

Treasury Committee

Oral evidence: Digital Currencies, HC 910

Tuesday 1 May 2018

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Members present: Nicky Morgan (Chair); Rushanara Ali; Mr Simon Clarke; Charlie Elphicke; Stewart Hosie; Mr Alister Jack; John Mann; Catherine McKinnell; Wes Streeting.

Questions 1 - 93

Witnesses

I: Ryan Zagone, Director of Regulatory Relations, Ripple; Martin Walker, Director, Centre for Evidence Based Management; Dr Grammateia Kotsialou, King's College London; Chris Taylor, Chief Operating Officer, Everledger.

Written evidence from witnesses:

– [Dr Grammateia Kotsialou](#), [Martin Walker](#), [Chris Taylor](#)

Examination of witnesses

Witnesses: Ryan Zagone, Martin Walker, Dr Grammateia Kotsialou and Chris Taylor.

Q1 **Chair:** Good morning to the panel. Thank you very much indeed for being here this morning for our first oral evidence session on our inquiry into digital currencies and blockchain. Just for the sake of those who are going to be reading the transcript, hopefully, afterwards, could I just ask you all to introduce yourselves and just say a little bit about who you are representing this morning?

Dr Kotsialou: My name is Grammateia Kotsialou, and I am a research associate in the department of political economy of King's College London. I am currently involved in the VOLT project, which is Voting Over Ledger Technology.

Chris Taylor: Hi. I am Chris Taylor. I work for a company called Everledger, and I am the chief operating officer of the company.

Martin Walker: My name is Martin Walker. I am director for banking and finance at the Centre for Evidence-Based Management. Also, I have a very long history in IT management in many banks. I have written several papers about blockchain, worked for a blockchain company and am still involved in blockchain projects.

Ryan Zagone: Hi. I am Ryan Zagone. I am from a company called Ripple. We specialise in cross-border payments for financial institutions. I was our head of research initially, and now I am focused on policy work.

Q2 **Chair:** Thank you all very much indeed for giving up your time this morning. I am hoping that this is an opportunity for all of you to show off your extensive knowledge and for all of us to gain some knowledge, to help us with the inquiry.

I should say that, where we can, we will try to direct questions to particular panel members, so do not feel you have to answer every question. On the other hand, if there are things that you want to contribute to a question that has been asked, please feel free to jump in. I want to start with a question that hopefully all of you could answer. How does blockchain differ from traditional databases? Why is it that people have got excited about blockchain?

Ryan Zagone: Blockchain, as a technology, allows us to validate, store and synchronise information across many different parties more securely and more efficiently than we have been before. We are looking at reviewing information for its accuracy and authenticity. We are storing it in a way that cannot be tampered with. We are synchronising it across many different parties, even globally.

Validating, storing and synchronising information has many different use cases. There is a lot of hype around the technology right now. People

recognise that this type of capability allows us to be much more efficient in how businesses or commerce can be conducted. There are lots of use cases for that. It is very general tech. Even on the panel today, we are seeing many different use cases. Ripple is focused on using this technology to improve cross-border payments. The payments space is quite outdated now. If you do a cross-border payment it usually takes about two to four days to send a payment overseas. With this tech, Ripple is doing it in four seconds, so it is a material increase. The key focus from banks has been financial inclusion. Santander is one of our key partners. It has launched a remittance product, so real time remittances instead of four days, and corporate payments, so real time corporate payments between different countries.

Martin Walker: One of the key things about blockchain, to where it has reached now, is it really is not a generic technology at all. It started from the original Bitcoin blockchain, which was a package of existing technologies designed to solve one very specific problem. As people have tried to take that technology and apply it, it has mutated incredibly. To make it work in the real world, people have actually dropped, to varying degrees, many of the features of the original blockchain, simply because it was never designed to be a generic technology.

Chris Taylor: One of the key elements of blockchain technology is the way that the information in the ledger is made immutable from the way that the technology is constructed. I think Ryan touched on it earlier. In a traditional database, records can be edited quite easily, either by an administrator or by other people who have access to the database. In a blockchain, information cannot be edited. It can be appended to, but the original information remains as a form of record. That makes it a useful tool when trying to trace back the history of transactions related to that database, whether that is related to assets or whether that is related to currencies and other kinds of transactions.

Dr Kotsialou: To these features I would add also that it is more difficult to hack because the data is replicated to every node of the network. Also, compared to a traditional database, you can add smart contracts on some of the blockchains. Smart contracts are extra functionalities that you can add on the top of the foundational record of data. With these functionalities you can add extra services. For example, on the voting that I am more expert on, you can maintain a list of political voters, you can allow counting of encrypted votes and you can also block the interim results on the voting procedure.

Apart from the smart contracts, blockchains allow a percentage of malicious participants to join the network. Even if there is a part of malicious participants, the blockchain could still work. In databases this is not true. Because it is a centralised application, if this is a malicious participant then it can just add invalid data in the database.

Q3 **Chair:** I am sure we are going to come back to the voting. That is particularly relevant to the building that you are sitting in now. We have heard about payments. We have heard about voting. What other

industries are exploring the use of blockchain? Everledger, your business is a slightly different use of all this.

Chris Taylor: Yes. Everledger uses a form of blockchain technology that is divorced from the digital currency originations from Bitcoin and other types of digital currency. We have used the blockchain technology in the industry. We have started in the industry of diamonds, in order to provide additional transparency into the origination of an asset. We take the various characteristics of a diamond and lock those into the ledger. That record is then immutable. That record of that diamond can be traced all the way through from the mine where it originated all the way through to the end consumer and potentially beyond, into secondary markets.

The blockchain ledger allows us to capture each step of that asset along its journey through the supply chain. That can be through trading patterns, through import-export processes or through grading houses. All that information is gradually building upon the original record of the diamond. That allows the participants in the supply chain to have greater confidence around the authenticity, existence and attributes and history of those items.

That enables our clients to have greater trust in the people they are dealing with. It also enables other participants in the supply chain, such as Governments, to have greater confidence about what is crossing their borders. It also provides other participants, such as finance houses and insurers, a way to identify if assets have already been financed, for example, or have already been insured, or are already the subject of an insurance claim previously. It has a high value in the reduction of fraud across the industry.

Q4 **Chair:** Mr Walker—I do not know about others—to what extent is blockchain a proof of concept rather than implemented technology? Have we now got beyond people wanting it to be approved and it is accepted?

Martin Walker: I am going to repeat my point: it is almost meaningless to talk about blockchain as a single technology, because it is not any more. In terms of where it has got to, I would divide it into three broad groups: the good, the bad and the ugly. The biggest group, where almost all the effort and the resources have actually gone into, is the world of cryptocurrencies, decentralised systems, ICOs, et cetera.

This is an area where people can make enormous amounts of money, but there is very little obvious benefit to society and there are a huge number of red flags it raises around privacy facilitating crime. Even decentralisation means there is no one clearly accountable and we see blockchain-based businesses that are structured specifically to get around regulation. That is by far the biggest group.

The next group I would call the ugly. The ugly is basically where people have taken the blockchain technology, they have bought into the hype and they think this is a universal panacea that can solve everything. It is very interesting to trace back this question of why people seem to think it can solve everything, because the list of use cases is endless. You can

trace this back to social media, to about 2014. Someone published a list, saying, “You can use blockchain to solve all these problems”. There was no explanation of how or why. This list has just been passed on from consultancy paper to consultancy paper, and people have tried to fit it.

My fellow panellists have talked a lot about immutability and distribution of data. Many of these things are things you can do with techniques that have existed for years, for decades even. Even some of the most basic concepts, such as a Merkle tree that you might hear about, is from 1979. Distributing data, keeping it consistent, making it tamper-proof are very old techniques. The ugly is where people try to force in variations of blockchain based on this list, which nobody remembers where it came from, to try to make it work.

The good, which is a much smaller group, is where people have started with the Bitcoin blockchain, evolved it, dropped most of the features, and are starting to head towards systems that might end up being useful in terms of making data consistent, distribution of data, et cetera. They are ending up looking a lot more like conventional systems that were already around.

The other part of the good—as I say, this is by far the smallest section, because most things are still in proof of concept—is where blockchain is just being used as a catalyst. People are doing things, digitising things where you do not need blockchain to do it. It has got people’s attention on areas that have not been automated and have not had much attention, in payments and trade finance and areas like that. It is getting people to do one of the hardest things in IT, which is to agree on common standards around how you represent data and how you process it. Most of the problems in applying technology are around people and getting agreement on things like this. In some cases, the blockchain dream has been a catalyst towards that.

Chair: We are going to look at one specific use now.

Q5 **Charlie Elphicke:** Ryan, can you explain how it is that Ripple has been making use of blockchain?

Ryan Zagone: We focused on cross-border payments, where previously it was a quite painful process. Cross-border payment would take two to four days. You would not be able to track that payment and you did not know the fees up front. It was not until days later, when your funds were delivered, that you would find out how much was taken out as a fee. It essentially went into a black box. You could literally mail a box of cash and have better tracking and certainty than you could sending a payment through a bank.

