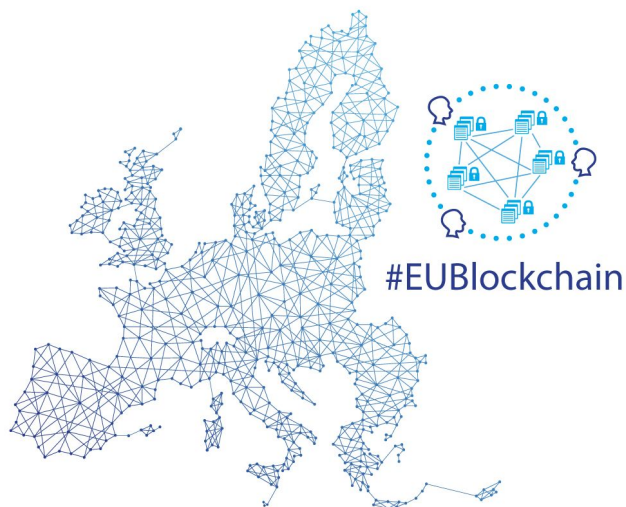# EU BLOCKCHAIN OBSERVATORY & FORUM

Workshop Report -
Supply Chain and Traceability
Brussels, 19 February, 2019

#EUBlockchain

By the European Commission, Directorate-General of Communications Networks, Content & Technology.

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Introduction

Ken Timist, ConsenSys
Ludovic Courcelas, ConsenSys

- The issue of the day: After bitcoin and the base financial use case for cryptocurrencies, tracking, tracing and supply chain is perhaps the oldest use case for blockchains, and one of the most discussed.
- This is understandable, considering that today's global supply chains are immensely complex and long, involve a great number of actors, and rely often on outdated - often paper-based - processes.
- This has resulted in increasing demand from stakeholder groups for improvements.
  - Buyers (consumers) want more and better information about the provenance and quality of the projects they purchase.
  - Merchants want to unlock value by gaining efficiencies in their supply chains but also in serving the demand of their customers for more granular, trustworthy information on their products - and so potentially commanding a premium.
  - Enforcement bodies want to more accurately and efficiently tracks and manage supply chains and their attendant market activities.
- The purpose of the workshop was to examine what projects have accomplished so far, how they have or have not scaled, and what hurdles they have faced and/or overcome. It was also to try and understand the role that Europe and Europeans can play in shaping blockchain-based supply chain innovations.
- At the moment the US and China are at the start and end point of many global trade corridors and are in a good position from which to set standards. The question is what place Europe can have in setting norms and standards as well as in developing its own regional champions.
- The specific objectives of the day are to:
  - Identify the proven benefits of blockchain in supply chain and trade, and highlight well-established use cases
  - Consider how the EU could foster the emergence of flagship projects
  - Break down the main hurdles faced by projects and share best practices
  - Draw a vision for future platforms and their benefits for citizens, merchants, regulators and other stakeholders

Panel discussion: Creating and operating supply chain solutions: what is there, what it takes, what is to come

- *Maxime Michelot (CrystalChain)*

- *Pablo Valles (ConsenSys Supply Chain)*
- *Marina Niforos (Logos)*
- *Arnaud Le Hors (IBM)*
- *Angel Versetti (Ambrosus)*
- *Jean-Pascal Assemat (LVMH)*
- *Ken Timsit (ConsenSys)*
- *Moderator: Vitus Ammann*

The day opened with a panel discussion on how to create and operate blockchain-based supply chain solutions. Panelists first introduced their projects:

