

BLOCKCHAIN TECHNOLOGY FOR THE HUMANITARIAN SUPPLY CHAIN

CASE STUDY

Start Date: June 2017

Completion date: November 2019



Can distributed ledger technology help to improve the transparency of the humanitarian supply chain, allowing for more responsive management of the aid system?

THE CONTEXT

The problem:

Humanitarian supply chains are notoriously tricky to understand and manage. In a delivery context that is dynamic, global and extremely time sensitive, the procedures by which large volumes of aid are processed and tracked are often not optimised nor fit for this reality.

Humanitarian aid delivery is conducted by a large variety of agencies, each using their own systems, data sets and processes. This results in a lack of end-to-end visibility, which leaves the supply chain fragmented and opaque. The supply chain is therefore slower, more wasteful, and open to corruption than it could be, which results in overall distrust in the system. There is thus a need to improve the level of collaboration between development actors, to make the system more transparent and efficient.

The idea:

Blockchain has been talked about as a solution to the lack of data consensus between network actors. This, seen alongside the frustration of humanitarian aid agencies towards the aid delivery system, suggests that collaboration between humanitarian actors can be achieved through a private permissioned blockchain platform.

Blockchain technology can help provide an immutable "proof" in the real-time tracking of goods, from their origin to transfer and custody. A Blockchain platform would also remove the need for burdensome paperwork and the associated costs of tracking humanitarian goods.

The expected result of a blockchain-enabled platform is therefore an increase in transparency, efficiency and collaboration along the supply chain. If an interactive demonstration of blockchain technology can be made within a rapid response scenario, then its demonstrated benefits will help the development and adoption of a similar platform in the future.

The team:

DFID Pioneer:
Seb Mhatre, Dan Lihou & Olivia O'Sullivan

Tech Partner:
Datarella



Independent Technical Expert:
PA Consulting

>60%
of aid budget
is in logistics

134
countries needed
aid assistance
in 2017

\$27.3bn
Humanitarian aid
budget in 2017

THE JOURNEY


The pilot started in January 2017 and ran sets of experiments - called Sprints - which tested key assumptions. For each chapter there is either a pivot point  or a significant event  which influenced the programme. Here's a storyboard describing the main steps in this pilot's journey:


Establish the project scope

The project began with work from the Independent Technical Expert, PA Consulting, who helped to define the parameters of the Proof of Technology. In collaboration with DFID and other humanitarian advisors, the needs of users were identified through multiple workshop consultation. What quickly became apparent was the complexity and opaqueness of the supply chain, which was confirmed by DFID staff. The main aim of each workshop was to describe the process and identify "pain points" across the humanitarian supply chain. "Last-mile" delivery, which is the final stage of aid delivery to recipients in the field, was identified as the biggest "pain point" in the process.

However, it was agreed that the pilot project had to consider testing within a more predictable part of the supply chain for the Proof of Technology.

 workshop in Whitehall with DFID staff

 Tender selection process

 Minimum viable product developed for initial user feedback

Engage users with a mockup dashboard

The pilot team then wanted to understand user needs in order to create a platform they would value. This included making sure users understood the benefits of blockchain, as well as getting clarity on which features to develop further. A second Google-form was released, based on a mockup dashboard of the blockchain-enabled application. The pilot team received feedback on the usability of the interface, on how "events" should be classified, as well as general feedback on the dashboard design. Users engaged well with the software and left constructive feedback.


The pilot team discovered that the underlying technology of the platform needed to be clarified. It was assumed that humanitarian staff involved in the project knew about the security benefits of blockchain technology, but this wasn't in fact clear. Respondents also noticed that the "blockchain" part of each transaction was kept to the background, which meant that users did not feel like they were engaging with something that was more secure than a centralised database. One of the changes in design to reassure users about security was therefore to create a passcode to unlock transactions with a private key.