We recognised there was a key pain point in cross-border payments, which was limiting consumers’ use if they were sending money back home. It also became a key limit to economic growth for small corporates that were looking to start to grow internationally, importing raw materials or exporting goods. They could not manage this very complex four-day

payment cycle, so most of them backed away from international growth and would just focus domestically.

We took the technology and we built two products with it. The first is a product that allows banks to do real time cross-border payments, so four seconds instead of four days. We guarantee the fee up front, so the sender knows exactly how much the fee will be, and it has real time tracking, so they can track it all the way through. That allows banks to connect to currencies they are using today. It is a pre-funded model. There are two parts to a payment: you have to connect and you have to have that foreign currency. Our first product just allows banks to connect and the bank already has the foreign currency.

There is a key problem in payments that no one has solved, and it is how to connect to currencies that are foreign or exotic, or do not have a very high volume, say your tier 2 or tier 3 currencies. An example would be, say, Mexican peso to Korean won. There is payment demand, but it is very hard to find a market between those two currencies. What we have taken is a second product that uses the digital currency or digital asset, and we have used that as a bridge to connect these hard-to-reach currencies.

Q6 **Charlie Elphicke:** That is XRP.

Ryan Zagone: That is XRP.

Q7 **Charlie Elphicke:** You are using XRP as, effectively, the translation mechanism.

Ryan Zagone: Yes, exactly. It becomes this bridge. It is the same technology that underpins Bitcoin, the currency, but we are not using it as a currency here. The Bitcoin model would replace the euro or the pound or the US dollar. You use Bitcoin to buy your coffee. In our model, we take that same tech and we connect existing currencies together more efficiently.

Q8 **Charlie Elphicke:** Let me understand that. If you like, Bitcoin is more Android and what you are doing is more Apple, a sort of centralised controlled ecosystem.

Ryan Zagone: I have never thought of it in those terms. XRP is not controlled by us. It was not issued by our company. That is an open-source platform. We are just making use of this open-source technology and we have built that into our product. There is a tight correlation between us and the currency, just as the market has begun to understand it. In reality, it is open-source. We, as a company, could go away and that technology would continue to exist.

Q9 **Charlie Elphicke:** Rather than being a separate currency, really what you are doing is a kind of payment bridge, which you call RippleNet. How much money has been transferred through RippleNet today, and what has the expansion rate been over the last year?

Ryan Zagone: We have signed over 120 financial institutions to the network for them to enable real time payments. The focus is on remittances, which are now live. We have had several banks that have launched remittance services and corporate payments, particularly for payments that need to be made immediately or down to the cent, that control exactly what gets delivered. This fills a product gap that most banks have. We have 120 financial institutions using it. We have had a couple of clients send around \$1 billion thus far, mostly corporate payments, and then we have some smaller-value numbers around the remittances. Those products are just now launching.

Q10 **Charlie Elphicke:** Let us just look briefly at the risk. Let us say you have a transaction going through, as you say, from pesos to Korean won. It goes into XRP and then goes into Korean won at the other end. Concerns have been raised about what happens if the value of XRP was to catastrophically change while that was happening. How do you mitigate that risk?

Ryan Zagone: The payment would go into XRP as a bridge and out of it immediately. It is not exposed to XRP price before or after the payment. It is just in those two or three seconds that it gets converted through, so the price volatility only really matters in the exact few seconds you are making the payment. An important point to make is we have two different products. There is one product banks are using today. That is live. That does not use XRP. Banks are connecting with their own existing accounts.

We have a second product we are testing now that uses XRP. It is in pilot with Western Union—MoneyGram—and some others. That is not a live product though, so the banks we see on our network are not using XRP right now. We are looking down the road at how they can expand their reach through XRP.

Q11 **Charlie Elphicke:** More generally, how do you think blockchain can change financial services?

Ryan Zagone: We are seeing an ability to leverage that tech to better meet customer needs, so on the remittance and corporate side, for ability to synchronise data, so doing this much more efficiently and at much less cost. Our early models have found banks were saving about 60% on the cost of a payment by using our tech. That is a material reduction that starts to open the market to new types of payments, very small payments at lower cost and more efficiency.

Q12 **Charlie Elphicke:** Are there any other projects other companies have invested in that you think have got real potential, outside what you are doing?

Ryan Zagone: Yes. We see use cases around securities trading, making that more efficient. Trade finance and digital identity are some of the other key solutions in the market. We are not working on those directly, or at all, but there are other companies doing so. That seems very promising.

Q13 **Charlie Elphicke:** You could transform letters of credit and that sort of stuff.

Ryan Zagone: Yes, exactly.

Q14 **Charlie Elphicke:** How do you think it could do that?

Ryan Zagone: With the ability to be more transparent, because you can have more transparency in these systems, you would have more certainty about who owns what type of invoice or where that payment or transaction is in the flow. Trade finance processes usually take several days, so it kind of goes into a black box, like payments. We do not really know where the tracking is. This gives you much more visibility to those use cases.

Q15 **Charlie Elphicke:** Finally, how do you stop crooks hacking the system and running off with all the money?

Ryan Zagone: We have taken this tech and specialised it for enterprise use. We are a vendor to that financial institution. That financial institution is regulated. They have requirements for the type of vendors they use, so they audit our systems, they audit our solutions and we do third party audits as well, to ensure that it is enterprise-grade technology that we are delivering.

Q16 **Mr Jack:** Martin, let me turn to you on blockchain and financial institutions. I heard what you said earlier in your opening statements about the good, the bad and the ugly. Do you think blockchain will generate solutions to the inefficiencies in the financial sector, as its supporters are claiming?

Martin Walker: It would be useful to just take a step back and talk a little bit about Ripple to put that into a bit of context. We can talk about the potential efficiencies in the financial sector. One of the things that commonly happens with anything around the blockchain space, for people who are trying to sell it, is not really quantifying stuff, painting a big picture and throwing out a metric that is not necessarily meaningful.

For instance, if you look at payments, the core part of payments is just sending a message to tell a bank to do something. It is very interesting looking at one of the Ripple models that has been used in a lot of that 120 that have actually been just pilots or proof of concepts. Ordinarily, a bank would send a SWIFT message to another bank, telling it to make a payment from its account. What I have seen on some of the Ripple demonstrations is we bring along the Ripple technology, you send the same message, out of your infrastructure, it goes into Ripple, and then it comes out the other side. You have just added an extra layer of complexity but with tracking.

When it comes to the tracking, the SWIFT network has actually added tracking. The hard thing about tracking payments is getting people involved in payments to actually update the status. Simply having a blockchain does not actually get people to update the status of where the payment is.

You can also look at the idea of using a cryptocurrency as a crossing currency. I have worked in the FX area. I have worked on the operational side and the technology side. You have the concept of crossing currency to deal with that scenario where there is a lack of liquidity. The common crossing currency is the US dollar. The dollar as a crossing currency has a lot of advantages. A large proportion of world trade is denominated in dollars, financing, et cetera, so it has liquidity against every currency and is relatively stable.

Putting a cryptocurrency into there—and the Ripple is a cryptocurrency that can move dramatically, even in three seconds—is highly problematic. Also, even if you are in the scenario for, I think, one of the new products from Ripple, you need someone to provide the liquidity to be willing to trade to change into and out of Ripple. Holding Ripple, a currency that has seen its price drop 80% and then back up 100% in the course of the last two months, is just not credible.

Putting cryptocurrencies into the financial sector is a huge source of risk. What happens if the liquidity dries up? In the financial crisis we saw that even dollar liquidity can dry up. The Federal Reserve provided swap facilities to all the main central banks to do that. Who is going to do that if we get payments or currency flows using the Ripple system? Who is going to provide liquidity in that scenario? That is Ripple.

Most of my background is in banking technology, but I have also spent several years working in capital markets. I also spent several years in the operations department of HSBC, where I built an MI system. This is trade processing. It collected all the things that caused the costs and the inefficiencies, which is basically where people are involved in the processing of the trade. We could clearly see from the data what the key factors are that actually made something more expensive to process than another. The biggest factor was simply if you had two parties trading with each other and they booked the trade separately into their own systems, rather than doing it on an electronic platform. That was the biggest single cause of inefficiencies all the way down the trade processing stack.

When I started getting involved in blockchain in HSBC, one of the things I did was look across the whole trade processing area. I had this set of data. I had the correlations between the factors that caused the inefficiencies and I had to base it on some model of blockchain, which was actually the variation of the Bitcoin blockchain. Everywhere I looked, it actually caused an added layer of complexity.

There are some specific scenarios in my specialised area, which is capital markets, where there is scope for something to actually improve the way trade is processed. It is something I have touched on before, but there is a very common theme of how you agree, between all the relevant parties, that this is the trade model, this is how we are going to process it, and get consensus at the very beginning. Getting consensus at the very beginning is the most important factor I have seen, using my statistical analysis, to actually getting rid of the inefficiencies.

