

Blockchain from farm to fork

Blockchain is mostly known in finance as a technology linked to cryptocurrencies such as bitcoin. However one of the most innovative applications relates to the food sector, which can use this technology to get more transparent supply chains

Using blockchain in food supply systems is quite a recent research field. Electronic giants and start-ups are testing this technology to enter the market with a new tool to get more trusted information about what arrives on our plate.

To understand how blockchain can change our habits, we had a chat with Sharon Cittone, chief content officer at [Seeds&Chips](#), an international event held annually in Milan, Italy, to offer a wide view on the technology innovation in the food sector.



Could you explain (for dummies) how a food blockchain system works?

Imagine a kind of mom and pop store where people would buy things on credit, and the shop owner would keep track of all of these transactions on a ledger that only he or she had access to. For much of our human history, these types of trust-based relationships were the backbone of our economy, where our word was our bond. However if you were to scale this up to a sort of intergalactic general store where personal relationships weren't really possible, how would you be able to track all of the transactions? How could you trust anyone in the system, if you didn't even know who they were or where they were from?

This is where blockchain comes in. **This digital ledger is administered and monitored by a peer-to-peer network that records, observes, and encrypts every single economic transaction**, not only of money but of pretty much anything and everything that has value. Each transaction becomes a

block, the blocks form chains. As such, **no blocks can be modified without altering every other block that follows it in the chain**, and that requires the approval of everyone monitoring the system.

In a food blockchain based system, the principal is the same, though instead of cash transactions you'll see pieces of the value chain uploaded to the blockchain, every step of the way from farm to fork. All you need is a smartphone, a bit of bandwidth – OK, a lot of bandwidth – and something of value that you want to be included in the ledger.

Recorded data in a blockchain system can't be changed, this is an important guarantee. But who actually supervises the reliability of the info entered?

Fraud is always a possibility in any value chain, and no one presumes that blockchain is immune to these risks. However, IT companies are investing heavily in making blockchain a secure, reliable, and consistent system, and through their efforts and the logical structure of blockchain technology, it's actually one of the best systems for preventing fraud on the market.

As said, blockchain is distributed among many different holders on a peer-to-peer network, which means that there **is not one or a few people controlling all of the data but rather an entire network of people monitoring each transaction**. If we refer again to the mom and pop store and the ledger, it's the same concept except that there are countless moms and pops making sure that the numbers all add up, and this is a great way to make sure that nothing or no one has too much control at any given time. Moreover, blockchain transactions are immutable, or unchangeable. Once you enter data into the ledger, you can't go back and doctor it. **Of course, if mistakes are made you can amend them, but the original data that you entered remains a part of the register, and a consensus must be reached before any changes are added to the chain**. This means that things can't just magically disappear and then someone can plead ignorance: every detail is monitored and agreed upon by all of those record keepers. Finally, **blockchain networks can be restricted so that not everyone has access to the ledger**, meaning that in order to be involved in the blockchain you have to be verified and approved.

Why do we need this technological revolution?

One of the principal reasons that blockchain is being so widely embraced in the food sector is because it addresses some of the most problematic aspects of our global food system and offers a real alternative. In particular, **blockchain has the potential to fundamentally transform key dilemmas that we all face: transparency and accountability, monitoring best practices, origin, and processing integrity, market access for small producers and developing countries, and ensuring international labour standards**.

If we can track our food from the earliest cultivation stages to the end stages of consumer outlets, we know who has handled it, how it was treated, how well the products were maintained, and what the real value is. In an ever-expanding marketplace, people are increasingly asking for this information and they're making their decisions about which products they buy based on the answers. When we're able to account for every movement that a product makes, we can give people honest answers, and this increases customer confidence and ultimately, the revenue of a company, farmer, or individual.

This is particularly important in the case of fraudulent or counterfeited items, which is an enormous problem within the global food system. For example, fraud is rampant in the olive oil

industry, with an estimated **70% of the olive oil sold in the US either counterfeited or adulterated.**

These cases of fraud are not only economically damaging: **in 1981, counterfeit olive oil sold in Spain led to thousands of deaths**, after the product was found to have been adulterated with industrial grade-grapeseed oil. **Due to the lack of transparency in the olive oil supply chain, the guilty parties were hard to identify.** To address this, Swiss startup [Ambrosus](#) employed the blockchain protocol to track olive oil, [mapping the supply chain](#) and identifying the stakeholders and weak points in the system. They extensively researched the ways that olive oil can be mislabeled and mishandled, resulting in a poor quality product that makes its way onto supermarket shelves around the world.

Is this technology already used in the food sector or is still in a testing phase?

Because blockchain is just beginning to be a fully realised technology, we're definitely still in that experimental phase where we're really testing the limits of what's possible. That's absolutely true in the food system, but **there are some incredible startups that are already well on their way** to demonstrating the viability of blockchain for food and they are in turn paving the way for even more companies to enter the field.

