Report

Global Food Blockchain Leadership Forum, held 11th April 2018, Nottingham

Governments and food businesses strive to improve food safety and security. Operating in self-interested information silos can prevent effective communication and transparency, inhibiting information flow to consumers and the wider food chain. Food safety and security are industry wide issues and can only be resolved and enhanced by working together and innovating to reduce risks, costs and increase opportunity. Rewarding those who do the right thing can increase food safety as well as increase profitability and business growth. With this in mind, the Global Food Blockchain Initiative has been created by Dr Rachel Ward, Prof. Bob Stevens, James Flynn and Andy Kerridge with the sole aim of bringing food chain stakeholders together to create one system that everyone can use that is secure, accessible for all stakeholders and capable of independent scrutiny to improve food safety and food security globally.

Nottingham Trent University sponsored a Global Food Blockchain Leadership Forum event to explore, together with invited stakeholders from across the food supply chain, how blockchain technology might be applied to transform food supply chain operations, improve traceability, support food risk management systems, and reduce food chain costs and risks.

The event chaired by Geoff McBride from STFC was facilitated by several highly experienced keynote speakers who described the challenges faced by the global food supply chain today, explained blockchain technology functionality and shared their insights as pioneers already applying blockchain technology.

Attendees from UK retailers, food manufacturers, primary producers, packaging manufacturers, hardware and software solution providers, certification bodies and academia were asked to discuss key questions in smaller working groups relating to the potential for blockchain and other distributed ledger technologies to be of value to the food supply chain, and then how such technology might be effectively implemented by the food supply chain. The working groups were asked a set of identical questions to structure the working sessions, and this report is a collation and summation of the views expressed. The event was held under the Chatham House Rule to facilitate open and frank sharing of experience, views and opinions and as such there will be no attribution to any points made.

A proposal is now being taken forward by Dr. Rachel Ward, Dr. Donna Champion and Nottingham Trent University to establish a collaborative interdisciplinary network to enable development of an effective global information architecture for the food sector - coordinating 'proof of concept' works, trialling tools and technologies, facilitating interoperability through development and harmonization of standards, developing methods for scrutiny and verification of evidence/information shared using blockchain technology and enabling SME access and engagement.

Blockchain and Distributed Ledger Technology

What is it? – Many still did not understand what the technology actually is and what it can do

There were few food chain stakeholder attendees invited to the event who had an adequate grasp of blockchain technology and even fewer understood or had heard of distributed ledger information technologies (DLT). There was some awareness of the potential capability or functionality of such technologies, but little knowledge of limitations or resource needs.

The significant hype about blockchain, as well as some high profile demonstrations (e.g. Walmart) in a range of sectors has led to interest, but also caution.   There has also been significant disinformation, with people getting confused with Bitcoin, and comments were made concerning energy use, costs and complexity.

With this background level of knowledge, it was no surprise that there were many questions raised around the value and purpose of blockchain, e.g.

- Why do I need to bother with blockchain?
- What problem is this technology trying to solve?
- How can I measure if a blockchain is of value / robust / relevant?
- Who is the customer for blockchain technology in the food chain?
- Cost-benefit? – is it worth the cost?
- Nice to have vs. need to have
- What do we need at the moment? – do we need this NOW?

As a first step, there is an fundamental opportunity to generate and disseminate educational material addressing the basic facts about blockchain and other types of distributed ledger technology. This could be in several formats – as blog posts, publications, presentations to groups, and contributions to on-line forums.

How can Blockchain be relevant to the food industry?

There are claims that this technology can solve all the traceability problems in the food supply chain and bring instantaneous information to all stakeholders and actors up and down the food chain at the flick of a switch, including functionality such as automating restocking of domestic fridges through the Internet of Things (IoT) and so on. It was agreed that a clear path is needed to illustrate the potential and realistic applications for blockchain/DLT without getting very far into the how it might be applied.   There is a danger that people are getting lost in the detail as to whether one technology or another is appropriate to tag products, capture data and interface with existing systems, instead of considering the overall disruptive potential for this new technology, and its future iterations. Some of the questions raised below provide examples where attendees were focusing more on the 'how' the technology could be implemented, when solutions are unlikely to be a 'one fits all' approach, and will vary on the application requirements.

