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GARY GENSLER: Today we get to explore one of the use cases where there's actually a lot of activity going on in blockchain technology, trade finance. We also have, I think, at least two of the groups for final projects are doing things on trade finance. There might be some that haven't disclosed that to me or after today might shift to it. You never know. And I think 8 or 10 of you actually wrote your individual pieces today. So it's 15 or 20 of you that have been spending a lot of time on trade finance.

And I think the reason is that there's a lot of application of the underlying technology. And that's what I'm going to try to do today and then hopefully get the help from the two groups that have some final projects in this regard and so many of you that wrote on this today.

I'm going to go through readings and study guide, what is trade finance. So we're going to run through. I'm going to give you a little sense of what trade finance is from my perspective. And then we're going to just go into the blockchain projects themselves. So we'll skip through these because we're going to be chatting about what attributes that trade finance really has. Well, Alpha you have a group. What attributes is trade finance? What attracted you to this?

AUDIENCE: Multiple stakeholders that are changing, transferring data and information.

GARY GENSLER: So two things that I just heard multiple stakeholders transferring a lot of data. Anybody else, what other attributes are there?

AUDIENCE: There's a lot of paperwork that is being transferred between the importer, exporter, and the banks, issuing banks and beneficiary banks.

GARY GENSLER: So not only is it data, but it's still actually a lot of paperwork. And actually often times actual physical paperwork. There are still companies, I mean, they're not as persistent now as they were years ago called document couriers that literally brought the documents around the globe.

AUDIENCE: You have different regulations in different countries. It's hard to see and trust one central authority that it's going to give you all you need done on the charge.

GARY GENSLER: So a lot of different regulatory regimes. But also different countries. So you have some information asymmetries. And thus those issues of trust across those jurisdictions.

AUDIENCE: Along the lines of the issues of trust, there's also a lot of fraud with it as well, a lot of double spend and financing issues that come with this space.

GARY GENSLER: So a lot of fraud and double spend. Or in trade finance, it has another term, actually. Anybody? It's double financing. But it's basically the same conceptual framework as a double spend. Can I finance one set of goods, one cargo being shipped across the Atlantic or Pacific, can I fund it twice? And so that's a bit of the fraud.

AUDIENCE: And also because of the high cost, and also all the due diligence, like small and medium enterprises have a very hard time getting it, like because of the financial crisis and also all the terrorist attacks.

GARY GENSLER: So do you think that small and medium sized enterprises have a difficulty for the reasons you just said, because of terrorist attacks and so forth or is there something more broadly that's going on, maybe even for centuries? New hand here.

AUDIENCE: I know it's more of a problem like small financing that they don't have access to the find the things they need that are required, their business requires, the essential things.

GARY GENSLER: And I can't tell whether it's a hand up or you were fixing your hair.

AUDIENCE: Um, both.

GARY GENSLER: Both, OK.

AUDIENCE: So I guess I was going to say, so small businesses often don't have the resources administratively to deal with paperwork. So often the operational burden becomes so costly for them, that it is no longer actually profitable for them to trade.

GARY GENSLER: And also small businesses-- you want to add?

AUDIENCE: They just don't have a credit history. So banks tend to not want to finance them. They just don't trust them.

GARY GENSLER: Right.

AUDIENCE: I just want to put some numbers to make it clear to everybody. I was looking at a study for the Asian Development Bank saying that small and medium sized enterprises are the most credit constrained. Around 50% of their demands are being rejected by banks for trade finance, whereas 7% to multinational corporations.

GARY GENSLER: So this small and medium sized enterprises also are smaller. They're not as well known. And trade finance, just by definition, is cross border. It's cross jurisdiction, cross country. How does somebody in the US know a small business in Kenya? Or pick your countries-- China and Mexico. So there is a lot of information challenges. That's been the history of this business for a long time.

We'll hold off on the ongoing projects. But we'll come back to that. So we had a bunch of readings. I updated this because it's ever changing. And I hope that if you had a chance to dig in to the Bain review. I thought as these writings go, it was probably a little better than some of-- I'm sorry for any of you going into consultancy, Tom. But as these things go, I thought it was better than some of the Deloitte papers and PwC papers that are still quite helpful. But I thought this was a little bit more detailed.

So what is the background, the economic background? This is just from-- I think I pulled this from some World Bank figures. Worldwide exports of goods are \$17 trillion. Services are 5 or 6 trillion. But trade finance is really around the exporting of goods more than services. I'm not really familiar with it in the service context. And manufacturer's \$12 trillion. Fuels, agriculture, you can see that. So that's basically the body of it.

And the financing, international finance-- and I purposely use words. This is the financing of international trade. It can come in two different ways. One is if the bank is guaranteeing something or the bank is supporting it through the documents. This is the traditional definition of trade finance. It is letters of credits and documentary collection. Anybody want to tell me what a letter of-- what the difference of two things are? Since we've got a whole bunch of people-- I see a hand up.

AUDIENCE: A letter of credit is a formal letter from a bank just laying out the terms of credit extended to let's say the next year.

GARY GENSLER: OK, so it's a formal letter laying out the terms. But critically, what is it doing?

AUDIENCE: Removes counterparty risk. Removes the counterparty risk away from your buyer to the bank.

GARY GENSLER: So it removes counterparty risk. It's guaranteeing payment. But there is a second form that banks support this market in a very big way is documentary collection. Anybody familiar with DCs? It's basically the banks are moving the paperwork, this incredible paperwork around the globe. And we'll dive into this a little bit. And they're not-- they're not taking counterparty risk. The banks themselves are not guaranteeing the credit. But they are performing enormous services in terms of the paperwork. And in essence, it's documents versus performance or documents versus authentication that goes in.

A bunch of different ways. Factoring and forfaiting, not that this is a quiz on these terms. But these are different terms. Factoring is when you sell receivables, short-term receivables. Forfaiting is when they're longer term. So they're kind of a little bit the same thing. But one is short-term receivables, short-term letters of credit. One are longer term.

You can actually take import and export loans out which are longer term. And they're about a whole inventory and a whole supply chain. You can get financing beforehand, supplier credit, and a new form aboard called supply chain financing where you're really funding the whole supply chain. But we're going to focus primarily on the first two. And most of the blockchain projects in this space are focusing on the first two.