A third survey was sent to logistics personnel. Only three responses were received, but this helped inform the pilot that the dashboard was sufficient for their needs, although lacking a scenario in which handovers don't go according to plan, such as the refusal of shipments.


Find a suitable shipment partner

The START network found a receptive shipment partner in Atlas Logistique. However, the proposed tracing of goods delivery to Cox's Bazar, Bangladesh, was no longer able to go ahead, as there were no DFID-funded shipments scheduled during the pilot timeline. After similar issues with other potential partners, DFID became the sole humanitarian agency involved in test delivery. The pilot team attempted to test the system on aid being sent to Mozambique, which was dealing with the aftermath of cyclone Idai.

The team believed that they could track on-loading equipment heading back to the UK. However, aid workers in Mozambique did not feel comfortable taking on the additional responsibility of the project, due to the time-sensitivity of dealing with rapid-onset crisis response.

 From sourcing a partner organisation to covering a DFID to DFID transfer.

 Shipment test moved from Bangladesh to Mozambique, and then to a successful run in Pakistan

 Live in-field pilot

Conduct a test shipment

The team finally settled on testing the technology on a shipment of 304 tents from Lahore, Pakistan, to Dubai. The shipment began in May and ended in July 2019. While not wholly representative of a disaster response scenario (the shipment was to replenish warehouse stock, and did not include an Implementing Partner), it nevertheless demonstrated a successful trial of the technology. The test also successfully demonstrated that three separate organisations (DFID, the tent supplier, and the shipping company) could all work on the same tracking system simultaneously and successfully.

The test was finally able to highlight the fact that a shipment can be under inspection - which can take many weeks - but not be accounted for in the new interface. The team decided that future iterations would include shipment "statuses" that were more flexible and perhaps user defined.

Get feedback and evaluate

After the test shipment, the team sent a survey to all participants. Six responses were received, including at least one from each organisation involved. Overall, feedback was good in terms of functionality, but it was deemed too soon to comment on the specific impact of the system on aid delivery and accountability.

In order to give more weight to the tracking aspect of the application, the pilot team decided to explore less secure ways of conducting activities, including how keys are used, in order to make the system more usable and robust.

Understand users' needs

The tender selection process brought in Datarella as the technical partner. Datarella began engagement through a kickoff workshop, which introduced potential users of the blockchain platform. Stakeholders ranged from DFID, to the suppliers of humanitarian goods, to the logistics service providers who ship the goods, and finally to an implementing partner who deploys these goods in the field.

The pilot team decided on interacting with, and getting feedback from, stakeholders on an ongoing basis by means of Google-forms, as they allowed the embedding of videos and could also be completed quickly by time-poor humanitarian actors. An initial Google-form was sent to stakeholders, to better understand their priorities and question the critical assumptions of the project.

The team learned that custodianship of goods were seen as crucial to any delivery system, and that an increased transparency of such goods would improve humanitarian supply chains by reducing the need for trust in suppliers. An additional hypothesis was that focusing on custodianship would allow better performance assessment and speed up delivery time.

Finally, in a similar vein to the inception workshops, "Last-mile" distribution was seen as a weak point in the supply chain, but was deemed outside the practical scope of the pilot.

 Kick-off workshop

Conduct an additional sprint

At the time of writing, the project is engaged with the World Food Programme on a joint goods shipment proposal. WFP would receive training on the Track and Trust system for delivery of a shipment in Ethiopia.

HOW TRACK AND TRUST WORKS

The Track and Trust platform achieves its desired level of security in the way that data within the network is decentralised. Blockchain is a distributed ledger system that establishes a network in which multiple parties hold their own copy of the same data (called ledger) on their own computer (called node). It is the fact that each node within the network holds its own ledger, or record - which is in turn cryptographically secured - and communicates this with each other, which makes it extremely hard to manipulate data held within the network.

The Track and Trust network uses a private permissioned Ethereum blockchain, which is one of the most common blockchain technologies being used today. A private Ethereum network was chosen for the pilot because it is programmable, has functionality that one can define freely, and charges no transaction fees.