It is quite interesting, having looked at quite a few of the blockchain proof of concepts, particularly in the capital markets area, they make very big assumptions. They make assumptions like you have consensus at the beginning, you have agreement on the trade, so you have assumed away the biggest problem. They assume things like, "We have cash that everyone accepts on the ledger that I can exchange". I have had a couple of papers published on cash on a ledger. Representing real world cash on a ledger is very problematic, because you end up with all kinds of credit and market risk.

There is a scope for a better consensus mechanism between the parties involved. Also, if you look inside a bank, particularly an investment bank, you see many systems processing the same data, often doing the same kind of processing. Many different systems, with their own different models and way of processing, can end up in inconsistencies.

Q17 **Mr Jack:** Even though it increases complexity, it seems to reduce cost, but you do not think it reduces risk.

Martin Walker: I do not think it increases cost.

Q18 **Mr Jack:** I said it reduces cost.

Martin Walker: No, it does not. There is potential for something—

Q19 **Mr Jack:** When Goldman says it can save 30% and Ryan said it can could save 60%, that is not saving costs.

Martin Walker: Let me tell you a story.

Mr Jack: A brief story.

Martin Walker: This will be a very brief story, sorry.

Mr Jack: If people start like that, it is 15 minutes, "Once upon a time..."

Martin Walker: I promise this will be a very brief story. A very large consultancy did analysis on the cost savings and came up with huge numbers—billions. There are actually quite a lot of papers like this. How did they do it? They went to the senior management of various banks and they asked them, "How much do you think you will save by rolling out blockchain"? There are two problems with this. Most people still do not understand blockchain. Most people still do not understand what a relational database is.

The second problem is part of the problem with the complexity in the banks is you often know the big number but you do not actually know the cost drivers. If you had a clear picture of where the costs were coming from, you could reduce a lot of costs by just getting the basics right.

Q20 **Mr Jack:** That is your point in the "good". It has made people analyse their cost base and rethink how they do things. Are you seeing any benefits for financial services/institutions from blockchain, leaving cryptocurrencies to one side?

Martin Walker: We really have to put cryptocurrencies to one side. They are very special. In terms of demonstrable benefits, there is little to nothing. There is this big problem in the blockchain world of confusing “could” with “is”. It is a huge problem.

Q21 **Mr Jack:** You see blockchain solutions as a fad and investments in them really not worthwhile.

Martin Walker: Here is the thing. I work for the Centre for Evidence-Based Management. We are a non-profit international organisation. Our mission is to try to improve the quality of decisions that managers make. This boils down to a common sense of, when you are trying to solve a problem, “What is the problem? Is it a real problem? I have a solution to the problem. Do I have any evidence it works? Have I looked at alternatives? Have I baselined this solution against other things”?

All that it takes to make a credible idea, sometimes a good idea, into a fad is that people just switch off their brains, stop thinking, stop asking questions and start believing. Even things that could be beneficial get turned into fads. In over 20 years in and around the banking sector, blockchain has become a fad, and fads can be very destructive. It is a series of many fads I have seen in banking. Over and over again, there have been these magic wand pixie dust things that come along, whether it is the way you write software, where you write software or how you write software. If 10% of what I have heard in my banking career had come true, we would have the most amazing banks that would run their infrastructure for £1 a week. There would be no problems.

Unfortunately, we have just had fad after fad after fad, because there is still this chasm between the management and the technology. Management in banks still do not understand technology very well. There are a lot of people in technology, even in banks, who do not understand the business side.

Q22 **Mr Jack:** This is my last question. What risk, if any, do you see to the banking system through this? Obviously, we have had bubbles in the past. Is this a bubble where people will come to their senses? Is it just hitting the profit-and-loss account, or is it something more serious than that?

Martin Walker: Again, this comes to the fact that you can turn anything into a fad. In the various blockchain-related technologies, there are elements of things that are actually quite sensible. If you do not look at it with fad-like eyes and were critical, you can potentially get some benefit there. The amount actually getting spent by the banks on blockchain-type proof of concept pilots is still a relatively small part of the IT budget. Most money is still getting spent on regulatory change.

Unfortunately, though, it is a distraction from looking at getting some of the basics right. It is also a negative thing about blockchain as a fad, as opposed to the underlying blockchain family of technologies, some of which are quite interesting. In many ways, this is blocking out genuine innovation. For genuine innovation you need to be analytical. You need to

understand the problem. You need to be imaginative. Genuine innovation is hard.

We have created what one of my former colleagues described as “innovation theatre”. Every bank has created an innovation team, many of which have very smart people in them trying to do real stuff. If you want to be seen to be innovative, it is really easy now. Any problem: “I will solve it with blockchain. I will do a proof of concept. It does not matter if it never goes anywhere. I have ticked a box. I am now innovative”. This distraction is the worrying thing.

Chair: Mr Zagone, we are going to come back to you. You will absolutely have an opportunity to answer some of the points that have been raised. Do not fear on that score. We are going to talk about Everledger now.

Q23 **Wes Streeting:** Mr Taylor, most of these questions will be directed to you, obviously. Can you begin just by explaining how Everledger has made use of blockchain and what the key features of the service offered by Everledger are?

Chris Taylor: As I mentioned before, we do not use a public blockchain. We do not use Bitcoin or Ethereum, those kinds of public blockchains. We use permissioned ledgers. A Bitcoin or an Ethereum blockchain are open access to anyone, and information on transactions on those networks is open to all the participants on those networks. Permission ledgers apply some level of permission, if you like, to join the network, so there is control on who can join the network to ensure that the data and the transactions on that network are from parties that are trusted to participate on that particular network.

On our permissioned ledger, we capture the characteristics of high-value assets. The example that we have started with is diamonds. We capture the external facets of the asset, which could be the dimensions. It can be the result of a gemmologist grading report. It can be anything to do with the source of that item, or it can be anything to do with the lifetime journey of that asset. For example, it can be a change of ownership, as simple as that.

We capture all the aspects of that asset and all the transactions along the journey of that asset. That can be ultimately of value to the participants in the supply chain of those assets, to have a greater trust around the source, the characteristics, the credibility and the authenticity of those assets. Also, it can be an ultimate value to the end consumer.

More and more, the end consumer is looking for a story around the assets that they purchase, particularly around jewellery and diamonds. They would like to know where it is from and how it came to be in their possession. Generally, if you are talking about an engagement ring or a wedding ring, that is part of the story of a particular couple of people. The jewellery item or the history of that can add to that story and become part of that event. Consumers are more and more looking for that.

They are also more and more interested in the ethical nature of the way that these items were sourced or manufactured. We capture the ethical certifications, where those are available, to associate those with particular assets. Companies and end consumers that are interested in ethical items or sustainability can also have a view into that information and have a window into the aspects of that particular asset, to make sure it aligns with their goals when they are purchasing something.

Regulation is more and more pointing in that direction as well. Companies now have to report the extent to which the goods that they are retailing have been sourced in an ethical manner. From a retailer perspective, that kind of information is becoming more and more important as well.

Q24 Wes Streeting: How do you ensure the accuracy of the information that is going into the database, to ensure that it is giving the customers a reliable picture?

Chris Taylor: It is the same as any system. It is garbage in, garbage out. You have to make sure that the participants that you are allowing to contribute on to the network are trustworthy. At the moment, or historically, consumers and procurers were trusting the next party down in the supply chain to trust that what they were providing had the right background and the right provenance. If you have multiple instances of the journey of that asset, you can be more confident that asset is authentic.

We also take advantage of external companies that can come in and audit methods and processes. Historically, that information was lost at a particular point in time, when a transaction had been completed. Now we can capture all that information along the journey of the asset until it gets to the person who is interested.

Q25 Wes Streeting: Who are the main stakeholders for this?

Martin Walker: We are working with all types of parties in the diamond supply chain, from mining companies, through traders, through diamond manufacturers and jewellery manufacturers. They want to give their customers more confidence and more history around the assets that they are selling or the jewellery pieces that they are selling. We are also working with grading houses and audit and compliance organisations.

Q26 Wes Streeting: One of the key questions is about what makes blockchain the right technology for what you are doing. Is it particularly innovative? Are there other ways and it is just the database?

Chris Taylor: These are common questions, yes. Martin mentioned that a lot of these technologies have been around for ages. He is right in some cases. Blockchain does not solve everything. It does not entirely solve problems that could not be solved in other ways. We believe blockchain solves the problems that we are solving in a better way than traditional database technology can provide.

Distributed databases have been around for some time, for example. However, they have been more traditionally deployed where the

participants on the network already trust each other. The distributed ledger allows participants to transact who do not actually trust each other to share their data. Distributed ledger technology is developing in such a way that you can share as much or as little information on the network related to a particular transaction or asset as you wish, as is predetermined.