But international trade also has trade credit. What's open account? What does that mean in any business when we're here at Sloan, somebody? Alean I'm not going to call on you. I'm not going to make you. Jake.

AUDIENCE: Trade is that when you ship the goods like prior to payment being due.

GARY GENSLER: So?

AUDIENCE: So you ship goods prior to payment being due.

GARY GENSLER: All right.

AUDIENCE: The payment is due like 90 days later.

GARY GENSLER: So it's due 90 days later. Open account is what most businesses do. If you just say I'm shipping something, send an invoice. And the terms might be 2 and 30. You get a 2% discount if you pay prompt, but 30 days, just open account. In domestic business that's how most

services are provided and goods are shipped is open account. It's the international export business that you find it different.

Then cash in advance, of course, is what it sounds like. And consignment is all the other way. An exporter would actually ship. You'd put it on your shelves. You wouldn't have to pay. And the exporter continues to have the risk of the sale. Not used a lot in international trade. You can also get public guarantees or insurance.

So that's the whole world of these \$17 trillion of trade. Only about 5 or 6 trillion is thought to be actually using trade credit, letters of credit and documentary commitments, these two main things.

So this ranges it. This gives you a little bit of a flavor. And this you can think of is what's the most secure for the exporter is over here. The exporter is going to have the most security if they get cash in advance. But does an importer like that? Not really. An importer really would rather have consignment, having risk all the way on the other side. Consignment would say the exporter takes all the risk. So it's all about commercial terms.

But you can think of it as the other side of this is the least attractive for the importer is paying cash in advance. The most attractive to the exporter is cash in advance. And every one of these happens somewhere. In a \$17 trillion market, \$17 trillion of exports, all of this is open for negotiation. But think of the exporter likes this curve. And the importer likes this. And as I will show in a second, most of the market is in the middle.

So now trade finance. Exporters, importers, advising banks, and issuing banks. And what you're going to quickly sort of sense is, there's a lot of room maybe for blockchain technology because there's a lot of moving parts. By the way, normally if you work at Wall Street or at a commercial bank, you might never touch trade finance. It's just like a department that if you're on a trading floor, you're not really thinking about a lot. Who's worked on a trading floor here? Did you ever think about trade finance? No.

But it's a big market. It's a very big market. But basically, the exporter and importer sign a contract that's for the sale of goods. It could be oil. It could be agriculture product or manufacturers. The importer then arranges with an issuing bank a letter of credit. The letter of credit is sent to the exporter's bank. Sometimes the exporter's bank puts a second guarantee on it. The exporter's bank might be actually guaranteeing the importer's bank performance.

So there's hundreds of different arrangements. But the classic thing is that the importer gets a letter of credit to say, look, you don't know me, but you can take the risk and I get this letter of credit. You exporter will get your money based upon some documents, when you put some documents together and send them to me that you've actually put your oil or agricultural products on a ship. So shipping is a big part of it.

The second piece of this is, how did the documents actually go? The exporter then ships something. The shipment usually leads to some documents. And at the time of the shipping, you see number six in this little box over here is, the exporter, when they ship something, also sends some documents to their bank. Their bank sends it overseas to the bank in Kenya, let's say, even though that doesn't have any ports. Ethiopia, you have ports, right?

AUDIENCE: Kenya has ports.

GARY GENSLER: Kenya has ports, sorry. You're landlocked. All right, sorry. So I've got it right. So Kenya-- I got it wrong. But Kenya's got ports. But the exporter, at the same time they're shipping, will also send the documents, but send the documents to their bank. Their bank sends it to the foreign bank. The foreign bank says, ah-ha. That triggers the condition in the letter of credit. Payment will be made. And payment can be made when you put the goods on the ship. Payment maybe is made when the goods get to the foreign country. All these arrangements can be different.

So this gives you a sense of the change. Letter credits were estimated in 1970 to be about half of all of trade. Now they're about 15%. World Economic Forum Bain papers that you all had the pleasure of either reading or skimming or you'll read it tomorrow. But letters of credit is a big piece of the market.

Primary open account has widened as part of the market, I think, in part because international trade is probably more dominated by large companies now than in the past. And in the 1970s, even the large companies didn't know if they could trust each other. The larger enterprises, larger multinationals really would prefer just to trade on open account and extend each other's credit rather than using the banking system to guarantee their credit. But trade finance is still a good call at 15% to 20%, which would still be rather significant numbers. So that's a little bit on the sort of questions about trade finance, how it fits in, before we start talking about blockchain projects.

I think I had one other thing. Here are all the parties that can be involved. And just to sort of

confuse us all, here is a list of some of the documents. And that's not even a complete list. I went to a legal website to find out what all the different documents you might have. Anybody know what a bill of lading is?

AUDIENCE: It's some kind of receipt from the vessel carrier that is carrying your goods. And whoever owns that bill of lading has the right to claim the goods.

GARY GENSLER: Right. So it's like a warehouse receipt. Remember, we talked about some of the origins of money were around warehouse receipts because I might put my corn or wheat or gold or bronze in a warehouse. A bill of lading originally, though the definition is moved on over the centuries, the original definition it was like a warehouse receipt on a ship that you took your products or goods and placed it on a ship. And you had a bill of lading because it was on the ship.

And you could actually, just like those original forms of money, warehouse receipts, you could sell a bill of lading or discount it and get money for it. So bills of lading have centuries old, maybe thousands of years of history, similar to warehouse receipts. And in essence, you might think of a bill of lading a little bit as a form of money.

But what did I list just for fun? 50 different documents. Alean.

AUDIENCE: How easy is it to fake one of these?

GARY GENSLER: Say it louder.

AUDIENCE: How easy is it to fake one of these bills and claim someone else's goods?

GARY GENSLER: Very good question. So it was a point earlier. And again, this goes back centuries that there's been a lot of fraud around faking a bill of lading or a bill of exchange, a warehouse receipt, in another effort. So what you have is you have a lot of forms of notary, well before cryptography, a lot of forms of notary where various transport agents and shippers had to really have seals and forms of ways to say this was a committed. Leonardo.