- How to tag/link unpackaged food or food sold loose?
- Track the package or the product?   Majority of recalls are wrong product in wrong package
- What happens to RFID after its use – eaten, recovered?? Especially if embedded in product
- What other packaging types can use RIFD apart from plastic?
- How to handle mixed pallets/picking?

What opportunities might Blockchain bring?

Blockchain is a tool for connecting and communicating securely between authorised entities. It is not going to fix something that is broken or address issues with inaccurate or fraudulent data being entered into the system. It does have the potential to speed up traceability, but only if there is a solid, 100% intact and complete traceability system already in place. Blockchain will be able to highlight gaps more exactly and more rapidly, but the gaps will still be there. The immediate opportunities appear to be improved efficiency in speed of access and degree of visibility of data, with controlled access to data that has been formally verified. That data can be anything from pesticide applications to ear-tags/passports for cows, from the temperature of the ovens in the bakery to the expiry date on a ready meal in a domestic fridge.

The critical considerations discussed varied depending on the individual's position in the food supply chain. Retailer representatives suggested that a really useful element for them would be to know that everything on the shelves is in date without having to make physical/visual checks. An automated system providing sight of products which are close to expiry, their location on the shop floor or store warehouse/distribution system would avoid errors, save costs and reduce waste. For others, real-time chill chain monitoring would be great advantage. Identifying, tracking and reducing waste overall were also seen to be important. However all these points relate to technological tools for tagging and transmitting data, and would not need blockchain / DLT. Blockchain could be used once the sensor/tag etc. technology is in place to assign data to specific source/identifiers e.g. to lock the chill chain information into the data for that specific shipment of chilled goods. So again, the attendees were confusing blockchain technology capabilities versus the developments in the tools for applying automated tracking (sensors/tags etc.).

A major opportunity identified by many attendees from across the food chain was improved supply chain mapping. This could improve efficiency as it would reduce duplication of data entry, support the collection of evidence of compliance with existing regulations, and improve food chain security by exposing fraud and non-conformance. Full sight to source would also allow application of predictive data in risk mapping, and specific integrity indicators. This vision for full sight of the food supply chain would need to be built up over time.

There was much interest, understandably, in traceability i.e. 'Where does my supplied material come from beyond my direct supplier?' 'Where has my product gone?' The ability to assure and validate back to source to support claims such as 'clean label', variety/species or 'organic' was perceived as of value and that this would be aided by improved traceability capability. Visibility of inventory / stock and linking supply chains together is a fundamental benefit as there are few devoted supply chains. For example, the beef that is used for a burger sold in a take-away restaurant will come from the same cow as a steak sold in a supermarket for example. A 'Check a supplier.com' approach was proposed as one possible opportunity. "Google maps" overlay of product recalls, and other information could make tracking more visual and accessible. It could also be used to demonstrate the availability (volume, ripeness, etc.) of produce in the chain to drive predictive purchasing models.

There are varying country food safety standards and capability, and enforcement infrastructure can be insufficiently robust. In addition, >95% food chain operators are micro, small or medium sized enterprises with limited resources. This is creating an increasing need for capability building and enablement to address the lack of infrastructure, skills and technology to improve governance and risk prevention. Implementing blockchain/DLT as a mechanic for data capture from these smaller operators would support better risk management decision-making and possibly also support harmonization in global food safety standards.

The longer term opportunities for blockchain / DL technology were agreed by many to be social transparency, governance transparency and improved regulatory control for the benefit of all stakeholders. It would enable insights into critical resources - food/water/energy and highlight opportunities to minimise waste. Access to rapid intelligence in good time will allow businesses to be well-informed and reward those who are well-intended. It will also encourage a food safety culture where people / businesses do the right thing even when no-one is looking.

Barriers to implementation of Blockchain/Distributed Ledger Technology

Many opportunities to improve food supply chain information management and risk management overall can be addressed by technologies – however, these technologies are not necessarily blockchain or other types of DLT.