- **CrystalChain** develops blockchain-based traceability solutions in various sectors including food, textiles and fashion. Clients include Chargeur, for which they built a full ship to shop solution, and Carrefour, where they are working on a means of tracking the provenance and quality of produts in the company's Carrefour Quality line.
- **ConsenSys Supply Chain** models and develops blockchain-based solutions for enterprise-grade consortium projects with a focus on proving product authenticity and povenance as well as digitising supply chain processes. Projects include
    - **Komgo**, a Geneva-based commodities trade finance consortium (pain point:lots of documents, a commodity sea cargo requires 36 original documents and 240 copies spread over 27 intermediaries).
    - **Viant**, a supply chain project that carried out a bait to plate PoC with the WWF to track tuna from the fishery to the consumer (pain point: the majority of fish is mislabelled)
- **Logos** consults among other things the **International Finance Corporation**, the private sector arm of the World Bank Group. They are looking to see how blockchain can impact the way that companies and public authorities can engage to conduct business and promote growth in emerging markets. They are also looking to support global trade, which has suffered greatly since the financial crisis, and want to see how blockchain can do this by re-engineering supply chain processes for more efficiency and better traceability.
- **IBM** has been a pioneer in the development of blockchain technology for the enterprise through its support of and expertise in the open source Hyperledger project. Among the best known supply chain projects using the technology are
    - **Everledger**, a project to tackle the problem of fraud around diamonds.
    - **IBM Food Trust**, a platform for traceability in the food industry.
    - **TradeLens**, a shipping consortium built by IBM and Maersk.
- **Ambrosus** is a technology company that creates tools and business solutions on blockchain to allow companies to track and provide the full history of a product's lifecycle. One of their main concerns is data integrity on the chain. They address this among other things through IoT technology, generally sensors which provide data on the products. These are connected to secure gateways that ensure the data is correctly entered onto the chain. Once on the chain, Ambrosus has also developed their own

layer 2 solutions that provide scalability and allow companies to use their own infrastructure to interact with the blockchain. Ambrosus also provides a dashboard for end users to access product-specific, trusted information.

- **Luis Vuitton** has a Traceability Systems team that is looking at blockchain as a way to provide its customers confidence in the origin of the materials in the items it sells. They aim primarily to tackle three problems in their blockchain work:
    - how to "link" physical products to the blockchain to ensure data integrity;
    - how to use blockchain to add efficiencies to the customs process, particularly when dealing with controlled materials like crocodile skin (currently importing such materials across borders involves a great amount of paperwork to prove that the skins are regulatory compliant);
    - How to use blockchain to control grey markets, where products are sold legally but through distribution channels not intended by the manufacturer.

The introductions were followed by the panel discussion itself.

- First Amman asked about IBM's TradeLens, which is a supply chain project cooperation between IBM and Maersk, and about the general adoption of the supply chain projects running on Hyperledger. Le Hors pointed out that all the projects he had mentioned were already live, so way beyond the proof of concept phase. And what was interesting to him was on the one hand the fact that there was a huge incentive for all the players involved, the stakeholders in the market, but also government agencies, customs officials, pretty much everyone except criminals, who stand to lose a lot. On the other hand they are seeing that, because blockchain represents a new kind of shared database technology, people have issues with privacy of data. One problem with TradeLens is that other players in the industry were resistant to join a platform controlled by Maersk, which was seen as a competitor. So there is an issue in supply chain blockchain consortia - as in all blockchain consortia - of how to cooperate while keeping privacy.
- One audience participant challenged the supposition that only counterfeiters stand to lose from the transparency of blockchain-based supply chains. A lot of legitimate players in the chain have business models based on profiting from information asymmetries, they also stand to lose. Le Hors answered that it was true that business models based only on reducing friction would be at risk through such systems. But there are other roles for intermediaries: the notion that blockchain will eliminate all intermediaries has already been proven wrong.
- Another audience participant challenged on information privacy. Even if you can obfuscate individual transaction information, there is a lot that can be deduced from aggregate information. So that can be seen as competitive information. Doesn't a blockchain-based supply chain run the risk of too much transparency hurting businesses? Le Hors answered that Hyperledger Fabric was designed from the get-go with privacy in mind, and they are improving that with better obfuscation methods like zero knowledge proofs that provide trusted information but no correlation, and that is something you can do with permissioned networks and not permissionless ones.