- Q27 **Wes Streeting:** In addition to the applications that you have already mentioned, Everledger has identified use of blockchain in law enforcement. Could you just tell the Committee a bit more about what you are doing in that space?

Chris Taylor: If you think about insurance on a diamond, for example, and that diamond is stolen, at the moment, provided that theft is proven, the insurance company will pay out on that diamond. That diamond will disappear and probably resurface somewhere, either on a secondary digital marketplace or through unscrupulous people dealing in second-hand goods. By the use of our technology, we can identify assets that have previously been the subject of an insured loss. We can help law enforcement to identify where assets are resurfacing into the mainstream public arena. That does not help to prevent the crime, but the more that this technology is used, the more that people realise that these kinds of crimes might be caught. Hopefully that will be a deterrent.

- Q28 **Wes Streeting:** What has been the appetite or interest from law enforcement agencies, either here or around the world?

Chris Taylor: As everyone is at the moment, law enforcement are quite interested in blockchain. Wherever we can help make their life easier, they are interested in talking to us.

- Q29 **Mr Clarke:** Dr Kotsialou, my questions are on blockchain and voting. Thank you for your very helpful written evidence on this. Can you just talk the Committee through how blockchain technology can be used in political elections?

Dr Kotsialou: At the moment it is a bit too early to talk about national elections, for example, because national elections are at high risk of being attacked. There are still some security issues in online voting in order to allow this to happen. For example, blockchain voting systems might use the blockchain technology, but not to its full extent. For example, they could store only the final result on the blockchain. You can have a permanent record of the final result, but this does not guarantee that the votes have not been altered before it goes on the blockchain.

The second thing is that, at the moment, it might be a bit technically advanced for the average person to download the blockchain voting application on to the computer. However, even if this is the case, we could fix that by entering another interface, for example another website, that would be linked in the blockchain system. If this happened, we would need to make sure that these other websites are secure, because there could be viruses on these interfaces that could alter the vote before you enter the blockchain application.

Third, as I mentioned before, if the majority of the validators are malicious, they could add fake nodes in the blockchain. The rest of the validators—the honest ones—could go back to the last, let us say, healthy block and start from there; they could start mining from the last healthy block. As soon as we would be able to see that two forks are being created, at least you know that an attack has happened. Blockchain technology can also help to identify an attack.

That was the risks in online voting. I would not allow political elections.

Q30 **Mr Clarke:** What are the advantages? That sounds quite concerning to me.

Dr Kotsialou: In general, keeping a permanent record of the votes. You can add extra applications on the blockchain. As I mentioned before, you can maintain a list of the eligible voters. You can check, using smart contracts, if a person that is about to vote is the eligible one.

Q31 **Mr Clarke:** Fraud is a big advantage.

Dr Kotsialou: It allows encrypted votes to be counted. You can first encrypt the votes, put them on the blockchain, and then count them. You can also block the interim results, because there are also cases where interim results are not very desirable. Apart from that, it can increase participation in the general election process because more people would be able to see what votes have been recorded, with encrypted votes. They can take part in the counting process. If you are able to see what votes are encrypted, you can count it by yourself if you want. This all depends on the features that you want to have in your application. For example, you might be voting on a small scale, or within a company where the votes are public. In these types of voting, we do not have the problem of keeping the privacy of people.

Q32 **Mr Clarke:** That leads me on to the issue of shareholder voting. Obviously that is the other type of voting that might conceivably benefit from this. Are you aware of any firms that are currently using blockchain or are considering using blockchain for shareholder votes?

Dr Kotsialou: At the moment, in the project we have in King's College, in collaboration with the University of Surrey, there are two parts involved. The first part is that we are working with Crowdcube, which is the largest equity crowdfunding in the UK. With Crowdcube we are trying to minimise the administration burden on the company. Also, we are thinking of creating a platform where you can have a share registration and rights management platform by using smart contracts. That means that a shareholder, by using this platform, would be able to perform certain actions according to what kind of shares each shareholder has. Also, on top of that, we would add a weighted voting system, where the power of the vote of each shareholder would depend on the number of shares that each person has.

Q33 **Mr Clarke:** How far away do you think we are from that kind of technology being used by, say, Barclays for its AGM or whatever?

Dr Kotsialou: Do you mean in banks?

Mr Clarke: No, just any company, any firm.

Chair: A large listed company.

Mr Clarke: Yes, a large listed company that was having an AGM. Obviously, we all know there are real issues around trying to increase shareholder participation and control over these companies. How far away are we from that becoming a practical, viable reality?

Dr Kotsialou: First, this is the least that can happen with this technology. It should minimise administration burden. Our project is probably one of the first, and it started in 2017. In a chronological timeframe, I guess I would say at most in five years you could see this happening.

Q34 **Mr Clarke:** We know that there is individual and state-sponsored hacking. Over the last couple of years, we have seen the sheer extent of, say, the Russian state's ability to try to disrupt activity for malign purposes. That is quite apart from the criminal elements who might choose to do so. How would you combat that? How can you, if you like, future-proof this technology so you are one step ahead?

Dr Kotsialou: Again you are asking about national elections, right?

Mr Clarke: Potentially, but the scope for disruption is not limited to national elections. It could be financial transactions as well.

Dr Kotsialou: In terms of security that blockchain can add in general, it has to do with the data replication. If they are replicated in all the nodes of the network then it is harder to change. It is also the data validation. The rules that the nodes follow in order to validate votes, or any other transaction, are all public. Everyone can check what these rules are and everyone can check that the transactions in a block have been validated in the correct way. In general, the more decentralised we make a system, the more trusted it will be from your clients as well.

Q35 **Mr Clarke:** Yes. It is whether that decentralisation is an advantage or a disadvantage, is it not?

Dr Kotsialou: For example, for a private institution, it needs to find a balance between having the control of the company and gaining the trust of the clients. They have to be decentralised enough to be trusted and seen as transparent by the clients.

Q36 **Mr Clarke:** Finally, you mentioned in your evidence that the House of Commons could benefit "immediately" from introducing electronic voting. I have some concerns about that, because there are advantages to the lobby system, particularly for me as a very humble backbencher getting access to Ministers. Nonetheless, could you just talk us through how that would work?

Dr Kotsialou: I believe that one of the simple use cases of online voting would be in Parliament. It is known that you spend a lot of hours queuing

when voting in laws. If there was an online tablet through which you could vote on each law, at least it would minimise the administration burden. That is one of the main benefits, as well as time. Also, correct me if I am wrong, but I think that you need to be in Parliament one or two days per week.

Q37 **Mr Clarke:** Yes, you do.

Dr Kotsialou: That might cause problems for people that come from the north.

Q38 **Mr Clarke:** Tell me about it. That is also an issue actually. For example, we have been talking about how female MPs could ever end up taking maternity leave in a way that does not cut them out of voting. I suppose there is potential in that.

Dr Kotsialou: Yes, exactly. One of the advantages is that you could use the WiFi and intranet WiFi in Parliament in order to make it more secure. A simpler case is that the votes, I think, are public, so we do not have to work on keeping the secrecy of the ballot. We can also back this up with a blockchain technology for keeping a permanent record of the votes.

Adding blockchain, let us say, for the online voting system within Parliament could also enable the use of smart contracts. That means that, on the top of that, you could do other applications as well. For example, you could trigger the automatic implementation of a law, given that this law could be deployed in an automatic and computational way.

Q39 **Rushanara Ali:** I have some supplementary questions off the back of Wes's questions. Mr Taylor, on your website you mention that there is \$2 billion lost annually, just in the jewellery trade, due to insurance fraud. Have you got some estimates of how much would be saved through the use of blockchain technology in the kind of work you are doing, and its implications for the wider insurance market?

Chris Taylor: I do not have figures, but I can provide some areas where cost savings and other savings might come from. I explained briefly about how assets that have been stolen can subsequently be identified and then potentially repatriated to their owner, which would reduce the cost of fraud to insurers.

There is also a lot of work happening in the insurance industry on efficiency as well. There are applications of blockchain that would help in this area through the use of smart contracts, for example. Smart contracts enable greater degrees of automation of processes. Smart contracts can trigger certain events when certain criteria are met. For example, if a claim was outstanding in an insurance company and all that was waiting for that insurance claim to be approved and paid was a police report, you could automatically have that police report fed in through the network from the law enforcement agency. That would then trigger a payment, an approval, or an internal review point, thus saving some time and administrative burden.

Q40 **Rushanara Ali:** Have you done any assessments internally of the work

you are doing and what costs it saves by way of fraud? Have you any sense of what you have managed to prevent happening? I know it is difficult to do but do you have some idea of that? Also, is there a lot of interest from the wider insurance market in what you are doing?

Chris Taylor: We have not done any work as yet to understand the extent of the savings. I am sorry; what was the other part of your question?

