MEMORANDUM

FROM: Michael Best Strategies

DATE: May 8, 2018

SUBJECT: Leveraging Blockchain Technology To Improve Supply Chain Management

WITNESSES:

Douglas Maughan, Cyber Security Division Director In The Homeland

Security Department's Science And Technology Directorate

Robert "Bob" Chiaviello, Ipr Counsel, Nuby Law

Michael White, Head Of Global Trade Digitization At Maersk

And Chris Rubio, Vice President Global Customs Brokerage Staff At Ups

TRANSCRIPT:

ABRAHAM: The Subcommittee on Oversight and Research, and Technology will come to order. Without objection, the chair is authorized to declare recess of the subcommittee at any time. Good morning and welcome to today's hearing entitled Leveraging Blockchain Technology to Improve Supply Chain Management and Combat Counterfeit Goods. I recognize myself for five minutes for an opening statement.

Good morning again. Welcome to today's Joint Oversight and Research, and Technology Subcommittee hearing Leveraging Blockchain Technology to Improve Supply Chain Management and Combat Counterfeit Goods. Today's hearing will highlight potential applications of blockchain technology in shipping, logistics and customs, emphasizing supply chain management.

A focus today will be how this technology can be leveraged to greater visibility into the supply chain and how technology can be used to combat the distribution of counterfeit products. We will hear from government and private sector experts about blockchain's potential to improve the security of our systems and how it can ensure customers and the companies alike, that the products and services being used are verified.

The Science Committee continues to engage in oversight of emerging forms and applications of technology, just like the discussion that we will occur on blockchain today. We recognize that these technologies can benefit both the public and the private sectors, and seek to understand what can be done to ensure that this technology is appropriately leveraged in an efficient and productive manner. Through ensuring reliability, increasing productivity and securing systems and data, the application of blockchain technology is an area in which there is much to learn.

While the applications for blockchain technology are continuously increasing, this hearing is an opportunity to learn more about a specific use and supply chain management. Today's witnesses can provide valuable insight into how blockchain can enhance security and be leveraged outside of the private

sector to improve government efficiency. We must also recognize that the barriers faced by the private sector in leveraging blockchain technology in order to fully realize its potential benefits. By hearing from individuals today that are taking part in ongoing and proactive efforts within the private sector to utilize blockchain technology in different areas of their business models, we can gain a better understanding of what, if anything, industry needs from the government.

I want to thank, Mr. White, for being here to represent Maersk and, Mr. Rubio, representing UPS. These companies are presently engaged in important case studies using this technology. We look forward to learning about those efforts.

Additionally, Mr. Chiaviello is here today to do detail some of the counterfeiting and business issues companies like Lov n' Care are experiencing. Baby care products are some of the most important on the market, we must be able to verify the authenticity of these goods. There is a potential role emergence -- emerging for technologies like blockchain to address these global supply chain safety issues.

The committee will continue to prioritize issues like verification and overall cyber-security. We hope venues like today's hearing will help provide a better understanding of the issues our private industries are facing and how they are utilizing emerging technologies. This knowledge can better inform the committee on how the application of blockchain technology could potentially bolster private companies and the federal government's cyber-security weaknesses.

Dr. Maughan, we appreciate you being here today to provide more insight into the role DHS has played in utilizing the emerging technology. DHS Science and Technology Directorate is in a unique position to provide valuable insight and services as a useful role in exploring a broader understanding and application of the technology in areas directly related to shipping logistics and customs. Additionally, through -- though the many projects and ventures it supports, DHS has the ability to effectively identify the potential for blockchain technology and address how the federal government could benefit.

These potential solutions could help secure data and enhance our national security. I look forward to the insight, our witnesses will provide. This dialogue will help us resolve important questions and better understand the next steps that must be taken to ensure the -- the integrity, resilience and security of our systems in industries that could, and do, benefit from the application of this technology. Let's go to witnesses.

ABRAHAM: We're going to recognize our witnesses now. Our first witness today is today is Dr. Douglas Maughan, director of the Cyber Security Division of the Science and Technology Directorate at the Department of Homeland Security. Dr. Maughan previously worked at the National Security Agency from 1987 to 1999 as a senior computer scientist before moving to DARPA to work as a program manager.

In 2003, he joined the Department of Homeland Security as a program manager and was promoted to division director in 2010. He holds two bachelor's degrees from Utah State Universities in computer science and applied statistics, a master degree in computer science from Johns Hopkins University and a doctorate in computer science from the University of Maryland Baltimore County.