AUDIENCE: And I think part of the problem is that each one single piece of those documents are easy to falsify. That's why this system became so burdensome in terms of paperwork, because they started to build a lot of steps to guarantee that you can track all those things and make sure you reduce the risk. It's relatively easy to get one of those faked too.

GARY GENSLER: And it's why many people think this is actually one of the better use cases, better ecosystems for a revised technology similar to blockchain or actually blockchain technology itself, a lot of multiple parties. And though I only listed seven, you can have multiple banks. You can have the importer's bank, the exporter's bank, between them you can have a correspondent bank, right, so at least three banks in the chain or sometimes even more. Freight forwarders, shippers, customs agents in both countries. You have a question, James?

AUDIENCE: Nope.

GARY GENSLER: So lots of parties, lots of documents, high chance of fraud. And guaranteeing validation and verification is a big piece of this marketplace. So then the question is, can you put somebody in the middle? See that little blockchain in the middle, kind of cute. All right, you're not going to laugh a little with me. That's the question, so multiple parties involved. Verification is critical to all the workflows and the economics. And it relies on significant document flows. That's the basic. And it's what--

Today's lecture is really to say well whether you're looking at health care records, whether you're thinking about commercial real estate, you're thinking about internet of things, remind yourself of trade finance because this is probably one of the best use cases, at least for permissioned blockchains. So you can debate whether it could be done on a traditional database. But it's multiple parties. Lots of validation and verification is important, an awful lot of different documents.

And there there's property rights involved. Critically, there is key property rights because when you're shipping oil on the high seas or shipping any bits of that \$17 trillion on the high seas, people want to finance against it.

AUDIENCE: I have one question for me to better understand this. How do you finance these from sending a good from San Francisco to Boston? And the same time, why? Is it a matter of that we need all these documents and we need to put documents on the blockchain or can we just get rid of the documents? Why don't we see the same thing in intra-US?

GARY GENSLER: Very good question. Though the word trade finance has come to mean, for many decades, maybe hundreds of years, international trade, the same can be true for domestic trade, particularly as you're going, as you said, from San Francisco to Boston. You could use a letter of credit between a major domestic manufacturer and a small business in Boston.

So I might say, I don't want to take-- sorry, Joe Quin, but you're that small manufacturer. You're that small entity in Boston. And Tom's not willing to take your credit risk. You could still want to have a letter of credit. It wouldn't be called technically a bill of lading if it's not on a ship, even though that term sometimes is used. But everything back here could happen in domestic trade, but usually doesn't. Most of domestic trade is done on open account. But some of it's done on letter of credit especially, if just small businesses. Does that help?

AUDIENCE: Yes. I'm trying to think why do we need it in one case and not in the other one?

GARY GENSLER: There's more-- I think it's applicable in both. It's more applicable on international trade because you have more challenges of trust, I would even say information asymmetries. If you're sitting in China and you're exporting to Kenya, you have less chance to actually know that local community. And your bank in China doesn't know them either. And so what was built up to satisfy those issues of trust is the banking sector largely picked up that, either guaranteeing the documents or actually guaranteeing the credit. Hugo.

AUDIENCE: There's also something to say for like border control, right. Like, I know, in my lab we've had like waste materials shipped to us internationally. And customs agents really even care about that. You have to put a price on that, even if it has no price. So like if you could just put something on a car and drive it from San Francisco to Boston, then maybe like, yeah. If you're driving from Canada to the US, it would be different from shipping it from China to the US. But I think the trust issue comes up a lot more when you're dealing with international and regulatory differences between the two places.

GARY GENSLER: I'm not saying it doesn't exist in domestic trade. It definitely exists in domestic trade. But international trade long ago created a system to address different languages, different cultures, different regulatory regimes, taxing regimes. And it was going on a ship.

AUDIENCE: Even more anti-money laundering. So there is other regulation that is part of the policy that complicates it. One nation, a letter of credit-- you need to make sure that you're not breaking any regulation between different jurisdictions. Part of it will be ML as well or ABC or whatever.

GARY GENSLER: James.

AUDIENCE: But, I think, looking at that question, it seems like we are using technology, in this case, blockchain to fit into the existing framework of how things work. But shouldn't the question be flipped to say, hang on a second, do we need blockchain in a system that is better designed,

not having 50 different documents, and actually thinking about the actual problem. I can see the point of the trust which may need a blockchain solution. But a lot of that-- be that trucking receipts, railroad receipts, or cargo receipts, those are historical relics. Surely there must be a technology other than blockchain that could solve the problem.

GARY GENSLER: Well, maybe. Or maybe blockchain technology is just the right technology that's coming along in the 21st century to solve it better than initially pieces of paper and literally document couriers that had to be trusted to do it.

AUDIENCE: They've gone the way the dodo, right? So--

GARY GENSLER: Well, they haven't fully gone the way of the dodo.

AUDIENCE: While I think that there's much to be said about blockchain that creates trust in parties that may not naturally trust each other, the problem seems to me is there is a lot of things that doesn't need to happen in this day and age, as you mentioned, domestic mail services. It's between sender and receiver. What happens in between is tracked by UPS or whoever. But what we certainly don't see is all of that list of stuff while this is happening. But it's unnecessary, domestically,

GARY GENSLER: You might be right. But what's happened well before blockchain technology came along is digitization. But part of the trade can't be dematerialized. See in the securities business, what we talked about when we talked about clearing and settling of securities, the equity ownership has been dematerialized. And it started to happen in the 1970s. The legal right that you have this cash flow called an equity interest in Apple is all digitized. Part of this trade is not digitized, \$17 trillion of physical goods on the high seas. So I still think you're going to need something that shows that the physical goods made it on a ship or on a cargo vessel of some sort. And so there are some differences. Erik. Still haven't heard from.

AUDIENCE: Yes. Just to address a concern of James that many of the manual plus the station projects fail at the beginning because they actually did that. They kind of tried to reflect exactly what happened in the manual world into the digitized world, which resulted in many inefficiencies. And this is not the case. We're not actually trying to do exactly that off line process using blockchain technology. That's not the alternative.

But that actually made me think that I wanted to point out this to your argumentative of centralized databases. And centralized databases have been around for more than 60 years.