- Asked about the status of the Chargeur project, Michelot answered that two modules are already live, and that the main benefit for now is transparency: the ability to provide information to back up the claim that a product conforms to the Organica label standards. Before a customer had to trust the supplier's claim. Getting people to trust blockchain information is however a challenge, so requires education. Another challenge is getting all the players along the supply chain to understand blockchain's benefits and so be motivated to contribute.
- Amman asked Niforos about another benefit of blockchain in supply chain in terms of improving trade finance, especially for SMEs. She answered that this has indeed been a particular area of interest for economists and business working with the IFC, as trade finance has been hit hard by de-risking after the financial crisis, and access to trade finance for SMEs has been hit particularly hard. There have been some consortia/projects addressing that, including WeTrade in Europe, FastTrack Trade in Singapore, GateChain, Marco Polo, which is an offshoot of R3. That said, there has yet to be seen much impact of blockchain technology on this problem. But the potential is great. In a report the WTO said blockchain initiatives among signatories of the Trade Facilitation Agreement in trade finance and general supply chain could lead to an additional 1 trillion dollars in trade.
- Amman asked Valles for his global perspective, to which he answered by talking about Komgo. In Komgo two components are already live: the KYC Module and the Letter of Credit module. In both cases they are already drastically reducing the number of documents and above all the redundant work of re-submitting them to multiple stakeholders. He also saw a great deal of synergies between the trade finance and the supply chain/logistics initiatives. While right now there are initiatives on both sides, to bring real value they will need to come together and so should rely on technology standards that are interoperable.
- Asked about the main hurdles, Michelot said these were not really in the technology. There is always a technological solution. The real hurdle is how to motivate the many stakeholders in the supply chain to use the tech. To many it still seems like black magic, they don't really see the benefit. He then told an anecdote of a cheese manufacturer they deal with who is still not on the Internet and finds her paper-based processes absolutely sufficient. What she doesn't perhaps understand is that customers are changing: they are demanding more and more transparency on their products. Blockchain-based supply chains can provide that, and so by not participating she may be losing out in the long run. But the challenge is to show how that is, to help people get over their fear of change. On the other side, there is a clear need to protect data privacy so that is a challenge too. And interoperability will also be very important.
- Amman asked Assemat his estimate of the hurdles. He answered that perhaps Luis Vuitton does not have the same issues of trust in materials, as customers tend to trust them already, but they still demand more transparency, especially younger customers. So they want to know more about where the leather has come from, how it has been processed, and blockchain can help them more easily track and provide this information.

The big challenge remains how to create this link between the physical product and the on-chain data.

- Verseitti was then asked if his technology could help provide that kind of trust: can you trust the sensors? Versetti pointed out that it helps, but it is not the most important part. There are people who say that it is not important to talk about the technology, that blockchain is safe and therefore we don't need to talk about how it works. He thought that was wrong and gave the example of Facebook, which was embraced by many governments when it first came out, and now is being attacked, and that is a product among other things of people not really understanding how it works as a technology and a system. So it is important to define what blockchain really is. Some are advocating permissioned chains and others permissionless, and they are two different things. In the case of blockchain it is important to also keep in mind that it is as much a social construct as a technology. The number one step in designing a blockchain system is not to hire an IT person but a game theorist: you need to construct a system that has incentives between different stakeholders that don't have to trust each other but by all pursuing their self-interest they create trust in the system. Without this element blockchain is just a distributed database, and we have had these for a long time already.
- Amman then asked Niforos about the role of public bodies in a blockchain world when at the moment they are often providers of the kind of trust that blockchain wants to take over. Niforos said that in developed areas where you had dominant market players already there could be resistance. In areas like emerging markets where you had fewer dominant legacy players this would be less the case so it might be easier to use blockchain-based platforms to leapfrog in several areas of their economic development. That said, while there was clearly a strong anti-institutionalist streak to Bitcoin and the invention of blockchain, there are in many areas government actors tasked with protecting the rights of citizens and having them as part of the equation can help us avoid a kind of Facebook problem in the blockchain world. So really governance and regulation are the biggest hurdles we face in blockchain adoption.
- Amman asked Versetti about the convergence of IoT (sensors) with blockchain, and where he thought that was going. He answered that blockchain can clearly be a repository of truth, but if you can't trust how the data got there, it wouldn't be much use. He gave an example of a truck with sensors that could record data but then that data is input onto an Excel spreadsheet by someone and a week later onto the blockchain, and such a system provides too many opportunities for error or fraud. What you really need is real-time data integrity, including secure protocols that allow physical devices to record data on the chain. This likely won't be perfect either. But if we can go from 30% data integrity to 95% data integrity we have accomplished a lot. That will provide a great deal of transparency. He gave the example that most people are not aware what labels really represent: that the Green Leaf organic food label does not guarantee that food is GMO free, for example. With granular transparency it will be easier for people to understand what they are really buying. Another example where data integrity are essential will be in smart cities that rely on sensor data. IoT devices today are easily hacked, so the security

provided by trusted data in a blockchain-based system can help guard against hacking and make smart cities reliable and secure.