- Q41 **Rushanara Ali:** Is there wider interest from the insurance sector in the advantages and benefits of using technology like this, and looking at some of the claims you are making and what it could generate for them in a positive way?

Chris Taylor: Yes. Insurance is very much about insuring objects. Our technology allows objects to be tracked and traced a lot more easily. Whether that is in a consumer insurance application or whether it is in business insurance, there is a lot of money lost to insurance claims from business-to-business transactions.

- Q42 **Rushanara Ali:** Have you had approaches from insurance companies to learn from what you are doing and look at how it can be applied?

Chris Taylor: Yes. We are working with a number of large insurance companies.

- Q43 **Rushanara Ali:** Such as?

Chris Taylor: They are under NDA, so I cannot mention names. Apologies.

- Q44 **Rushanara Ali:** What about stolen assets? You mentioned the origin of diamonds. Can you see applications for what you are doing for stolen assets, particularly in conflict zones, where assets from museums and so on are being moved around? Is there scope for finding a way of recording the origin using blockchain? Obviously, there are records, but let us take warzones, where records get destroyed, and then it is very hard to find the origin of those assets.

Chris Taylor: There is a specific application in the diamond industry around the Kimberley Process. The Kimberley Process came into force about 15 years ago from countries around the world, 54 member countries, the EU being counted as one country, who have agreed to trade diamonds only on the production of a certification of those diamonds being conflict-free. "Conflict-free", in that context, means that the money from those transactions is not going towards financing rebel causes and anti-government activity, also known as blood diamonds. That is the way it is known better.

That process has worked really well. It has eradicated a lot of conflict minerals and diamonds. However, it is still paper-based. By adding a blockchain ledger to that process, you can enable a more certifiable history of where those diamonds are coming from, or where those minerals or other elements are coming from, to make sure they are not

from conflict zones or countries that might be on restricted lists and those kinds of things.

Q45 **Rushanara Ali:** Are any of you aware of other areas where blockchain is proving to be useful for tracking supply chain—clothing, for instance? I have a strong interest in the trading and ethical or non-ethical trading of garments. As you know, in a number of countries, the unethical practices have led to thousands of people being killed. Is there scope for that? I was quite struck by Mr Walker's input earlier on about the limitations of this technology. Perhaps we can have an interaction between the two of you.

Martin Walker: Wherever you have any kind of thing where you are trying to track the supply chain or identify provenance of a physical object, the recurring problem, no matter what technology you use, is actually keeping the data record linked to the physical object. Ultimately, you are talking about the physical world. I think in Everledger you etch an ID on the diamonds.

Chris Taylor: Every diamond is unique, which enables us to capture the uniqueness of that diamond. That enables us to track individually every asset that moves through the supply chain. There are other ways. For other asset classes you can capture a uniqueness of those assets as well.

Martin Walker: That is the real problem, actually keeping that link between the record and the real thing at such a level where anyone is going to check. When you go into a clothes shop, Sainsbury's or wherever, are you going to scan this and actually check every link in the chain?

Q46 **Rushanara Ali:** You can now. You can with barcodes. You can use your smartphone to check. My question is not necessarily about what the limitations are but whether it is possible.

Martin Walker: I know, but the thing is you are relying, on the reputation of who you are buying from, that this system that has been put in place is reputable. You are also relying ultimately, in the physical world, that someone has actually performed an audit of the process and made sure the link between the data and the physical is always there.

Q47 **Rushanara Ali:** That is what I am getting at. Is there scope for that to happen? Let us take companies that have had huge reputational damage because of the garments industry accident in Dhaka, where over 1,100 people were killed needlessly. Western multinationals could potentially invest in technology to help them. I do not think there would be any shortage of enthusiasm for providing the physical information of where the supply chain is in order to make use of the technology. Increasingly, consumers want to know what they are purchasing. At the moment, they are flying blind. When they go into a shop, even if they are willing to purchase products that have an ethical supply chain, it is quite hard to do that.

Martin Walker: The challenge of why you still need people, you still need auditing and you still need to trust is because there are many, many stages in that supply chain, at each of which some kind of fraudulent activity could occur. The labels could be swapped, i.e. the link between the physical and the data.

Q48 **Rushanara Ali:** If there is the will to do it through the supply chain of a company like Tesco or M&S, you could see it happening, could you?

Martin Walker: That is the thing. The key thing you have touched on is the will to do it and the trust in companies to do that. The technology solution is almost immaterial. Whether you use a database or whether you use blockchain, it is the will to do that. It is the process around that to make sure that is actually happening.

Q49 **Rushanara Ali:** I am just trying to get at where the potential might be there. I understand your cynicism, and I think it is right for us to be sceptical and look at the risks. If there is potential for technology to be combined with the will of a company to do that, they could.

Martin Walker: There is definitely potential for the technology. Again, the question is which technology and how you make a baseline decision around which is the most appropriate technology. Again, it has to exist in a context of trust, auditing, et cetera. I totally agree that it is something that is a great thing to do.

Q50 **Rushanara Ali:** I have one final question. There have been references to the potential for blockchain being useful in terms of the public health records—you have talked about voting—and in other public service provision, in tax records and things like that. What are the pros and cons? Does anyone want to add to that?

Chris Taylor: I was just going to comment on the database comment of Martin. In a supply chain that you are trying to connect the provenance of items to, you are not going to have multiple companies and participants in that supply chain connecting on the same database. That is not going to happen. They are all competing and they are all concerned that if customers further up the line know where those items are coming from then they are just going to get bypassed as a middle man. You are not going to get people connecting on a database.

On a blockchain or distributed ledger network, you can keep certain details of those transactions hidden, but you can then make transparent the details that are important around the provenance, the ethical nature and the sustainability nature of those sources.

Rushanara Ali: It could be done.

Q51 **John Mann:** Why have house sales not been put on the blockchain?

Martin Walker: I will throw a question back at you. What problem would you be seeking to solve by putting house sales on the blockchain?

Q52 **John Mann:** I could see a whole heap of problems being solved by doing

it, including knowing that my money has actually gone to the person purchasing the house. Mr Taylor, I understand exactly where you are coming from on diamonds. Just to make sure I am understanding fully, if I am given access to your system and I am purchasing a diamond, and someone has hacked your system, I would be able to see, as would you, the point at which it has been hacked.

Chris Taylor: Yes.

- Q53 **John Mann:** That, therefore, is a huge advantage if I am, say, an insurer. If someone has hacked into your system then I can see exactly where it has been hacked and I can see what the record was before.

Chris Taylor: There are different angles to that question. When you say hacked, if the system is penetrated by someone who is not authorised, they cannot go back and change the records that are on that database without subsequently knowing that has happened. I think that is what you are getting at.

John Mann: Yes.

Chris Taylor: Yes, that is correct.

- Q54 **John Mann:** That is a big advantage for my house, which is a physical asset. From King's College, is that not why the Republic of Georgia is putting all its property on the blockchain at the moment?

Martin Walker: The idea of an append-only database is you are only adding data, or there is what is called a Merkle tree, which is used in blockchains. That is where you link together the records to make tampering evident. It is one of these things that predates blockchain. You could do it independently. You could have a Merkle tree built into a conventional database.

- Q55 **John Mann:** The advantage of blockchain is that those who are given access to it can actually access it. Is that not the big advantage? There is an element of democracy built into it.

Martin Walker: It depends on which model as well. There are so many. There are public blockchains, which raise all manner of problems.

- Q56 **John Mann:** Let us come to the Republic of Georgia attempting currently to put their property records on the blockchain.

Dr Kotsialou: I am not aware of this, but I agree with the advantages: you can access, you can see the whole history, but you cannot change the history. These are indeed the main advantages.

- Q57 **John Mann:** When the Co-op supermarket has put origins of fish through an app accessible via the blockchain now, are there any disadvantages?

Ryan Zagone: When we are looking at advantages and disadvantages, you have to look at the types of capabilities that already exist in that country or in that market. Looking at Georgia, that may have challenges

to maintaining a database themselves, or we are seeing in other developing countries where consumers—

John Mann: Georgia is doing it because they are fearful of cyber-attacks from their next-door neighbour, Russia.

Ryan Zagone: We are also seeing this in developing countries, where consumers may not trust the Government—it may be an unstable Government—to keep land titles. There are several examples now where some of these developing countries have created land title platforms that are blockchain-based. Even if the Government changes, it provides stability to citizens and certainty to citizens that they still hold the title for the land that they hold, even if a Government or an authority changes.

Q58 **John Mann:** For example, in the great lakes of Africa, where that is happening.

Ryan Zagone: Exactly. That is not a solution for every market.

Q59 **John Mann:** No one has bitten on the housing market. On healthcare records—NHS health records—if my health records were on a blockchain-based technology, then I could add in any extra information I have without compromising those records as held by my GP, could I not?

Martin Walker: You could do that with a conventional system as well.

Q60 **John Mann:** The conventional system would not then allow me to use the same system in a competing database system in my local hospital.