They've been digitizing manual processes for a while. The question comes is, why didn't they already digitize these sort of problems? The answer is because this trade finance issue has special characteristics that make it especially suitable for it to be addressed by these specific technologies. So that's why I would argue that.

GARY GENSLER: And what do you think that specialness is?

AUDIENCE: It's precisely the fact that you have multiple stakeholders dealing with information that goes among all of these moving parts and you have a high cost of trust. So what you're actually doing is using blockchain technology permissioned or otherwise to address this specific challenge.

GARY GENSLER: And you have a property right as well that people often want to borrow still against while it's on the high seas. But I agree it may well be that the blockchain technology is not the only solution to this. But it does feel like it's a particularly fertile area. And we're going to turn right now to some of the projects. And there is a lot of projects in this space. Alean. And then we'll go in back to Aviva.

AUDIENCE: So is the overarching goal here to fix the fraud or to fix the complexity, what's the goal?

GARY GENSLER: Well it's a really good question. So those working on projects, is it more about fraud or the complexity?

AUDIENCE: Fraud.

GARY GENSLER: So efficiency.

AUDIENCE: Yes, the complexity I guess is a function of the fact.

GARY GENSLER: So you can you can drive a lot of efficiency, which is due to the complexity. I think, that's one of the overarching goals is driving efficiency, but also to lower the fraud or the loss to fraud. It's both. But I think it's driven more by the efficiency from my readings of this.

AUDIENCE: Fraud.

GARY GENSLER: More by the efficiencies.

AUDIENCE: What's the fraud rate?

GARY GENSLER: I don't know the fraud rate. That's a good question. We'll see if we can find it out Aviva was

going to be next.

AUDIENCE: So let's say that trade finance does transition to a blockchain and then that it's more in the private blockchain. So then how do we solve the problem of interoperability?

GARY GENSLER: Can I hold that, because it's a very good question that will come up when we talk a little bit about some of the IBM projects, particularly with one of the largest shippers? So it's the right question. But we're going to chat about when we talk about it. Can I talk about some of the projects or was there something?

So where are we? Well, there's five big consortium. Two of them you can see are backed on-- or working on the Corda. That was R3 Corda that we talked about earlier this semester. Two are on IBM. One that's on a Ping An Group, we didn't talk about earlier this year.

So letter of credit approach. Receivables and payment guarantee financing, which is a little bit different. This is, we already have receivables, how do we fund them? Monitoring open transactions and letters of credit. And then the Hong Kong group is a supply chain record keeping.

And just if you want to see it sort of visually, this is all the banks that are involved in each of the consortium. And you'll see basically that there's some overlap, I think, unless I'm mistaken. I and G might be in a couple of them. I think two of these consortia maybe have now merged.

But it goes a little bit. It's not fully going to answer your question of Aviva. But even if there were five different consortium trying to figure this out amongst different groups of banks, at some point in time to really gain a great deal more efficiency, how do they operate, how do they transact across their platforms?

Now they each, obviously, don't want to give up economic rents. They don't want to give up market power to somebody. They don't want to all of a sudden find out that some entrepreneur is charging them so much because they created a network, because the one consortium that figures this out early on could price pretty close to their cost structure, but later on could, you know, price a lot higher and collect a lot of monopoly or economic rents. So I don't know where this will sort out. And I don't even know that they're going to want to solve the interoperability problem amongst themselves. Sean.

AUDIENCE: One interesting kind of finding fault with consortia is all of the banks listed up there, all these

are Asian bank or European bank. None of the US banks are actually participating. I see US Bank, so one.

GARY GENSLER: But do you see JP Morgan Chase? Now, who's the largest issuer of trade finance in the world?

AUDIENCE: US Government?

GARY GENSLER: What's that?

AUDIENCE: It's not the US Government, is it?

GARY GENSLER: No, no, no. I think it's-- I think it's HSBC. I might be mistaken.

AUDIENCE: I think it's HSBC.

GARY GENSLER: You think too, it is HSBC. But you're right. The five big-- Wells Fargo is not on there either. Now that doesn't mean they're not working on other projects, because here here's some other projects. And these aren't the consortia. I'm just giving us flavor. There's a lot going on in this space. And those of you who are doing final projects, I challenge you to think about these projects. And say, well what are you recommending that's different, you know. It's not just me too, me too financial, not the other me too stuff.

India's interesting to me. There's another consortium that wasn't on that page. And I'll probably pronounce it wrong. "Final Cal" or "Finic Cal."

AUDIENCE: Finacle.

GARY GENSLER: What's that?

AUDIENCE: Finacle.

GARY GENSLER: Are you familiar with that?

AUDIENCE: Not much, I just know the pronunciation.

GARY GENSLER: Just the pronunciation. Thank you for helping me out. I needed it. For validation documents and payment, so they're not really saying we're just trade finance. But we're going to validate all the documents This goes more to fraud. I think this project, validating the documents, saying, yes, they're true and good, and you can lend against these documents. And a lot of times these documents are the bills of lading and bills of exchange or loan lendable and so

forth.

So a lot of projects, one-- I could only find and there may be others, I could only find one with a token. And I put it up there last, Ethereum based ConsenSys, the company that's run by Joe Lubin who is the Canadian venture capitalist who helped back Vitalik Buterin and Ethereum. ConsenSys has 300 or 400 people at least working in ConsenSys doing Ethereum based projects. So I was pleased to see I could find one native based token. But to my knowledge, all of the consortia and all of the ones I listed up there are permissioned blockchains from what I can tell.

But I'm curious, those of you who are working on this, have you found any native token projects here?

AUDIENCE: There is still b-verify, which is a project from the Media Lab. It doesn't have a native token per se, but uses permissionless blockchain, existing permissionless blockchain infrastructure to gain the readability of lots of statements to build a warehouse receipts use case. So they are using transactions in the Bitcoin network right now to write--

GARY GENSLER: But does b-verify have a token?

AUDIENCE: No.

GARY GENSLER: No token.

AUDIENCE: It's been restructured. Yeah. Yeah.

GARY GENSLER: What's that Alean?

AUDIENCE: I think they build on top of our research from Cecil.