The panel then moved on to the QnA

- One audience member brought up the issue of sustainability: we had been talking about supply chains from the point of view of raw materials, manufacturing and consumption, but what about the part of the chain after consumption, in particular recycling. Amman agreed this was a good point and asked if there were any projects working in this direction. Le Hors said there were, for example he was aware of a project on Hyperledger involved in recycling plastic. And interesting among these projects is that many are not commercially driven, but rather driven by a desire to leverage blockchain to help solve such problems. He then added that IBM saw issues of trust and governance also as very important. While they are a technology provider, in many blockchain projects they find themselves as a mediator between stakeholders in the project. That's because, unlike traditional databases where you buy a solution from a vendor, in blockchain you are typically trying to create an ecosystem for disparate parties to collaborate, and that requires trust. So while many people see blockchain as trustless technology, the truth is that it is not: it is simply moving the trust from one place to another. In a consortium you need to trust the governance between the participants. In a public chain it is trust in the developers and miners that are running the system. So governance is key.
- An audience member asked for elaboration on what happens when corrupt data gets into a blockchain. Michelot said this was a big issue, but while you can't get rid of corrupt data once it's on a blockchain, you can more easily identify it and where it came from. This is something you really couldn't do as well before. Valles added that, again even though you cant delete it necessarily, you can add data to it to identify it. So corrupt data is not really a technology challenge but a process one. Niforos said we had to be clear that blockchain was not a technology that washes data. It is garbage in/garbage out. So you need accountability at the point of data entry. Versetti agreed: they can have sensors and IoT devices to minimise human interaction. This won't solve the problem completely, but you can set up systems where data passes through the minimum amount of human hands, and that can help.
- An audience member, who was an MEP, asked about scalability issues with public blockchains, as scalability would clearly be an important component of global blockchains, and if there are the same issues in private, permissionless blockchains. Valles said there are indeed issues especially in supply chain as there are actors all over the world and so solutions have to be deployed on international infrastructures and there are issues of privacy to deal with as well. He suggested however not to try and reinvent the wheel from a technology point of view but leverage existing solutions. Le Hors felt that this was an advantage of permissioned networks because they tend to be smaller and can use different kinds of consensus. But the technology is young and it is clear that we are not going to have one global blockchain but a world of thousands if not millions of

chains with checkpoints on the main network. IBM doesn't have problems with its customers at the moment with scalability, but clearly there is also room for improvement. Timsit agreed, pointing out that whatever blockchain technology that is in use today is still slower than VISA or Mastercard. The technology is young, and saying that we are constrained by speed at this point is analogous to the French government's initial scepticism that the Internet would ever be useful because modem speeds (at the time) were too slow.

- An audience participant asked Assemat to provide more details on the pain points that Luis Vuitton was facing that he had described in his presentation. Assemat reiterated that it was the secondary market, where people might be buying a genuine Luis Vuitton bag but in an unauthorised store, and how can the company know that? The other part was the authenticity of the products. This was not a problem with Luis Vuitton, but when a customer buys luxury goods they are not just buying a bag but a dream, so the point was to see how to use blockchain to help explain part of the dream. How can it reinforce that dream? He also thought this would be easier with the younger generation that grew up with blockchain. Finally there was the point of bringing efficiencies to the supply chain with exotic products, which can be complicated from a customs perspective: how can blockchain help customers get such products more quickly.

Presentation EUIPO: Building The Anti-counterfeiting Infrastructure

- *Justyna Petsch (EUIBO)*
- *Adam Stubbings (EUIBO)*

The panel was followed by a presentation on blockchain and anti-counterfeiting by EUIPO.

- The EU Intellectual Property Office (EUIPO), is a decentralised EU agency, responsible for managing EU trade mark and the registered Community design, collaborating closely with national, regional and world IP Offices. In 2012 EUIPO's remit was extended with the European Observatory on Infringements of Intellectual Property Rights, responsible for supporting IP enforcement and related policies.
- The counterfeiting problem is getting worse and worse. In 2017, 10% of EU consumers, some 43 million citizens, were tricked into buying a fake product instead of a genuine one, with all security and safety hazards associated with this.
- Customs officers cannot intercept all the fakes, analysing less than 1% of products coming into the EU, so we need to look at technology to help.
- EUIPO organised the first EU blockathon to tackle the question: Can Blockchain live up to the challenge of building the next generation of an anti-counterfeiting infrastructure, the basis of a common platform to support interaction? During the event 11 teams competed to design the best prototype for the next generation anti-counterfeiting infrastructure.

- The next step after the Blockathon is to define, pilot and implement the next level of anti-counterfeiting technology. This will be done through continued cooperation with experts, defining a use case for future anti-counterfeiting infrastructure and then doing a pilot to demonstrate the potential.
- Anyone interested in taking part is invited to join the Anti-Counterfeiting Forum. Registration can be done at:
  https://euipo.europa.eu/ohimportal/en/web/observatory/blockathon/join
- One of the tools that EUIPO uses is an enforcement database: a communications tool that connects customs officials and police authorities to brand owners.