Our second witnesses, Mr. Bob Chiaviello, an IPR counsel at Nuby Law. Mr. Chiaviello has practiced intellectual property law for 37 years, starting at Pennie and Edmonds in 1980. After a brief stint with IBM, He joined Baker's Botts in 1990. In 2002, Mr. Chiaviello joined Fulbright and Jaworski as a partner and worked there until 2011. He received his bachelor's degree from Washington and Lee University and his juris doctorate is from the John Marshall Law School.

Our next witnesses is Mr. Michael White, head of the global trade digitalization at Maersk Mr. White has worked with Maersk since 2007, first as a managing director at Maersk Holding, he then became managing director at Maersk line before becoming the head of global trade digitization in 2017. He received a bachelor's degree from Virginia Wesleyan University, and also studied at Harvard Business School and the International Institute for Management Development business school in Lausanne, Switzerland.

Our final witness is Mr. Christopher Rubio, vice president of global customs brokerage staff at United Parcel Services. Mr. Rubio holds a bachelor's degree in accounting from Pace University and MBA in finance from Rutgers University. He has worked for UPS since 2004, first as department manager for the midmarket sales team. He then became the department manager for UPS trade management services before joining the global customs brokerage systems group.

I now recognize Dr. Maughan for five minutes to present his testimony.

MAUGHAN: Chairman Abraham and distinct members of the Oversight and Research, and Technology Subcommittees, thank you for inviting DHS to speak with you today. I will be sharing important aspects of how the Department of Homeland Security Science and Technology Directorate is using blockchain technologies in research and development, and working with department mission areas to integrate the innovative technology into everyday use.

As the R&D arm of DHS, S&T develops the tools, technologies and knowledge products for DHS operators and state local first responders, ensuring that R&D coordination across the department to develop solutions for the needs of today and tomorrow. S&T partners with federal agencies, industry, academia, and international governments to create and test real world solutions that help the nation's homeland security officials defend against, respond to, mitigate and recover from all hazards and threats in a realistic timeframe. Blockchains offer promise, as witnessed by the rapid growth of interest across government and private sector.

From government perspective, the technology holds potential for enhanced transparency in auditing of public service operations, greater supply chain visibility to combat the distribution of counterfeit products, and automation of paper-based processes to improve delivery of services to organizations and citizens. There are many types of blockchains with varying degrees of support of classic security principles such as confidentiality, integrity and availability, as well as supportive privacy principles such as pseudonymity and selective disclosure.

Analysis to determine if a particular blockchain supports the security and privacy considerations is often nonexistent and/or not readily available. There remain other challenges with blockchain technology, particularly a lack of support for standards that may limit the growth and availability of a competitive marketplace of interoperable, cost effective and innovative solutions, for both government and industry.

Certainly private industry is leading the way in blockchain development, as many see it as a key competitive advantage. Government must be informed and ensure blockchain technology, as it evolves, supports standardized approaches for security, privacy and data exchange, to create efficiencies and enhance the public good. Government must also consider leadership opportunities within the broader community and partner with industry to bring solutions to market.

Blockchain technologies are an integral part of several ongoing S&T research efforts with both DHS components and industry partners. We are exploring many issues, including the development of best practices and decision criteria on when and how to implement the blockchain technologies, understanding the support for security and privacy principles in commercial blockchain implementations, developing

specifications to ensure standardized approaches for decentralized identifiers, defining interoperable data formats using verifiable credentials, and identifying scalable and usable approaches to decentralized key management systems.

DHS S&T is also supporting the development of globally available specifications as a precursor to standards which are open, royalty-free and free to implement, to ensure interoperability across systems, while ensuring there is no vendor lock-in. We are doing this through organizations like the World Wide Web Consortium and the Organization for the Advancement of Structured Information Standards.

Within DHS, the U.S. Customs and Border Protection organization has been the most active operational component to partner with S&T on the use of blockchain technologies for its mission. Our ongoing engagements with CBP include: a proof of concept deployment with the border patrol to evaluate how blockchain technology can ensure the authenticity and integrity of imagery data collected from cameras, both fixed and mobile; conducting analysis of alternatives and feasibility studies to understand the potential benefits and challenges for facilitating and enhancing international passenger travel; and conducting proof of concept deployments in partnership with CBP's Office of Trade and Office of Trade Relations that are directly focused on applications of blockchain to shipping, logistics and customs.

Blockchains are moving rapidly from hype to reality in the application domain areas were DHS S&T is currently working. We believe are careful and considered approach benefits not just DHS, but everyone who is considering the use of a blockchain technology, by ensuring that there are multiple vendors with interoperable solutions from which the government can choose.