Track and Trust follows a pathway whereby DFID creates an "event" within the tracking system, then proposes a contract between each party involved with the shipment. This is then agreed by each partner, by signing the transaction on the blockchain with their own private key. When physically passing across a shipment, it is the completed "transaction" that passes over the custodianship of goods (from Supply Partner to Logistics Service Provider, for example.)

For oversight of the process, the dashboard shows a "Shipment" page, which lists each shipment by the accountable party, shows its contents, and gives the latest updates on shipment status.






PRIVATE BLOCKCHAINS, PRIVATE SUPPLY CHAINS

Track and Trust is a private permissioned blockchain, which means that it is 1) exclusionary to outside actors and, to varying degrees, 2) exclusionary to members within the network. Whereas a public permissionless blockchain - such as bitcoin, for example - allows any actor to join (public), make, and view transactions made along "the chain" (permissionless), the Track and Trust network is an enclosed system in which relationships between network actors are formed by consensus.

Within a blockchain, "privacy" refers to confidentiality: of participants, data, and the terms of contracts. Putting privacy in the blockchain therefore involves restricting access to data. Considering the sensitivity of information across a humanitarian supply chain, privacy should form an important feature of the Track and Trust network. Achieving increased accuracy and security, therefore, doesn't mean transparency for everyone as the system develops. Whereas up to now, the Track and Trust system was completely open in terms of data, if other agencies join the network questions of governance will have to be explored.

Nevertheless, the argument for using a private permissioned blockchain in this instance is compelling, because the project emphasised accountability: who has responsibility for shipments, and how can this information be trusted. Blockchain offers a concrete solution to this coordination problem based on consensus. Additionally, the potential for agencies to standardise their activities into one system, while independently validating their own transactions as nodes, was appealing as an exploration into long-term arrangements.

THE RESULTS

All of the critical assumptions behind this idea were tested and proved  or disproved.  We gained insight on all the assumptions, but some had questions remaining. 

VALUE	DID USERS ENGAGE WITH THE TECH?
	<p>There was strong engagement with the concept from humanitarian staff, although a common theme of the pilot was that they had little time to consider testing new solutions on the ground and took a long time to communicate with the pilot team. The interaction of users with the dashboard gave good insight into what could be iterated on in the future, including the need to convey the security benefits of the blockchain more effectively.</p> 
TECH	DID THE TECH DEPLOYMENT WORK?
	<p>The test shipment of tents from Pakistan to Dubai acts as a convincing proof of technology, in that users were able to track the custodianship of goods across the supply chain. While there were some gaps in the model that needed additional work, such as when shipments are delayed in transit, these can be considered as surmountable. However, given the difficulties involved with engaging other partners on the platform, there remain questions around the deployment of the technology as it scales up.</p> 
GROWTH	WHAT IS THE LIKELIHOOD FOR SCALE UP?
	<p>There also remains questions surrounding the scalability of a private permissioned blockchains for this use-case. First is the level of buy-in from humanitarian organisations, which at the moment is often limited to experimenting with their own projects, and requires a commitment to collaborate. Second, there is a need to build a governance structure that works for everyone. The pilot team centralised blockchain governance for the purposes of the pilot, but as the system grows into one that has blockchain governance by consortia, there is a need for system-wide rules that must be addressed.</p> <p>Datarella's work on last-mile distribution is, furthermore, crucial in growing interest in the Track and Trust platform, as it may result in the required incentive for actors to collaborate and agree upon a governance structure.</p> 
IMPACT	WHAT LEVEL POSITIVE SOCIAL IMPACT OR INFLUENCE HAS BEEN ACHIEVED?
	<p>Evaluation of the platform's effectiveness has to go beyond a single test delivery, to measure changes in the system's overall functioning. The pilot has nevertheless influenced aid agencies in their exploration of blockchain for humanitarian supply chains. The additional sprint, which partners with the World Food Programme, is evidence of this influence.</p> <p>Within DFID, the project has helped to catalyse debate surrounding blockchain technology, as well as give credibility to convictions at the organisational level (particularly with USAID and DFAT). Overall, the pilot has opened up opportunities to better understand the problems that blockchain could help to solve, motivate people around potential solutions, and draw the line between "hype" and scepticism.</p> 
OPPORTUNITIES FOR SCALE	
Has it attracted any co-funding or follow on investment?	Two "Kickstarter" feasibility studies, worth €60k each, have been completed with the European Space Agency. The studies used satellite-connected mesh networks to solve connectivity problems in last-mile humanitarian aid delivery. Datarella are now eligible for extra funding of up to €2 million, of which they are currently applying.