Working Session: Breaking down the hurdles faced in the development of based-blockchain supply chains at scale

After the lunch break, there was a working session focused on the hurdles in blockchain-based supply chain. Discussion took place among all participants present and was organised around four main areas:

- *Technical hurdles: privacy, scalability and standards*
- *Bridging the real world with blockchains: Oracles and IoT: how to get reliable data*
- *The organisational and governance challenges*
- *The future of supply chain solutions*

Below we present some highlights of what was said.

Overcome the technical hurdles: privacy, scalability and standardisation

- One problem is where you put the data on a blockchain. If you have all the data on the chain, that can be good for transparency, but not necessarily good for business, as you don't always want your competitors to know everything you do. But even if you keep individual data off the chain, on a platform you can still potentially deduce a lot from aggregate data, like transaction volumes. So the question of what data is there and what not, or the whole transparency question, is indeed tricky.
- One participant had seen two extremes in projects. There are some architectures that use the blockchain as the repository of data, generally enterprise projects done in permissioned blockchains, and usually for those there is a smart contract that allows everyone who has the permissions to see all the data. So transparency is high but privacy not. Then there are some architectures where no data at all is on the blockchain, each actor has its own database and blockchain is there to allow actors to prove their data is authentic in case of dispute later.

- Another participant pointed out that there are generally three information levels to manage: Public information that impacts noone and is good for everyone to share, for example information used for the end consumer. Confidential Information that is shared between two or more parties. And then private information, that belongs to a specific participant in the blockchain where they want to increase the amount of information that they are storing on the blockchain for themselves.
- There is often a balancing act. We want strong privacy on one side, which speaks to only using the blockchain as a notary tool and keeping data off chain, but there are also advantages to using on-chain capabilities, for example to trigger payments. So how can we can get the best of both worlds?
- When speaking of privacy in a blockchain context, there are three main layers: Access (who has permission to read/write); Visibility (to whom are transactions broadcast); Storage (how is data stored and where). Tools to protect the privacy of participants (all actors) include: ring signatures, stealth addresses, mixing, private data off chain. Tools to protect the privacy of data include: zero knowledge proofs, zk Snarks, Pedersen commitments.
- Participants were asked if scalability could also be a potential brake to a large adoption of blockchain-based supply chains.
- Currently, said one, there probably is not any project being stopped by a scalability problem. But someday it might be as things get bigger. We don't really have any reference in terms of supply chain as to how many transactions per second (tps) a blockchain-based supply chain should handle.
- Sharing personal experience from past projects, one participant usually put use cases in three categories: situations where there is consistently a low number of tps, one where there is low tps but with sudden spikes and peaks, and the third with high tps where the data is needed right away. You generally don't see the third case in blockchain scenarios, you don't see real-time requirements. Usually it is rather an issue of peaks.
- Scalability limitations may also not be in tps but more in data volume. Every international shipment is accompanied by a large number of documents of multiple pages and every day we have millions of shipments, so that volume of data is a serious issue that is difficult for current blockchains to handle.
- Another participant added that there are two standard ways to use blockchain for supply chain use cases. The first is as a notarisation solution (digital fingerprints). Here you have the possibility to manage the volume of data easily, as you can define taking a digital fingerprint per minute, hour or day depending on your use case. The second is to code business rules directly into the smart contract. This is using the blockchain as a state machine.

Bridging the real world with blockchain

- Data reliability is essential to supply chain systems. Blockchains are great for managing digital assets and ensuring their integrity. However, there are still many open questions regarding how to bridge events and assets living in the real world with blockchains.

- With blockchain we could use tokenisation as an incentivisation tool to drive people to input data correctly. But how to ensure quality? Some standards, like how many digits in an ID, could help. But standards can't solve everything. Blockchain could be used as a tool to help for instance by having another person as a validator who could step in and review the transaction and validate it.
- There is a whole new industry evolving of blockchain-enabled devices in which a cryptographic chip is a standard component, like for example in a phone etc. One participant mentioned a startup working with a camera that has a chip in it so that the image is cryptographically signed the moment it is taken and then can be sent to a blockchain.
- The company Ledger builds IoT devices with a secure element like this. They put a chip on a device directly on a windmill, for example, and it will give the chip information on how much energy the windmill produces and that goes directly on the chain with a key.