GARY GENSLER: Catina?

AUDIENCE: Yes. Exactly. Yeah. Catina is a person.

GARY GENSLER: So is that your research?

AUDIENCE: That's right. Yeah.

GARY GENSLER: That's terrific. But you're-- you're-- so you're going to talk to Eric. But you didn't have a token in that.

AUDIENCE: No, you don't need a token. That's the whole point. Like Bitcoin is out there. It's a great system. And you can build on top of it efficiently, providing mutability to any permissioned app. So don't start it as a contract necessarily, unless, I don't know, maybe there's a need for that. But in a lot of things there's not, like digital identity, for example. That can be very conservative.

GARY GENSLER: But if you put a token in it and sold it right into this bull market, I guess you wouldn't be sitting in this class.

AUDIENCE: Well, yeah.

[LAUGHTER]

GARY GENSLER: But I mean, I'm glad you didn't put a token. I'm glad you're here. But I mean that's part of-- like you're saying, you didn't need it as a technological and commercial point is what you're saying. Leonardo.

AUDIENCE: I was just going to mention, I happen to know a couple of people working on this project.

GARY GENSLER: Which one of them?

AUDIENCE: The last one.

GARY GENSLER: Could you tell us something about it?

AUDIENCE: Yeah, so I had to dig a little bit into the native talking that you mentioned. But most of the trading firms there are petroleum based, so like very large shippers of oil. Back to your point, bill of lading, in the commodity space, the petroleum bill of lading are the ones that most actively traded. And they change hands very often while the vessel is at sea.

GARY GENSLER: Actually if I can add to this, because I learned a little bit about this when I was in the US Commodity Futures Trading Commission. The bill of lading for oil on the high seas can trade hands hundreds if not thousands of times. The oil coming from the Strait of Hormuz to Houston might change ownership in-- I don't know how long it takes a 15 or 30 day trip.

AUDIENCE: About 20 days.

GARY GENSLER: A 20 day trip. It can change the ownership hundreds of times. So those documents become tradable goods. And it's not just in theory. It's very much in practice.

AUDIENCE: So the point I was going to make is I suspect they may be talking there must be some kind of collateralization against those, you know, the bill of lading from the company.

GARY GENSLER: So Alpha, who I'm sure I remember everybody in your group, what can you tell us about what you're working on? How are you going to beat all these consortia? I'm thinking, you know, your final project is going to do better than these, right?

AUDIENCE: Of course.

[LAUGHTER]

We're taking the--

GARY GENSLER: I did give these two groups the heads up that I was going to call on them. So this is not just-- but yeah.

AUDIENCE: We're taking the approach of just being very specific. So we're focusing on a narrow corridor between Chinese exports coming into Ethiopia. And so one there aren't many people, obviously, looking at that space, at least not yet.

GARY GENSLER: And is it through the trade finance side or what I'll call the supply chain side?

AUDIENCE: The trade finance side. And so we think it's particularly interesting around not just Ethiopia, but all of the sort of developing countries in that region, because credit and finance is already so limited. And so the domestic banking systems are undeveloped.

GARY GENSLER: Domestic banking system in Ethiopia particularly?

AUDIENCE: Right, and across East Africa, I would say. And so the reliance on trade finance in those import heavy economies, I think, is even higher. So the ping point, I think, is even stronger there.

GARY GENSLER: James, did you have a question for their group? Anybody that has questions for the group, pile in. They'll take the advice.

AUDIENCE: Not specific on this one, but more of a clarification. So I can clearly see that trade finance requires different parties and the ownership of the goods at any point in time in the supply chain is important, but--

GARY GENSLER: Particularly when it becomes commoditized, like oil and so forth.

AUDIENCE: But from like over time-- a lot of the times I hear about people saying blockchain using, in this scenario, there's a supply chain. Given that they're not really exchanging it for money, are there actually any commercial cases or use cases with genuine useful points about supply chain being on the blockchain? I mean, tracing where my coffee bean came from on the blockchain is pretty useless to me. But people seem to think about it as a great thing. I can trace back where something came from.

GARY GENSLER: Are you a coffee drinker?

AUDIENCE: Yes. Yes. Not because of your class.

GARY GENSLER: No. No. I just didn't know. You could drink tea to stay awake in my class too.

AUDIENCE: But I just didn't understand when people keep talking about supply chain needing to be on the blockchain. I just don't understand why. Where's there is trade finance, absolutely.

GARY GENSLER: All right, your solved is-- wait before everybody piles in. Does anybody have advice for China Ethiopia trade finance? I'm going to give everybody a chance to pile into James's question. But you're in a China Ethiopia trade finance.

AUDIENCE: Yes, I have a question of the interoperability. I mean, what's the solution for the Ethiopian purchasers, just have to basically buy into whatever system these firms are using?

So Ethiopian firms have to use letters of credit. So that's a regulation. So everything is done completely manualized right now. So we would offer just something very, very sort of specific like an eBill of lading or an eInvoice platform. It could be on a smartphone.

My Impression is that it'd be easier to get the Ethiopian firms to buy into this, whereas the Chinese firms may have multiple options or multiple systems. So how would you approach getting them onto your system specifically or being able to utilize your system using websites or whatever else they are using?

So yeah, so we agree. So you'd have to get just Ethiopian businesses and banks on the system. And so they would be sort of our initial customers. And for any Chinese bank that wants to do business to export to Ethiopia, they have to go through Ethiopian Bank. So inevitably, they'd have to go through this.

GARY GENSLER: So it sounds like you're trying to build a solution. Your adoption is through the importer side,

through the Ethiopian side initially. And then the Chinese exporters would say, well this is how I get into the Ethiopian market in a more secure, maybe more efficient, but certainly more secure way. Other thoughts on this project?

AUDIENCE: I thought I saw there was a new consortium that was predominantly Chinese shippers and container companies. It wasn't on that particular one.

GARY GENSLER: And it's not this. It's not the first one, The People's--

AUDIENCE: Not the first one. No, this one has a couple of Chinese shipping companies. It's very new. It's like November 8th or 9th or something that it was launched. So it's just getting started. They were looking for vendors. And yeah, it's a huge consortia there.