Martin Walker: Sorry; what do you mean by a competing database system?

Q61 **John Mann:** There are plenty of competing database systems. You are being very negative here, Mr Walker. For the use of blockchain in healthcare records, am I right in saying that if patients' healthcare records were put on the blockchain and that was made accessible to each hospital, patients could turn up at a hospital and have their health records instantly available?

Dr Kotsialou: Yes, that would be possible. Also, you can have facilities where different people will have different permissions to view different data.

Q62 **John Mann:** You could, therefore, choose to give permission to your dentist to access dental records, which currently do not fit into the NHS system. Would that be the case?

Dr Kotsialou: Yes.

Q63 **John Mann:** If you are an MP or a staff member here, you could give permission for the parliamentary health service, which does health screening, to input those health records into the NHS system as well.

Dr Kotsialou: I guess that would be possible as well.

Q64 **John Mann:** Is the reason it is currently not done because it is a manual system? In other words, a doctor is working on one system; a dentist is

working on another system; a GP holding the records is working on a third system; Boots the chemist, who might take my blood pressure, are on their system but nobody else's; and my optician is on an additional system. What is the disadvantage of bringing those together through blockchain technology for me as a patient? Is there a disadvantage?

Ryan Zagone: I am not a health expert, but I will say in the financial services sector there is a similar parallel, where banks have their own individual systems that are very siloed. It is hard to communicate. The technology that we develop is allowing those different systems to synchronise. There could be a similar parallel in the health system over very different fragmented systems now talking to each other in a secure, immutable way. That could produce many benefits as well. A question it would raise is about privacy and making sure that that information remains private and secure, going only to those who should be accessing it.

Q65 **John Mann:** Presumably, Mr Taylor, that is a problem that you have to deal with: privacy in terms of ensuring that your system is not misused in any way.

Chris Taylor: That is right. We have to be careful that the different participants on our ledger have only got access to information that they are privileged to have access to. If that is involving competing companies on the same network that means making sure that, in terms of the transactions that are happening between two parties, the financial details are kept between those two parties, as well as the relevant details around the asset, which could be simply a date and timestamp: "This is the point in time at which we had a change of ownership". You may have a location that you might want to share around the network as well.

Q66 **John Mann:** Mr Zagone, why are you not thinking of creating a product for the housing market? With the housing market, there is a quantifiable asset at a fixed location. I could add in, if I chose to, if I wished to sell my house, additional information. I could choose to do that, and that then would be part of my sales pitch, but it could be quantifiable information. For example, a system could be put up whereby an insurer quantified the house has been insured, or I could pay the fire service to quantify that it is fire-proofed.

Is there not quite a significant market in this, not least because there is increasing fraud, with people setting up fake, internet-based systems, so that money is transferred not to the person who is selling the property but to some criminal somewhere else in the world? Is there not an advantage, when it is fixed assets like that, to using blockchain technology in order to develop a much more democratic market?

Ryan Zagone: I agree. We are focused on payments. In a housing transaction, in a diamond transaction or in a securities transaction, half of the transaction is a payment, so payments become the foundation of your economic system. We started first with payments, since it is foundational, and all the technology we use is open-source, so other use cases, like ensuring the data that is being connected to the payment, can

easily be built on those platforms as well. We are still in the early days. The technology and how it has been specialised for different use cases is still in the early days, but we certainly see this vision of much more efficiency and interconnectedness.

- Q67 **John Mann:** I have a final question to you, Mr Taylor. Do you allow, and if not why do you not allow, an NGO that is involved in exposing the whole concept of blood diamonds and that trade access to your database, i.e. blockchain, in order to democratise the diamond industry and allow a third party, who is not a purchaser, seller or producer—an interested third party—to be able to also access and feed back in if they think something is wrong?

Chris Taylor: We do allow access to third parties who are not necessarily transacting on the network, such as auditing organisations, who may be auditing from a process perspective to make sure the data is going into the network correctly. They may be auditing from an ethical practices perspective and, yes, it could extend very easily to NGOs on a broader scale.

- Q68 **Catherine McKinnell:** In terms of the data on blockchain, it is only as accurate as the data that is being inputted into it. How do you manage those risks, in terms of the data being put into blockchain being accurate?

Ryan Zagone: I am happy to jump in. RippleNet—our network of banks using our system—is a permissioned network, so it is only the financial institutions that are part of that network. We have a governance body—a legal framework—around it, so that banks know the type of information to put in and can validate that back and forth between each other, to ensure it is accurate, before they act on that and move funds.

- Q69 **Catherine McKinnell:** Okay. What about Everledger?

Chris Taylor: The same. It is a permissioned network, so the participants on the network have already been screened.

- Q70 **Catherine McKinnell:** There are no anonymous identities. There are no anonymous individuals. There are no individuals who are hiding behind other identities on blockchain.

Martin Walker: It depends on what kind of blockchain you have. In what is called the decentralised public blockchains there is a very high degree of anonymity. This is one of the key things to which people have tried to apply variations of blockchain in the real world. They have thrown that away. They have introduced a central party to control access to the blockchain. A lot of those original features have been thrown away and it is starting to become a lot more like a conventional system in terms of there being a party controlling access, identification of people, security, et cetera.

Just to go back to Mr Mann a little, in terms of many of the things you have talked about in terms of making systems talk to each other, the hard bits are establishing the protocols for the systems to communicate,

establishing the standards about how data is represented, and managing the permissioning. These are things that you can do with a centralised database—what is called a distributive system, which is something that has been around for decades; the internet is a distributive system—or some variations of the blockchain. Waving the blockchain magic wand does not make these go away or make them any easier.

- Q71 **Catherine McKinnell:** Okay. How would you assess the risk of the accuracy of data and the identification of individuals? Would you say that there are bigger risk factors to your industries in the use of blockchain than the data and the identification issues?

Ryan Zagone: I want to make sure we are being accurate in how we are describing some of the risk in the systems, particularly the open systems, like Bitcoin. It is an open-source system. It is not anonymous. While you may not know the identity of the person, you can see their account and you can see the history of all the transactions from that account. That gives you much more visibility compared to cash, where you cannot track it at all.

This open-source technology gives you much more visibility into the history of records. Law enforcement has become quite smart at tracking that and putting together patterns to identify accounts. There are already new layers of visibility in here that you do not have with cash and you did not have with traditional systems. Several countries have put in place rules—Japan is a key example here—that requires users of those open systems to identify all of the individuals using the system, in the same way banks have to in other market. They have applied both “know your customer” requirements and anti-money-laundering requirements to those systems. That is working very well there.

We have been a proponent of those rules in other countries. Ripple made a recommendation to the G20 to create a framework that requires KYC, anti-money-laundering and consumer protection requirements to exchanges in the virtual currency space, to bring that activity into the regulatory fold and make sure that those risks are contained.

- Q72 **Catherine McKinnell:** If that risk management has been identified within particularly the financial services’ use of blockchain, should it not be applied more widely, and is it not a risk where it is not?

Ryan Zagone: It depends on your use case. The use cases for financial transactions, like payments, may differ from a use case like Everledger, where you are just tracking the history or movement.

- Q73 **Catherine McKinnell:** How can you be sure that the person who is initially registering on your blockchain system is not fraudulent in any way or engaged in criminal activity in any way.

Martin Walker: It depends on which kind of blockchain. As I mentioned, most of the ugly to good are permission blockchains. There is a central person who is identifying who you are and establishing your level of access. It is not quite right to say that KYC has been introduced on these

public blockchains such as Bitcoin. What has been introduced is on exchanges, where real-world money interacts with the blockchain. When you say it is not anonymous, it is a Bitcoin blockchain. You do not know who it is and they can create as many accounts as they like.

It is great that law enforcement has been able to analyse this more and uncover wrongdoing, but it is also wrong that it was there in the first place. The new generation of Bitcoins, where you have the anonymity, are built to be even more private, to hide not just who owns what but even hiding the transactions. Bitcoin was fundamentally flawed from the very beginning from a law enforcement viewpoint, but we are tolerating people building things that have even more privacy. To what end, other than to defy law enforcement and regulation? There is a big difference between public and private blockchains, which are permissioned.

Q74 Catherine McKinnell: Another issue that has been identified is potentially cyber-attack and hacking, but also taking majority ownership of a blockchain, and therefore having the rights to amend and adjust details, past, present and future. To what extent have you identified that as a risk within your organisations or more generally within blockchain, which then could undermine trust and confidence in your organisations?

Ryan Zagone: To Mr Walker's point, one thing I agree with him on is that it depends on the model of the blockchain you are using and what types of risk percolate there. We have looked at that very closely in the system that we have built for financial institutions. That has been battle-tested by the banks and by central banks and regulators themselves before that has gone into production. Last year we ran a proof of concept with the Bank of England, where they tested the software to enable new capabilities within their own systems. That was a very successful proof of concept, and they have added some of those capabilities into their blueprints for future systems. We are seeing these being battle-tested and the technology maturing to be enterprise grade, so good for a bank or corporate use. The technology is in that maturity phase.