Thank you, again, for your committees' thoughtful interest and leadership and blockchain technology, and how it will help DHS accomplish its important mission. I look forward to your questions.

ABRAHAM: Thank you, Dr. Maughan. I now recognize Mr. Chiaviello for five minutes to present his testimony.

CHIAVIELLO: Mr. Chairman, members, thank you for focusing a light on this problem. I also want to thank your staff for a helping to coordinate and the hospitality they've shown us coming up from Monroe, Louisiana, for this hearing.

CHIAVIELLO: I represent Luv n' Care, it's a company located in Monroe, Louisiana. We make baby products. If you're a parent or grandparent of small children, you probably are familiar with our products. We make sippy cups, pacifiers, bibs, a wide range of products -- we're not a tech company. So -- but, I'm here to explain to the committee a problem, a growing problem that we are experiencing from unfair competition, and particularly an unfair competition from overseas.

As a consumer products company, we've always had to deal with people who would copy our intellectual property and try to sell it as -- as counterfeits or knockoffs. But today, what we are facing is a foreign-centered threat. It's costing our company of millions of dollars a year and it's seriously affecting our bottom-line.

Some of what -- what we are seeing today is really at a combination of two things. One is the online retailing, combined with the ability to ship products directly from overseas into the U.S. market. When -- when I first started 30-some years ago, if there was unfair competition, it usually came in by a container load, which usually gave us plenty of time to -- to deal with it or -- either on the water, or by the time it arrived here we -- we -- we could deal with it either with customs or in the court system.

Today, the products are coming in by -- by UPS and China Post. What -- what we see as a foreign-based entity that will use a online retailer, like Amazon or others, they market their product to U.S.-based consumers. Typically they use our intellectual property. They're using are trademarks to promote their product. They'll even go so far as to copy our photographs from our website, photograph our -- our products, marketing it as their own. Then they use digital advertising to attract the consumer to -- to their website.

The consumer thinks, of course, that the product is somehow related to us, purchases the product and then product is shipped directly to the consumer from, typically, China. We -- we are now -- and this -- the product can be shipped in, we've done experiments or testing, could be 48 to 72 hours from placing an order online to the time the -- the -- the product arrives here in the United States. The -- the -- another -- well -- well our problem is primarily with intellectual property, where we can enforce our -- our rights.

There is also a problem with the U.S. health and safety laws. Baby products are a fairly regulated item, between the Consumer Product Safety Commission and the FDA. And our company spends a great deal of effort, resource complying with those rules and regulations, as well as our own -- as our own quality standards. Quite often, these pirates do not. We -- some of the products that we've inspected, they use inferior materials, they use banned materials, the products don't comply with the size regulations of the -- of the CPSC.

We've found pacifiers, for example, that are made using inferior plastic materials or with adulterants. So, that -- the -- the nipple part can -- can come off the -- the pacifier. Obviously, it can become a choking hazard. And the -- and the U.S. consumer, as well as we, have no recourse. These folks are located -- these pirates are located in China, they have no domestic connection. And of our current systems for trying to enforce a U.S. I.P. laws, and health and safety regulations, fail when the infringer of the violator is located overseas and outside the -- the jurisdiction of -- of U.S. courts and customs.

The way we-- the way we see the problem it's really a question of how the border is opened. And we implore for some solution to try and place of better controls on the border, prevent these kinds of -- this kind of activity. I want to thank the committee for its attention to this problem.

ABRAHAM: I thank you, Mr. Chiaviello. All right, Mr. White, five minutes please, sir.

WHITE: Good morning, Chairman Abraham, Chairwoman Comstock, Ranking Member Beyer, Ranking Member Lipinski and members of the subcommittees. My name is Mike White. I'm head of global trade digitization for Maersk. Before moving to my current role, I was president of Maersk Line North America for the past eight years. And I've had the pleasure of working in this industry for over 37 years. Thank you very much for the opportunity to testify this morning.

In a global economy, supply chains are of critical importance. It is estimated that over $16 trillion worth of goods cross international borders each year and more than 80 percent of those goods or carried by the ocean shipping industry. Over the past five years, global container volumes of increased on average of 3.7 percent per year.

Moving goods from point A to point B involves many parties who are separate but dependent upon one another. Importers and exporters, freight forwarders, customs brokers, ports and terminals, ocean carriers, customs and government authorities, inland transportation providers, financial institutions and others all gather discrete sets of sometimes overlapping information which they share using a convoluted web of individualized formats and aging technologies.