The organizational & governance and adoption challenges

- In discussing who should be driving adoption, one participant said governance is ultimately the responsibility of the brands, because they can push it through the supply chain. If you start on the other side of the blockchain it makes no sense because there are too many stakeholders that benefit from information asymmetries. So the IP rights holders should be the ones to introduce blockchain-based platforms and enforce them. Governments can support adoption by for example recognising the platform as compliant, and then saying they will only deal with compliant suppliers.
- Said another: Either you have a big player that has enough weight to build its own blockchain-based platform for its own value chain, and then they don't care about sharing that with their peers, but only want to digitise their own supply chain and have leverage with their partners to push that. Or you can have an initiative that is more open to the rest of the market, but wouldn't necessarily start with the whole market as that is difficult to manage. In this case you might have one player that wants to be first mover but with the idea of extending that to the whole sector eventually.
- The ingredients of successful consortium include a neutral and respected actor to drive it. This can make a difference. MOBI was started by Toyota, the Energy Web Foundation was founded by a tech startup, FoodTrust by two companies.
- The question was raised about what the most effective governance model might be:
    - Run by one major actor?
    - Run by a consortium of several major actors?
    - Governance shared between all members?
    - Run by a public entity?
- Several people were of the opinion that the third option, shared governance, is probably the best. But it is also difficult. So maybe an additional layer of a cryptoeconomics model could help.
- Yet in supply chain, one participant said, we haven't seen how to employ such incentive models. Supply chain has so many different standards and specific requirements, you

can't really code all the requirements on the protocol level, that would be too complex. Coding all that and making sure all agree and who will be arbiter, that is borderline impossible.

The future of supply chain solutions

- The final question was how do we foster innovation and ensure there are champions in Europe. Here there are different approaches, for example government agencies can impulse large projects with specific requirements to drive innovation.
- Clearly governments can help by providing funding, but then the question arises of what are the main criteria that you will use to select the projects.
- More adoption by government agencies themselves could also help. If they adopt it for themselves, that can be a strong message and way of driving adoption in the industry.
- This is the approach in Italy where the government is taking a position on blockchain. This is important because companies are looking at blockchain, but if no one from the public administration is using it, then companies tend not to move past the PoC stage.
- Blockchain, another participant pointed out, is about collaboration. There are very few use cases of blockchain that are for single companies. Collaboration is however very hard. The technological challenges can get resolved. The major challenge is the people, and it takes time to create a mindset shift. CEOs, for example, start to understand the value of blockchain. But then it has to go to the CIO level. CIOs understand the technology, but they may actually be more reluctant to experiment than CEOs as they have operational responsibilities to take into account.
- In the EU there is the European Blockchain Services Infrastructure initiative (EBSI) as well as the International Association of Trusted Blockchain Applications (INATBA), which aims to bring all stakeholders to the table. The EU is also starting a blockchain and AI equity fund to do early investments in interesting companies that could scale up. There is also a possibility for EU funding for blockchain skills in the next budget.
- Europe, a participant said, could also drive more adoption with more legal clarity, and not just on the blockchain side. With logistics suppliers for example currently the liability of sending the wrong product in a parcel lies with the delivery company, even though they are not responsible for putting the stuff in the package. Blockchain-based based digital twins should also be legally recognised as evidence so you can use them for taxation. So that would make a business case for companies to adopt it.
- Another thing that would be helpful would be a series of EU-funded projects that bring together ecosystems and create a practical use case whereby port authorities, customs officials and other agencies can be hands-on involved in signing blockchain transactions. Wine might be a good use case to start with because it is simple and very fragmented at the moment, so a good place for the EU to offer funding to jump start a blockchain-based supply chain.

Appendix

Workshop slides

- [Full day presentation](#)

Workshop videos

- Videos from this and all other workshops can be found on the [EU Observatory website under reports](#)
- Videos specific to this workshop:
  - [Part 1 Intro and Panel Discussion](#)
  - [Part 2 EUIPO Presentation](#)
  - [Part 3 Working sessions](#)

Official agenda

9:15	*Welcome coffee*
10:00	Introduction of the day - Agenda & Objectives of the day
10:20	Panel : Creating and operating supply chain solutions: what is there, what it takes, what is to come
11:40	Presentation: Building the Anti-counterfeiting Infrastructure - EUIPO
12:30-13:45	*Lunch Break*
13:45	Working Session: Breaking down the hurdles faced in the development of based-blockchain supply chains at scale
16:15	Conclusion