As I mentioned, Ambrosus is doing great work on specific products and their work on olive oil, Madagascar vanilla, and cheese has been hugely informative in understanding the path that raw materials take to get to our tables. We're also really excited about [Ripe.io](#), a startup using blockchain in agriculture. **It was started by two former Wall Street financiers** who believed that blockchain could be used in more meaningful ways than just mining for cash. Their pilot project, on Ward's Berry Farm outside of Boston, **tracks and documents the supply chain of the first ever blockchain tomatoes.** They monitor the ripeness, colour, and sugar content of 200 tomatoes on 20 different plants using sensors to record environmental factors including light, humidity, and air temperature. Additional sensors placed in the buckets where the tomatoes are packed for distribution keep track of the humidity in the storage facilities.

Ripe.io has also partnered with Sweetgreen Inc., a farm-to-counter salad franchise, to track their crops and distribute the information to farmers, food distributors and restaurants to whom they deliver. The result is a higher quality product with a traceable chain of custody that can legitimately call itself farm-to-table.

Perhaps the biggest sign that blockchain means business is the August announcement that some of the largest groups in the global food chain would collaborate with IBM on a blockchain protocol designed to increase consumer confidence in their products. Thus far, IBM has delivered their blockchain platform to over 400 companies including financial services, supply chains and logistics, retail chains, governments, and healthcare systems. The food supply consortium includes Dole, Nestle, Unilever and Walmart among many others. We think that projects like these are just the beginning, and the collaborations that develop as a result are really encouraging for the future of food.

How do producers, retailers enter their data into the blockchain system?

When a product is on the blockchain, each step of its life cycle is tracked by the places and hands it passes through, so it is effectively monitored by the very people who are invested in seeing it succeed. **Practically speaking, a farmer who is part of the blockchain enters the data of his product, and the sensors that she has on her farm confirm the integrity of it for the next person down the line, such as the truck driver who comes to pick up her crop.** The truck driver will then

enter their data about the temperature of the truck's holding pen, any losses that might have occurred along the way, and the distance that they travelled to the distribution point, and so on until the product reaches a retail point.

Entering this data is as easy as having access to digital technology and being logged onto the same ledger. Inevitably, there is also a certain degree of trust involved because there might always be a way to fudge the data one way or another, and this might give some people pause. But the benefit of blockchain is actually much simpler than the technology involved: it really operates on a principle of enlightened self-interest, because the more transparent each of us is, the better we all do. Indeed, part of its beauty is its simplicity, as counter-intuitive as that may sound to people who are just beginning to learn about it.

How can consumers get traceability info from a blockchain system?

One of the great benefits of blockchain is that it can be integrated into existing technologies, such as smart labels or apps that help consumers track and learn about their food. It's as easy as having a smartphone, and getting more products that have smart labels on them, and customers will be able to find out when their products really expire, and where they come from. In addition, companies like ripe.io are pushing for even more transparency, and they make their data readily available to consumers. Traceability is becoming a highly valued currency in today's marketplace, and that's thanks to the consumer.

How will this technology affect short food supply chain systems in particular? Is its use feasible in this sector?

Short supply chains are a really fascinating aspect of the global food system because they are one of the strongest links that consumers and producers have, yet at the same time they are incredibly fragile. One bad harvest, one bad spell of weather, or one negative consumer experience can really devastate a small producer, and it's not easy for them to rebound. In addition, their costs are often much higher than large-scale producers so they are often in competition with large-scale operations; people are likely to buy stock from a short supply chain because they feel connected to the story as much as for the actual product itself.

Thinking about applying blockchain to short food chains presents a really interesting opportunity, because not only we tell that same story, but we can also show the integrity of the product to consumers through the data that they record. In addition, using technology can help protect against some of these obstacles and actually result in better, more reliable harvests. Finally, by aligning producers, distributors, vendors and consumers, blockchain can create a real community out of short supply chains and strengthen the bond between stakeholders through the information that they share.

What are the key topics of the next Seeds&Chips edition (Milan, Italy, May 6-9 2019) in terms of technological innovation in the food sector? And in particular in the short food supply chain systems?

Indeed the next edition will be very focused on blockchain for food, because it is one of the most promising areas in the foodtech world and has implications for every point in the food chain. We're also seeing a tremendous spike in the amount of interest and investment in the Ag Tech sector (precision agriculture for example), and this will be a crucial part of the next summit. Small producers and short food supply chains are instrumental in the developing world, where the vast

majority of agriculture is based on smallholder farms that sustain families and communities. If we want to make real inroads into developing sustainable food systems, we have to pay attention to these people, and develop technology that addresses their needs and the context in which they live. We are committed to focusing on food and Ag Tech, particularly in Africa.

As with the previous edition, we will devote a significant portion of our time talking about sustainable water conservation and management. Water is the fundamental element, the building block upon which everything else develops. We want to keep looking for ways to innovate in the water sector, while identifying young and talented individuals from all over the world are thinking about this problem, and bringing them all together to share their ideas.

By Loredana Pianta