoring system was created which resulted in an overall score that was completely automated.

The result is an AI-powered supply chain monitoring tool with built-in risk scoring which can be used to benchmark supplier performance with respect to compliance and the food safety performance of each food company based on data from trusted sources.

In addition, many supply chain issues, which otherwise may go undetected, do not end up on a regulatory database. To address this problem AI was applied to web searches using the Google Search API with a customer-configurable list of keywords of interest. This helps detect other issues which our customers may want to be aware of. For example, if the owner of a particular supplier was prosecuted for fraud, food safety or child slavery. This approach yielded additional intelligence from non-trusted sources that could help detect a wider set of issues.

Finally, a deep analysis of the food safety hazard data was required to detect 'unusual goings on' that we called anomalies. A unique anomaly detection algorithm was developed which looks for patterns like 'newness', i.e., incidents that have not occurred before, or incidents that have not happened for a long time. This resulted in an anomaly score being assigned to food safety incidents which may be able to help with early detection of important supply chain issues before they affect our customers business.

AI Scan is the kind of tool that FDA refers to in it's "New Era of Smarter Food Safety". It is aligned directly with the strand of the blueprint for "Tech Based Data Analytics (Using AI to Scan External Information)". Tools like this will be more commonplace in future because they help identify and reduce risk in the food supply chain.

It is hoped that you found the information presented here useful and thought provoking. At Primority we have a vision for what the future food supply chain looks like, not only in the future, but now. If you have any questions, feel free to reach out.

8. About Primority

Primority Ltd is a cloud technology company based in Atlanta and the UK who focus on digitally integrated food safety and quality management systems. Our cloud-based 3iVerify is designed to help food companies and food importers easily manage all aspects of food safety compliance through the following modules:

- Vendor / Supplier Approvals / FSMA and FSVP Compliance.
- Automated Supplier Certification and Document Management.
- Raw Material / Food Product Approvals and Specifications.
- AI Powered Automatic Supplier Monitoring (AI Scan).
- Internal GFSI Standards based Document Control.
- Data Capture to Support Traceability, Goods In checks, HACCP and Quality.
- Fully Integrated Corrective and Preventive Actions
- Dashboard and Reporting Tools

3iVerify's modular nature and monthly subscription model ensures that customers can buy only what they need and add on additional modules as their needs change and evolve. This makes our solution affordable, quick and easy to deploy and delivers benefits quickly.

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or **Carlos Ortiz – Chief Compliance Officer**
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Appendix: References and Resources

1. “Food for Thought – Ideas on How to Begin a New Era of Smarter Food Safety” – FDA - https://www.fda.gov/media/131682/download
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