It is a very similar cycle to ones we have seen with other technology breakthroughs. I will use the automobile as the example. The Ford Model T was the first broadly accessible automobile. There was a lot of hype around that, much like there is a lot of hype around blockchain, the hype being that it can solve all of our problems and it will give us world peace in the process. There is a lot of hype right now, similar to the Model T when it first came out. That one design did not allow us to meet all of the use cases that we saw for the automobile, so it went through a long period of specialisation. There are a wide variety of models specialised for use cases: your 18 wheeler to move goods, your minivan to move your family and your sports car to move fast. Each of them have different risk parameters and mitigants to make sure they are safe, but they are all specialised. We are in that specialisation process now for blockchain, so taking it and modifying it, specialising per these different use cases.

Catherine McKinnell: They are regulated. All of those different car

models are regulated, in terms of safety standards—

Martin Walker: It is also a rather strange analogy, given that the Ford Model T is a car. It moved people around. Ford progressively made them cheaper and cheaper, so the car was accessible for anyone to buy. Bitcoin and blockchain is a very strange starting place—this anonymous payment system with this made-up money.

Q75 **Chair:** There is a separation. What this session has explored is the separation between blockchain and the currencies. Part of the reason for having this inquiry has been the confusion, or the continuing assumption, that they are one and the same thing, and trying to pull them apart. The blockchain is a mechanism by which assets move around, in the same way as a car is a mechanism by which people and goods move around. What Catherine is getting onto is about the regulation. You make a point, Mr Walker, about us tolerating these things being set up, but it is not a question of tolerating; it is a case of bright people around the world will take advantage of technology and Government and regulators are always going to be playing catch-up. That is what we see on the internet with the dark web, is it not?

Martin Walker: The point about the blockchain family of technologies—I will keep making this point—is it has ended up with a very diverse family of things, many of which have thrown away almost every feature of the original Bitcoin blockchain. There are two different things, especially when you have the permissioned world and you have the non-permissioned world.

The thing about almost anything that has a cryptocurrency involved is it raises a lot of red flags right from the very beginning. On day 1, Bitcoin blockchain raised red flags around anonymity. The idea of even a legitimate company that makes money selling cryptocurrencies raises a number of huge red flags by itself, in terms of a level playing field between investors.

If you look at the Ripple example, they have done some very interesting things around payment messaging, but if you look at where their money has come from they have raised \$90 million from venture capital funds. I have been on both sides of the fundraising. They get to see all the finances. They get to see how much revenue is coming from these 120 clients, how much of that is from doing payments and how much is just from doing experiments and proof of concepts. On the other side, and also most critically, they get a right of ownership in Ripple Labs.

On the other side, if you have a cryptocurrency involved, cryptocurrency gives you no rights, so ordinary investors see all these stories about, for instance, Ripple and this fantastic technology, and they go out and buy the cryptocurrency. The cryptocurrency does not give you any rights of ownership, it does not give you any right to exchange it with Ripple Labs back for cash and it is very dubious whether it has any value. \$90 million has been raised from venture capital funds, who get to see all the information. In the last 18 months on the open market Ripple Labs has

made \$365 million selling cryptocurrencies, and the vast majority of that was sold via exchanges, so that means ordinary people are buying into cryptocurrencies where there is an associated real story, which gives them no rights and does not put them on a level playing field with expert investors.

Chair: There are two issues. One is that Catherine wants to pick up on the general regulation point, but I know Stewart has specific questions for Ripple as well. I wonder whether, Stewart, you might want to ask your questions now, and then we will come back to the more general regulation point.

Q76 **Stewart Hosie:** Just before I get onto the regulatory bit of it, can I just ask, Mr Zagone, why is XRP controlled centrally, and does that central control give Ripple the opportunity to manipulate the XRP price?

Ryan Zagone: That is a common misperception. XRP is open-source and it was not created by our company. It existed as an open-source technology. We created a company that was interested in modernising payments and began using that open-source tech to do so. We have taken aspects of that technology and have incorporated into our products, but we did not create XRP. We as a company could go away tomorrow and XRP would continue to exist.

We own a significant amount of XRP. It was gifted to us by some of the open-source developers that created it, but there is not a direct connection between Ripple the company and XRP¹.

Q77 **Stewart Hosie:** I understand that. If it is controlled centrally, who is controlled centrally by?

Ryan Zagone: It is not controlled centrally. It is an open-source platform that is distributed, so there are multiple different parties that operate that XRP network. We as a private company make use of that open-source tech. We contribute to it but we do not control it.

Q78 **Stewart Hosie:** Okay. Can I just ask something briefly? Mr Walker, when we hear about this decentralised system, I am struggling to see a difference between blockchains and its derivatives and what we used to call decentralised computing and record change tracking about 100 years ago.

Martin Walker: I am old. I studied computer science a very long time ago, and one of the courses we studied was called distributed systems. Many of the features of the blockchain have similarities with distributed systems. The difference when people talk about decentralised, which is where the big regulatory red flag comes up, is no one is accountable. That is a very serious problem, in terms of consumer protection and law enforcement, but also if you are linking the existing world financial

¹ Ryan Zagone, Ripple, later clarified that there is not a direct connection between Ripple the company and the price of XRP

system into something that is generally decentralised, where no one is in control.

If you look at the ICO phenomenon, they have constructed these fascinating legal structures to give the veneer of decentralisation, so no one is accountable. Speaking as someone who used to run IT infrastructure in banks, accountability is critical. There are lots of rules about accountability and the FCA has a whole chapter on systems and controls, and Bank for International Settlements has a whole set of guidelines about financial market infrastructure. So much of that just comes down to accountability.

Q79 Stewart Hosie: We will get back to some of that in a moment, but the point that was made earlier, Mr Zagone, is that if people buy XRP—a financial asset—from Ripple Labs, it does not entitle them to an ownership stake, there is no right to be converted back into conventional currencies and it does not pay any return. It also seemingly has no purpose. Is that simply to avoid XRP looking like a security or an equity, and to avoid the necessary regulation?

Ryan Zagone: XRP is open-source—we talked about it a few minutes ago—meaning there are many participants that make use of that technology. There are virtual currency exchanges that do sell it to retail consumers. They do so as either an investment or a payment tool. Those are exchanges not related to Ripple.

We as a company make use of that same open-source technology. We do not sell it to retail consumers. We only sell to institutional market-makers and financial institutions. We have a licence out of the state of New York to cover that activity—a BitLicense. It does not allow us to sell to retail consumers—to you or me. We sell to institutional partners, and we have a partnership for open market selling as well, but we do not directly sell to you or me, only to financial institutions.

Q80 Stewart Hosie: Clearly these things can be bought and sold at exchanges.

Ryan Zagone: They are.

Q81 Stewart Hosie: How many of your institutional partners are exchanges?

Ryan Zagone: There are exchanges that make use of that open-source tech. That is tech not controlled by our company. That existed before our company, outside of our control. We are just leveraging it as a tool. They are selling it on the market; other exchanges are.

Q82 Stewart Hosie: I am struggling here. How do I go and buy an XRP and then sell it in an exchange?

Ryan Zagone: You would buy it on that virtual currency exchange.

Q83 Stewart Hosie: From whom?

Ryan Zagone: From other parties that have XRP. Half the XRP is open in the market at exchanges. You would buy it on that exchange from a

party that is looking to sell. Given this dynamic—that we as a company make use of this tech in the enterprise space, and that there are also exchanges selling it in the consumer space—we have called for a global recommendation for licensing of those exchanges to ensure that there is consumer protection, AML and safety and soundness measures, to make sure those exchanges are also safe.

Q84 **Stewart Hosie:** I am going to come to Mr Walker just on that. Apart from a price rising through the bubble effect, why would anyone buy some of this stuff from any exchange?

Martin Walker: May I just correct a few things first? There is Ripple the company, Ripple the network and XRP, which is a currency. 100 billion XRP were created. Ripple Labs has 60 billion of them, which they sell. The founders took most of the rest, so he says XRP is open-source and it is nothing to do with them, but Ripple Labs controls most of this stuff and makes very good money selling it.

The reason why Ripple sell it via exchanges to the public is that in 2015 Ripple was prosecuted for—I cannot remember—anti-money laundering, and they only paid a \$700,000 fine. Part of the agreement was they were not allowed to sell XRP directly to the public, but now you have exchanges.

Chair: Mr Zagone, if there is something factually incorrect in what Mr Walker has just said could you just correct it?

Martin Walker: I would be happy to send you the link to the—

Q85 **Chair:** We have something in our briefing about the case, but I would like this on the public record. If there is something factually incorrect that has been said, you should each have a chance to correct the record. Mr Zagone.