The attendees discussed this in detail and were not convinced of the cost benefit argument for blockchain / DLT in the wider food chain. It was easier to see benefits for a product such as diamonds, or maybe high value foods such as aged whiskey and wine, or single ingredient products such as designated origin cheese or cured meats, but for more complex multi-component products the value of uptake was not clear. The hype around blockchain/DLT has implied that it would be able to prevent recall, provide faster traceability etc. etc. The considered view of attendees was that it could support faster traceability and smoother recalls, and but it could not prevent recall; provide more transparency for consumers but only if data was made available in the first place; support easier identification of fraud, but not prevent fraud occurring; improve the reliability of supply chain information, but 'garbage in, garbage out' principle would still apply and blockchain/DLT wouldn't stop 'bad' data being entered. An additional important question was also raised as to whether full adoption would be required for blockchain/DLT success.

One critical barrier discussed was how blockchain/DLT could bring value without impacting confidentiality of commercially sensitive information. There is a fundamental lack of trust up and down the food supply chain and a culture of confidentiality has developed with a lack of openness in sharing data on products, packaging and overall supply chain and sourcing. This present a significant transparency barrier across suppliers and competitors so identification of the types of data which could be shared beneficially without impacting security or business commercial interests is critical. Defining secure permissions will also be critical and require expert resource to establish and maintain – deciding who gets to see what information and when, etc. to support day-to-day supply chain operational needs, to permit independent scrutiny to support certification, and on demand for regulator interaction / inspection / action. It could also slow operations down if specific security clearance individuals were unavailable.

Another major cause for concern was again a lack of understanding as to the capability of the technology, and thus no basis on which to argue for it within their business organisations. Such issues were raised for example as how to manage and make transparent and/or identify genuine data entry errors as opposed to false information entered with malicious intent, and how would you detect whether sensors are giving the correct/accurate information outputs, especially if these are remote sensors located outside your business.

Other key points raised are below as needing to be addressed/resolved to permit progress:

- Risks from becoming technology dependent – need much better WiFi/internet connectivity given many food operators are located remotely/rurally; would need fail-safes/contingencies

- Costs – who pays? Requirements for start-up and implementation, and requirements for on-going costs and resources/skills were completely unclear.
- Supply chain resistance to adapt and change current practices.
- Who would be the key "Challenge owners" who are prepared to be early adopters, take the risks and invest in the technology? Who is the main beneficiary of traceability, supply chain mapping, etc.?
- Interoperability – is this a reality? Perception is that it is not, and this would be a deal breaker as getting blockchains talking to each other to "fill in the supply chain information gaps" will be key.
- Standardisation – would need to standardise systems, and the many players in the supply chain have different / competing needs / vested interests and operating standards (e.g. farm vs processor, packaging vs retailer) – difficulty getting alignment and consensus.
- How can such a system manage the complexity of globalisation and fluid supply chains which underpin the food chain? diversity in skills, technology capability, resources, country/local infrastructure/access to internet etc.
- No clear directive as to what 'good looks like' for a food chain information management system to facilitate informed decision-making by the food chain technical community when presented with a plethora of variants of blockchain/DLT solutions by the IT industry.

Threats from Blockchain/Distributed Ledger Technology

There was significant concern about the security of information. Although Blockchain is claimed to be immutable, this is not the case. Secure access and permissions was raised as a threat as well as a barrier because levels of access / security could be compromised. There was also a concern about leakage between clients within one blockchain, as well as external challenges, especially in light of high profile hacking over recent years. This concern extended to the hardware, with concerns already being expressed about security of the Internet of Things, attendees asked about security of tags and sensors.

Taking another viewpoint, transparency of information within a blockchain may actually be a threat to some sectors and the role of regulators was explored e.g. legislators ability to see data may then invite further questions. There may also be new questions arising from the supply chain itself and from consumers.

There was a sense of fear of the unknown – this is a disruptive technology and could disrupt existing business models, e.g. retailer power, industry practices, compliance structures, flow of finance, leading to unexpected changes and unintended consequences to/for the competitive landscape, status quo, existing eco-systems. There might also be a challenge to existing models i.e. reward cards. It may give more power to the consumer. Also present was a fear of blockchain being imposed by the retailers on the rest of the food supply chain with the costs being passed back down the supply chain to those least able to pay or protest and this would affect margins. This technology could create a two-tier system and remove access to market for smaller players.

The system is only as good as the data which has been put into it. There may be mistakes or deliberate falsification, so attendees flagged the need for ways to verify the information, ideally independently.