"The real aspiration of the project was to show that organisations could agree to the same system... a big lesson was that scaling up is less a technical barrier, but is really about how can you get a group of disparate organisations to come to a level of agreement for a system not to be owned by anyone."

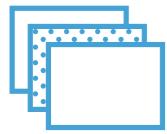
- Daniel Lihou, DFID Pioneer`

"One of the main reasons we couldn't find a test shipment was the difficulty people had in figuring out what shipments were going where. It was a lack of visibility - of systems in place - to easily identify potential shipments. Despite the fact that many organisations say they have great systems... the fact that they couldn't identify potential shipments for the pilot is interesting in itself."

- Seb Mhatre, DFID Pioneer

REFLECTIONS FROM THE HUB

Insights on Blockchain



Embrace human-centred design

If a transaction is hashed into the blockchain and no one is there to "hear" it, does it make a sound?

One of the most intriguing findings of the pilot was the feedback from the dashboard application concerning users' interaction with the blockchain. With so much emphasis on the security potential of the system, there was a trade-off on usability. Future designs considered the role of "operational transparency" as a way to convey the benefits of the blockchain, which kept the desired level of security while managing to keep the needs of users as central to platform design.

Explain your blockchain

In order to engage potential partners, the benefits of blockchain have to be well communicated. A key assumption of the project was that humanitarian actors were aware enough of the benefits of blockchain to understand why it held potential for humanitarian supply chains. This level of knowledge, however, was less widespread than anticipated. What needs to be emphasised in addition to this understanding is the specific blockchain architecture being constructed. Actors need to understand their relationship to different nodes in the system, how the architecture may be different to more well-known blockchain use cases, and how the system is going to function on scaling up.

Find the incentive

Humanitarian actors are busy. They are also used to functioning within fragmented and opaque systems for aid delivery. This means that, even if they may see potential in using blockchain technology, there may not be the immediate incentive to take part in what is another layer of administration or responsibility.

In a system that has a clear coordination problem, the kind of incentives that value the improvement of "the sector" will also not cut it. There needs to be an incentive coming from the agencies that initiate humanitarian aid, so that partners want to test solutions and adopt future practices. Reducing risks may also be an important factor in adoption, which favours an approach where users and use-cases are added gradually to the system.

Governance is the key

For blockchain projects to scale, a key challenge is getting agreement amongst humanitarian actors. Getting the tech right is likely to be easier than getting agreement amongst stakeholders on the principles of collaborating on a blockchain system.

"We at Datarella have learned that in order to bring immediate benefits to organisations, blockchain technology needs to be integrated gradually into existing systems. Seldom do we have a case, in which a brand new product is to be built and implemented from scratch.

As for Track and Trust, it might make sense to gradually integrate the system in different stages of urgency - starting with non-critical ones. Learnings can be integrated, users gradually onboarded, and the system optimized, until the involved actors feel confident in handling it and eventually use it in a rapid onset crisis response."

- Kira Nezu, Tech Partner, Datarella

"Blockchain does not stop your need to solve governance problems. But where it might help is that by taking a look at the problems - in a very structured way - it can get people thinking through what these governance issues are, and to think of something that could address them."

- Seb Mhatre, DFID Pioneer