GARY GENSLER: No, no. This is one of the most active and it's remained active, but mostly permissioned blockchain chain technology. It's the most active and very vibrant. And if you had to say probability weighted, there'll be something successful in this space more than maybe some of the other spaces. So who wants to chime into James' supply chain-- this unit? You're going to jump in.

So I just want to tell-- here's just two example of some shipping. And I just pulled up five quick examples of supply chain projects. But Eric, you want to address James coffee? You like coffee more than James.

AUDIENCE: I won't give you an example of coffee, but let's say fruits. You have a big retailer chain that-- and I think the example is in Britain. Suddenly you have reports of sudden infection of E coli in a specific fruit. OK, so as a responsible measure, the retailer have to hold off-- actually has to know which part or which load of fruit is the one affected. So since the whole process of, you know, digging through a huge file of paperwork takes weeks. These guys would have to hold off a big bunch of fruit that they would eventually get lost with the economic implications of that. That was a-- They probably--

GARY GENSLER: So wait, wait. So let's see.

AUDIENCE: We're getting there. We're getting there.

So having your supply chain connect to a blockchain, that can allow you quickly get the information within hours and immediately identify which is the load that's been affected and take it out with the decreased economic costs.

GARY GENSLER: So you got at least three other hands. We'll go--

AUDIENCE: So I tend to agree with James. So what I've heard critiques of using both blockchain for supply chains for things like blood diamonds or preventing counterfeit goods or whatever. Diamonds we have DeBeers project. Yeah, so I know these guys are doing that. But the criticism. I've heard is that because these aren't digital native goods, there has to be an interface between the real world and the blockchain.

GARY GENSLER: Physical good to the digital good.

AUDIENCE: And what I've heard from critics is that it's at the point of origin that fraud or counterfeiting whatever takes place. And it's the point of origin, where that data needs to take place anyway. So it's garbage in garbage out. You can put a counterfeit thing in, but then that passes through the supply chain.

GARY GENSLER: We have Shammon, Raheem, and then Tom.

AUDIENCE: I'm going to pick James' side.

GARY GENSLER: Oh my god, I need somebody on the other side of James.

AUDIENCE: Maybe you can help me in a sense that like Walmart, right, is kind of a prime example. They've implemented, et cetera. But basically if Walmart just said like, so basically they're using IBM infrastructure, right. If they went to the supply chain said, look guys, we hired IBM, OK. Now you're going to send-- every time this good can transfer hands, you're going to send that information to IBM. That's it. I mean basically that's what happened because it's being stored on a server that IBM-- like what is blockchain about?

GARY GENSLER: Well--

AUDIENCE: Like I heard them how this is blockchain. But I really don't see what is blockchain about it. I mean basically--

GARY GENSLER: So who wants to take-- who want to take the other side for him? And I know, James. You're not taking the other side of James.

AUDIENCE: I think is a bit controversial. But when I was in the UK a couple of years ago, there were some activists talking about the origin of weapons and some areas where weapons were being

smuggled in some war zones. The point of origin in this case will be the developed world, which is going into the US, UK, China. If you can trace the origin of the weapons sent in war zones, you could know how did it end up there and you can stop maybe. I don't know.

You need to trust the data entry in the first place.

GARY GENSLER: You do have to have--

AUDIENCE: But the point of origin in this case, is not trusted. It would be trusted because it would be manufacturers. And most of the manufacturing would be--

GARY GENSLER: I'm going to hold off because I want to get Tom and then I'm going to give you a reply, James. Tom.

AUDIENCE: Yes, so I am on the other side. I think it works. And it sort of goes back to Alean's original question of whether or not this is about addressing fraud or addressing the efficiency of the system. The data entry is the same. I mean, if the data entry from a paper system or a non-block digital system or a blockchain system is bad, then it's always going to be bad. But if it's good, it's as good as it is right now and probably as good as it's going to be short of like RFID chipping every individual product, then what it does is allow that same record to go through the entire supply chain.

So what is deemed by whatever data input system to be a conflict free diamond is seen by DeBeers, the exporter, the producer, the porch, the ultimate importer of the good. And so you can save what are now verification costs in terms of time by processing a railway receipt, a trucking receipt, a shipping receipt, forwarding exchange receipt by making that same document viewable and immutable to all of the partners in the trade.

GARY GENSLER: And to Shammon's question, I think you've framed the right question. Basically, well, why not just the traditional database? IBM is the software provider of Hyperledger Fabric. Why not just give the information to IBM? And in fact, maybe that's what Walmart is doing, is what you said.

AUDIENCE: That's why I said what I did.

GARY GENSLER: Now I haven't dug deeply enough. And often when you dig into these websites and the news articles and the white papers you can't quite tell how they're using IBM. IBM, I think, has 1,500 people in their division that does Hyperledger projects. So they they're out there. IBM is marketing this. But I think the theory at least, because I'm not going to be able to answer what

Walmart's really doing. The theory is it's more censorship resistant, that the data is actually shared on multiple nodes even if it's permissioned, even if there's only 15 or 20 nodes or 30 nodes, that it's more censorship resistant than if it's all stored on an IBM server.

And I don't know the answer, whether the Walmart is actually stored on 30 different nodes. But if it were, then arguably then, even though it's permissioned and private, it's more censorship resistant and you can have more assurance around this. One of the challenges-- Aviva left the room, on interoperability is this number two, TradeLens. TradeLens, the IBM and "Marks," "Merks," how do you pronounce that company?

AUDIENCE: Maersk.

GARY GENSLER: Maersk. It's one of the largest-- it's one of the two or three largest shipping companies in the entire world. They come up with a project. They announce it, tout it. It's over a year and a half ago. There's no adoption because the other shipping companies are saying, why do I want to adopt something with you? Now it would be one thing if some neutral standard setter, almost like in the internet the I Can or something. But some neutral standard setter came up with a consortium. But all the other shippers in the world say, I don't want to give up to Maersk my data, my information, and what might be also market power. So interoperability works there as well.

All right, James wants to have a reply. But are you all right holding off?

AUDIENCE: Sure.

GARY GENSLER: All right. So we'll take two from my right.