Effective Implementation by Food Supply Chain

The attendees overwhelming agreed that they needed to explicitly understand the need and value propositions for adoption of blockchain/DLT before considering implementation, so that they were equipped to explain clearly and cogently the value to their business. It is important to be able to lay out all the pro's

and cons of blockchain/DLT for their specific business, operating model, products and role in the overall food supply chain.

Many shared the view that possibilities for implementation requires supply chain mapping and integrity indicators and that this will need to be on a global scale as most supply chains include components and packaging from overseas.

Traceability was agreed as the major initial value proposition identified which should be progressed, with access to real time live data providing improved interconnectivity. Enhanced traceability through blockchain/DLT should be possible to implement quickly for simpler food processes and could positively facilitate a 'passport to trade'. High value, short supply chain examples would be a good place to start application of technology and new approaches. As technology development comes in waves, this will allow a focused benefit per wave/phases of technological development and future technology iterations to build upon proven success and value. Establishment of a tool for intra-company information integration to share baseline information on traceability, compliance, and source could be a next step.

Once traceability was established, it was suggested to start simply by utilising existing data, but in a more efficient information system e.g. data generated by the Marine Stewardship Council assurance. Targeting application of blockchain/DLT to a very specific problem and incremental implementation would offer a staged approach to demonstrate value compared to current approaches and systems.

Finding the right entry point will be key, as will managing expectations to overcome the hype in this area. Some suggested entry points were luxury food products such as Japanese Whiskey, or foods with specific supply chain problems e.g. Scottish beef, Manuka honey. There was also a suggestion to trial how blockchain could contribute to a friction-less border in Northern Ireland as a more challenging problem needing a solution, but one potentially attracting substantial funding given current regulatory changes. .

There was a strong feeling across attendees that use of blockchain/DLT to provide full supply chain transparency for traceability greater than the current one up / one down requirement must not become a regulatory requirement, but that it could be used to support more effective and efficient compliance with existing and new legislation.

How to get food supply chain engagement?

Worldwide buy-in would be needed for full adoption across the food supply chain as it is inherently global. It was unclear how this might be achieved, and some doubted whether this was even possible. Adoption by the entire supply chain will be very difficult without a "power" broker or compelling legal or compliance event / reason.

Interoperability and positive collaboration across the food chain will be required to fully utilise the power of blockchain / DL technology. This will require some deliberate coordination and efforts to develop systems with interoperability designed in up front to avoid retrospective (possibly expensive) fixes.

An area of concern shared across the forum discussions was how to involve, educate, encourage, fund, and enable the primary producer/grower/fisherman and the large number of SME's in the food supply chain. With ~95% of the food and drink businesses comprising micro and SME's, employing some 115,000 staff they are a critical part of the supply chain, with the least resources or capability to make changes unless there is

significant and obvious benefit. (2016 figures ex https://www.gov.uk/government/publications/food-statistics-pocketbook-2017/food-statistics-in-your-pocket-2017-food-chain).

There is a real risk that a "two tier" system will emerge, with the "blockchained" larger well-resourced businesses wielding the power and the "un-blockchained" who can't access markets because they are technologically excluded. As the food supply chain nearly always starts with SME's, this could also result in an illusion of supply chain control and capability when the foundations remain invisible.

This led to some discussion about incentivisation for SME's. 'Token based' incentives were suggested to encourage information sharing, and balance the investment / reward equation between those who invest but don't see much benefit and those who don't invest and receive disproportionate benefit. Faster, direct payments through smart contract were also discussed but the implications and mechanisms relating to smart contracts were not fully understood.

Overall Feedback concerning GFBI

Attendees felt that an initiative specifically addressing the needs of the food chain with respect to blockchain/DLT was Interesting and a good ambition. They felt that they had learnt a great deal from the workshop and most agreed that they/their businesses would need to address / do something regarding blockchain /DLT.

Attendees were supportive of the GFBI vision. Several attendees suggested that this work should be considered as a subset of global standards for food safety / risk management as a fundamental infrastructure development. It could be implemented following the same model as GFSI i.e. independent governance, technical advice, steering group, not-for-profit led, as in essence it has the same global impact. Making sure the project/program has the right stakeholders will be important.