Ryan Zagone: Thank you. In 2014 the US Government did a review of all our operations and found that in the very early days of the company, in 2013, one of our subsidiaries was not properly registered, and we did not have a sufficient compliance programme in place for some of the activity we were doing. We agreed with that assessment. It was a retroactive assessment. We had a settlement agreement on that. We did pay a fine and agreed to put in place a full compliance programme. That is a three or four-year agreement. We have done so. We have met all the requirements of that agreement to date, and we have had no such findings since.

Chair: If there is anything incorrect, if after the session either of you want to correct anything that has been said about that, then you are very welcome to write.

Martin Walker: I would like to thank Ryan for that clarification, but there was a settlement made, there was an agreement made and Ripple Labs is no longer allowed to sell Ripple, the currency, directly to the public.

Q86 **Stewart Hosie:** Mr Zagone, you said there were 120 or so financial institutions with contracts with you. You also said, if I heard you correctly, that a number have moved or shifted \$1 billion, or so, each within that pool. Those are big numbers but small beer in the big picture. If XRP became more commonly used, how do you think Governments and regulators would react to a private company centrally controlling a crypto bridging currency? How do you think the international regulators would react to that?

Ryan Zagone: We have been very involved with the regulators to help them, first, to get feedback on how the technology should be developed, to identify risks and mitigate those risks. Let me be clearer: the money that is moving today is not using XRP. There are two different solutions. The solution that is live does not use XRP, so the money that is being moved today is fiat currency to fiat currency.

We are looking at leveraging XRP as a bridge into hard-to-reach currencies, so the hard-to-reach ones where there is not an easy connectivity today. That has been in pilot for about three years now. We have been very slow in that process, to make sure that we are checking all the boxes, considering all the risks and mitigating those. We have six pilots going on right now that have been quite successful at giving payment companies a reach into new markets. Those are still in pilot; we are still testing those and learning how to make sure we are doing that safely.

The currency, to repeat, is not controlled by Ripple. We have a concentration of ownership, but we do not control that platform. That platform is open-source. It existed before our company. We came about and said, "Hey, we think that is really interesting technology. Let's building a company that leverages it". We did not create it and we do not control it. There is a separation there. We could go away. We could fail and go away tomorrow, and XRP and that ledger would still exist.

Q87 **Stewart Hosie:** If your pilot's work comes to fruition and XRP becomes this bridging currency, for that to work in the way the dollar did for decades, it would have to be viewed as a reliable currency. How far away is XRP from being viewed as a real, reliable currency, even for bridging hard-to-reach real currencies?

Ryan Zagone: We do not consider it a currency internally. We call it a digital asset. The currencies in our system are fiat currencies—US dollars, euros, pounds. The payments made using XRP are still in those fiat currencies. In our pilots, the way that a financial institution would quote that conversion would be through this bridge, as an XRP. We call it a liquidity tool or an FX tool, but it is not a currency in that use case. It is a tool.

Q88 **Stewart Hosie:** Okay. You said it was an asset. What is it? If I want to swap my Venezuelan currency for an asset and then convert it into my Korean currency, which is the example we have used, is it a stock, is it an equity or is it a future? It must be something, otherwise there is no

trust in it. What is it? What is the asset, or is it just hype?

Ryan Zagone: There are many different categories that we see coming to the market, depending on how that technology is used. In the US, the IRS, our tax authority, has deemed them assets, just like property. The CFTC is saying some uses of these and some designs of these look like commodities. The Securities and Exchange Commission say some look like securities, looking at the ICOs. We are seeing, depending on how they are constructed and used, different categories. We expect that conversation to continue as technology evolves.

Q89 **Stewart Hosie:** I have one final point. Do you have, in black and white, the difference between the different assets? Could we have that sent to us, so that we can understand how some of the regulators are differentiating between them? I think that would be very useful if we could have that.

Ryan Zagone: I would be happy to send you the guidance. There are several countries that have been working on this framework, so I can share that.

Q90 **Chair:** That is really where I wanted to end up finally on this issue about regulation. Mr Zagone, you put your finger on it with different regulators treating the assets differently; we have had a conversation with the SEC about securities or about commodities. I really wanted to ask each member of the panel something. Mr Zagone, you just said you wanted a global recommendation about the exchanges. If there are views from the panel about where you think regulators should go, for consumer protection in particular, or, alternatively, if you think frankly this technology and these assets should have such big red flags that they should not be offered to members of the public—and I am talking about perhaps non-sophisticated investors; it is slightly different in the matter of voting—then it would be helpful to hear that recommendation as well. Mr Zagone, where does this go from here?

Ryan Zagone: When we look at the space, in terms of financial institutions using it and also cryptocurrency used throughout the retail market, when we look at the risk there, there are no new risks. Consumer and investor protection is not a new risk; we see that in traditional markets. There is AML, which we see in traditional markets. There is safety and soundness about the exchanges. These are the same types of risk as we see in traditional payment companies.

Our recommendation has been to take the type of rules and the tools regulators have in the market today and apply them to this sector, to bring that activity into the regulatory fold. That would include consumer protection, AML, cyber security and capital requirements. You are then starting to safeguard that activity. That is a pretty good way to capture the risk that is there today. Some countries have looked to ban the technology entirely. That is a short-sighted view because the tech does seem to have great potential.

I have one quote: "Positively, we see firms using cryptocurrency for international money remittance, lowering the cost and time of sending money overseas. So there are legitimate and economically significant use cases". That is from the Financial Conduct Authority in a speech on Friday. My last point is this: "There is hope ... that decentralised applications spurred by crypto-assets ... will lead to a financial ecosystem that is more efficient and potentially more robust in resisting threats". That was Christine Lagarde, managing director of the IMF, at the spring meetings two weeks ago in DC.

There is a lot of potential to the tech. We want to recognise that and make sure that regulation is balanced, to both capture the risk we see today, but allow these new use cases to evolve and come forth. We are focusing on trying to strike that good balance.

Q91 **Chair:** Thank you. Mr Walker, where do we go from here with your red flags?

Martin Walker: For the red flags, I would just urge the Committee to make sure that we do not repeat the mistakes that have been made, over and over again, of getting blinded by the word, "innovation", particularly relating to financial products. I know regulators have a very hard job to do, especially keeping up. Mrs Walker used to be a regulator, and they are good people who work very hard. When you get red flags right at the beginning, where you have a combination of technology and finance, we have to pay attention to those red flags, right up front. We have had almost 10 years of Bitcoin now.

That would be the main thing I have to say: do not get blinded by the word, "innovation". "Innovation" is a neutral word. Innovations can be for the good or for the worse, and the most innovative people have often been criminals or people who have been defrauding the little guy.

Q92 **Chair:** In your written evidence you noted that cryptocurrencies and other crypto-assets show all the regulatory red flags. What about the underlying technology?

Martin Walker: Again, the underlying technology has diverged in many directions. When it comes to the regulatory approach to that, on one level, if you are using some elements of the blockchain technology, which may even be things that were from 20 or 30 years ago, on one level it should not really matter to the regulators if you are using this. It should be immaterial as to whether they are using an Oracle database or a SQL server database or programming C# or Java, but at that level where you want to make sure that these things that are embedded in the FCA rulebook and the Bank for International Settlements rules on financial market infrastructure, about accountability, stability, et cetera, that is when they need to take a view on it and look at it.

Q93 **Chair:** That is very helpful. Mr Taylor, I am not sure what regulators you deal with. I am not sure that any business wants more regulation, but are there bits where you would want more regulation?

Chris Taylor: As I mentioned before, we do not, as Everledger, engage with digital currencies, so I cannot comment on regulation around that. In terms of blockchain technology, we see our permission ledger as a tool of business, which can have benefits for business, for Government, for regulators. There is a benefit to blockchain, particularly in the regulation space, with regard to the way it constructs the immutable audit trail, so that history of transactions can very easily be traced back. That is a huge benefit for regulators, not only in the financial industry.

Dr Kotsialou: Regarding cryptocurrencies, I would say that we should not stop it, because it brings something new in the world about currencies with no national borders, but it is true and I totally agree that there are good and bad people involved in that. However, I would suggest to regulate them because it would be good in the long term. If taxes will come and regulations, probably the price of many of those would go down because many people will leap out of it, but then it will keep more good and the innovative people.

Regarding the technology, I would suggest to have more regulation for blockchain companies. However, again, because there is a lot of hype regarding this technology, there are many companies that use in the minimum blockchain and they advertise it in another way. I would suggest to ask the companies to explicitly state in what way they use the blockchain technology. Last, I would suggest to set up interdisciplinary working groups regarding regulations and also other use cases, because it is a new topic and you need a computer scientist, economist and political scientist, so I would suggest interdisciplinary working groups around it.

Chair: That is absolutely fascinating. Can I thank you all very much indeed for your generosity in being here this morning? All of your evidence has been extremely interesting. If, having given evidence this morning, you think of anything you wanted to add or to correct, then please feel free to write to the Committee, but for now we are very grateful to you for being here. Thank you.