AUDIENCE: I think there's another issue which is more about the economics of it, which is, OK, let's say that Walmart adopts, like basically right now they can force a lot of the supply chain to adopt this. I think there's a real question about what they're going to do with that data, right, because essentially what it does it allows them access to the end producer. So the production of mangoes is very fragmented, right. But then you get consolidated. So there are multiple steps along the chain that actually extract economic value, not the growers. I mean, they're kind of screwed, right.

But now Walmart can go directly to the growers, because now they have access to the data of who the grower is, what their productivity is, and how much they produce or what time of the year they produce, et cetera. Well, there's a question about whether they want to cooperate

with that or how much information I want to share with that if I'm in the middle and I'm actually accepting economic rent right now.

GARY GENSLER: Right, so if the whole supply chain is somehow--

AUDIENCE: It's not just the administration.

GARY GENSLER: Yeah, that's right, the data. Just like Facebook collects data or Visa collects EMI data, that maybe Walmart would collect data.

AUDIENCE: My question takes the Walmart example a little bit further. I'm curious to understand do you put a supplier early on in the process, say a farmer or something selling to Walmart, do they even have exposure in terms of the user experience that they are on blockchain or does this just become the back end. I guess, I understand what we've talked in terms of private keys for digital currency. I'm trying to connect how that ties to the user experience here.

They have like scanners that they basically scan or it's their phones or whatever, right. So you have third parties using these linkages. They don't know basically where this data is going.

GARY GENSLER: So I'm honest. I'm going to take Shammon's description of it. I'm not as close to the Walmart. I think in the trade finance side, the consortium that these and these, the importer, the exporter, the banks, the shippers, and the best of these are meant to have a lot of involvement and exposure, because even though this looks pretty complicated and it is, they're large institutions. They're banks. They're shippers. They're freight forwarders, except for maybe the small and medium sized enterprises in Ethiopia. But then they're an importer that needs to have involvement.

I think on the supply chain side, the Walmart, an individual grower of mango, you're saying from your understanding Walmart's not looking for them.

AUDIENCE: Again, this is because they're very proud of that. They're proud of the fact that they can actually influence. The reason why is because they have the last mile. It is very simple.

GARY GENSLER: But they would have to have some way to do what Tom said. They have to be able to put into digital form the physical asset, the mangoes are from this pack farm.

AUDIENCE: Yeah. But they can use a cell phone. You know, so you type in, OK, so you know like--

GARY GENSLER: A scan.

AUDIENCE: Yeah.

GARY GENSLER: A QR code or something. James, you want to reply? And then we'll go back to you here.

AUDIENCE: Just quick points. I think--

GARY GENSLER: Are you convinced yet?

AUDIENCE: No. I think ultimately there's no doubt that once the digital record's created, the digital immutability, whether it's a blockchain or a very secure standard traditional database, they are going to be the same. The digital records, it's fine. But in the fiscal world in the context of supply chain, whether it's from the origin or any other individuals along the chain, all it takes is one bad actor to do something to the physical good. But while traditional record is immutable, you're link between the physical and digital is not guaranteed. So I still don't see how a physical commodity can be guaranteed to go from one end to the other of the supply chain without ever being tampered or altered. That is still a big question for me.

GARY GENSLER: Hugo.

AUDIENCE: Yeah, I was going to say that. I don't know if that's the objective. Because if you take diamonds, right, and as long as you-- like what people care about when they're buying a diamond is just the margin, right.

But my point is that it doesn't stop anyone along the supply chain to have--

It just makes it more expensive. But, but--

GARY GENSLER: Seriously, I think you're holding it up to too high of a standard. Because even the oil, let's go back, not diamonds, but oil. For quite some time you could have a bill of lading and then sell it. And as I mentioned earlier for the 20 days that things are coming from the Mideast to Houston, that might transact 20 times, 100 times today in 2018 markets. And nobody is actually looking to see whether the oil has been somehow siphoned off the ship and it's no longer there.

So there are aspects of trust that would still be in the system with somebody certifying when the ship is-- I don't remember the word, but on board, when the oil is put on the ship and when it comes off. And there's validations at those moments that would then communicate to the

digital records.

AUDIENCE: But I guess that's--

GARY GENSLER: Then you could do that through inspections of diamonds. I don't think you're going to change that. I think that's still going to be important. But what you can do is Alean's earlier point, you can lower a lot of the cost. You can drive a lot of efficiency. And you can probably lower the fraud around the documents.

AUDIENCE: Yeah. So I guess my point-- one of my-- I guess what I'm saying is--

GARY GENSLER: And then we're going to move on.

AUDIENCE: If the trust isn't there in the first place or you have to rely on some other trust, what exactly is blockchain adding in terms of the physical, the digital records? That's what I'm finding difficult to understand. But I think I'll finish up with a quick point. I spoke to someone at the conference from ExxonMobil, since we're talking oil. And he does a supply chain and implementation of blockchain. And I challenged him, why not use a standardized database? And he said, well, it's because if you're going to get everyone along the chain to upgrade to a new system, it's far easier by telling them, oh, it's blockchain, rather than saying, well, I have this sophisticated database.

GARY GENSLER: I'm going to hold that point. I'm agreeing with that point. But we had Dan and Jay.

AUDIENCE: Yeah. I just want to say, I mean, I fell like this is way more feasible for a smaller kind of vertically integrated supply chains, where like for DeBeers where like they own every kind of step in the process. And therefore, you kind of-- can really trust and trace the flow of the product. But something for like groceries where you have, kind of, farmers all over the world and, you know, there's seasonality, right, changing. So there's just so many smaller shops that I can't ever see it being feasible for them to adopt kind of a high level technology.

GARY GENSLER: You may well be right, though QR codes have been adopted in millions of retail establishments, when 20 years ago it was kind of like, what's this all about? In fact 30 years ago-- he's in the news because he just passed away-- but President George Herbert Walker Bush, some people say part of the reason he lost the election in 1992 was that he didn't know what a scanner was in a grocery store. And he was president of the United States. Can you imagine that? But he didn't because he grew up in an era and it was happening while he was in the White House. And now you couldn't imagine not knowing what a scanner is. So I agree

with you. But what's happening in 20 years is sometimes hard to predict.

AUDIENCE: Yes to build on that a little bit, I think if you are completely vertical, then you don't really need blockchain in the first place, because you have your own database. Your tracking everything as it goes through that. The reason you need block chain is for the traceability when you have 20 different parties. But also once you digitalized this whole thing, I mean, right now it's all paperwork, so you bring it-- digitalization is going to allow you to use other tools like IoT. So you can maybe use-- to take the diamond example, use computer vision to actually tell that you have the exact diamond that you started with at the end of the supply chain. Or with food, that you can test the texture of food and things like that. So it's all about quality as well.

GARY GENSLER: By the way, you can hash-- you remember that stuff, that broccoli at the beginning? You can use cryptographic hashes also to take pictures, to take other data about the diamond, other data about the foods.

AUDIENCE: I'm just going to add, especially with the diamonds, I got kind of razzed after reading the article because we all know DeBeers. They're like the best marketers out in the world. They convinced every woman that they need a diamond in their life. They invented the concept of like a diamond engagement ring.

So I think like this is the perfect marketing ploy to say they needed to blockchain for diamonds, like the entire-- like DeBeers is the entire diamond industry and how they now receive diamonds is already completely regulated. But with regard of about in house and controlled by them because of the backlash against like conflict-- diamonds from conflict-- or conflict originated diamonds. So for me, it just seems like a big marketing scheme that they already feel like they have this under control. But in order to like buy more consumer confidence, they're using it.

GARY GENSLER: I think you land upon a point about marketing. And James has said it earlier, and a little bit of others in short. Oil executives, says, well, it's the only way I'm going to get broad adoption is if I call this blockchain. And that might be true even of the Australian stock exchange, even though I think there's a real use case there.

But it's about adoption. Now DeBeers might be doing it because they want to sell more diamonds. The oil executive might be doing it because he just wants to get rid of a legacy system. Or the Australian stock exchange might say, this is the only way I can get investment

in getting rid of a legacy system, because I can either scare my board of directors and say we have to do blockchain or I can inspire my board of directors by saying I have to use blockchain.

But nonetheless, blockchain technology will have some adoption. And I think it will have more adoption, so it's more ripe for adoption. And I'm going to turn to this again. You know where I'm going. It's like, yep, yep, you know, cost and benefits. These are-- I'm doing this as a favor for all of you too because, you're all writing your final projects.

But it's really about-- it's going to be where there's multiple parties involved in data and that data represents some property right, either money. In a dematerialized way, it's easier to envision that's money versus security, money versus something dematerialized. It's a little harder as we've done today on the supply chain, when it's against a physical asset. But if there's multiple parties and where verification matters, verification costs, you can probably drive some efficiency with a blockchain technology solution.

Good question Shammon raises. Well, wait a minute, maybe you're just shipping the data to IBM. Are you really shipping it to just-- that's called a traditional database, a distributed database. Or do you get something out of censorship resistance? And if it's truly shared in 20, 30, 50, or 100 places, do you lower, as the Australian stock exchange really does believe they'll do, lower reconciliation costs, which is, again, a way to drive efficiency. But I can't remember the number, there are 77 member companies can all have a shared ledger and then lower the cost of reconciliation. It's still what somewhat controlled. Those 77, it's not a public blockchain like Bitcoin.

So whether it's the two groups that are here today that are doing trade finance. And you have a harder challenge, by the way, because you've got to go beyond this lecture. Alpha's is going, yeah, sure. But if you're doing commercial or consumer finance or real estate or whatever, and there are some really interesting projects amongst you, just thinking about where is that value add? What verification and networking costs are going to be lowered? What's the competition doing?

Figure out if there's any consortium doing whatever you're proposing to do. Or is there any of the 3,000 to 5,000 white papers, was there any ICO token? And then if you want to do a slap down and say why what they're doing is foolish and doesn't work and you're doing something better or you just want to learn, just please don't plagiarize. But just look at what the

competition's doing as well. And why is an append only log, you know, the right way to go? Alean.

AUDIENCE: What about competitors who are incumbents?

GARY GENSLER: Absolutely. So you're still doing the mortgage product, right? I don't know if you changed. Yeah, what's happening in the mortgage market? How is it being-- whether it's securitized or underwritten and whether it's traditional database management. But it's also an interesting to know if anyone else is trying to look at either permissioned or permissionless systems and where you fit in to that, because you're actually trying to raise money on this, if I remember.

AUDIENCE: Yeah.

GARY GENSLER: Yeah, so to the extent that you're going to raise money, those venture capitalists are going to be asking tougher questions than I'll ever be asking, at least I hope.

AUDIENCE: I honestly don't.

GARY GENSLER: Yeah. Yeah. I got it. You want cheap money. You want me to be the toughie. Yeah. All right. And what are the trade-offs? I'm not asking any of you to have solved scalability and performance. Some of the scalability and performance issues won't be solved for 5 to 10 years. But at least note them. At least say, hey, this won't work until this is solved or something like that.

Thursday we're going to do identity. I can't remember, is anybody doing projects on identity? You're together, right? Yeah. All right. Be ready to chat on Thursday and share where you are. Kelly's looking like you're going to be sick on Thursday. You'll be here. And how many of you are going to get your MIT diploma on a blockchain?

AUDIENCE: You have option?

GARY GENSLER: Yes.

AUDIENCE: Do we get an option of not getting one?

I don't think so.

GARY GENSLER: Oh, you mean you think you have to.

AUDIENCE: I think it's done for you.

GARY GENSLER: Oh, it's done for you. All right, there you go. What's that? You excited by that? Do you think you can finance off of it though? So trade finance, \$17 trillion. It's a very significant role that in financing this \$17 trillion of trade, lots of people involved, sort of ripe for blockchain technology, a lot of consortiums and projects underway. But they're almost all permissioned systems with a couple of exceptions. But it feels like it's a catalyst for change. I think that even if it's just simply because it's the way to get adoption. And I'm talking about trade finance. And then there's this related part of the supply chain management and so forth. Any other questions or are we breaking early?

AUDIENCE: Early.

GARY GENSLER: Do you want anything? All right, we'll break early. Great.

[APPLAUSE]