This inconsistent flow of information across organizational boundaries hampers the efficient flow of goods, but through a collective, complexity driven inertia or supply chain participants persist in their outdated practices. Perhaps this is because they trust that, flawed though it may be, the system will deliver ultimately academic from point A to point B and they can't afford to experiment with a system that may fail to do so.

The industry operates today, much as it does -- or has since the introduction of shipping containers in the 1950s. Many processes are manual, time-consuming and too often paper-based -- with transactions still frequently come today via fax machine. The cargo on any given container vessel voyage generates amount of documents, many of which are sent to the relevant container's destination by some other means. Container shipments can often be delayed in port because necessary paperwork has not caught up with the goods they carry.

In a Freightos survey recently cited by the Economist, two-thirds of respondents said over a quarter of their deliveries abroad arrive late. Nearly half said they spend more than two hours on paperwork when arranging given shipments and the vast majority of respondents had real difficulty tracking goods in transit.

In an industry where global transport cost of $1.8 to $2 trillion annually, administrative costs can sometimes exceed the end to end transport costs for a given container, and overall inefficiencies are estimated at 15 percent or higher. The World Economic Forum estimates that by reducing barriers within international supply chains, global trade could increase by up to 15 percent, boosting economy and creating jobs.

These barriers have proven incredibly difficult to surmount as participants are trapped by the layered complexity of entrenched methods. Everyone agrees that there must be a better way, but no single participant is able to affect change because of the overarching desire to stick with what is known to work, even if not very well, over an experiment that could fill with disastrous and cascading consequences.

WHITE: In 2016, Maersk and IBM began a collaboration with the goal of digitizing the global supply chain. To begin, we analyzed a number of current supply chains to understand the current challenges and specific areas of complexity. One of these involved a shipment of avocados moving from Kenya to the Netherlands.

This one container involved over 30 different actors or entities, more than 100 individuals and over 200 separate exchanges of information and documentation; the vast majority of which were completely manual, paper-based and extremely time-consuming.

We soon realized no sustainable solution can exist for streamlining the entrenched complexity without unprecedented buy in from the entire industry. In our analysis, and open and neutral industry platform, consisting at its core of a worldwide network of interconnected supply chain participants, is by far the best way to drive efficient, transparent and secure global trade. The trust necessary to build this network would not likely exist without blockchain technology.

In January of this year Maersk and IBM announced our intention, subject to receipt of all applicable regulatory approvals, to form a joint venture to implement this global platform. The platform will follow the flow of cargo from source to destination: as empty containers are provisioned and transported from a warehouse, as the containers are stuffed and transported to a port, loaded on board a vessel, cleared export regulatory clearance; and, continuing on the vessel to the import side, will follow flow of cargo through customs clearance and ultimately delivery to the final consignee, and the empty containers returned to a depot.

The platform will do this by leveraging network participants who both make information available and consume information by others. Blockchain enables us unprecedented collaboration by ensuring the security, trustworthiness, and permissioned accessibility of sensitive participation information even as that information is distributed across heretofore segregated enterprises. Participants will be able to go to one place to track real time status of a container and to locate and transact with up to date, trustworthy trade information.

Blockchain is a critical ingredient. It creates immutable record of transactions, which enables the ecosystem direct exchange of critical information; like records of inspection, bills of lading, and customs documents. Throughout the trade, each participant has real time visibility access to supply chain according to permission levels. Trust built by validating the participants, authenticating transactions, distributing information, and maintaining unalterable records that are located or accessible through the platform.

At the end of a given shipment, these immutable records will provide one version of the truth of how container was transited from beginning to end. And the documents submitted to the platform can be actioned and stored using blocking technology. This means that, once a document has been certified by government agency, the slightest alteration to that document will be exposed and rejected as different from the original. This will obviously have lasting benefits towards fraud detection and prevention.

The result: a of previously unattainable information backbone of global supply chain encompassing the milestones, documents in a structured form, customs filings and many more solutions. Access to this platform will give traders and transportation real time end-to-end visibility, and permission access to information about cargo shipments such as the status and whereabouts of containers, shipping milestones and trade documentation. As the network grows, its benefits the multiply and it will generate billions of dollars in savings for all industry participants, along with entirely new approaches to global logistics.

Thank you for the opportunity to discuss this vital topic. I look forward to answering your questions.

ABRAHAM: Thank you, Mr. White. Mr. Rubio.

RUBIO: Chairman Abraham, Chairman Comstock, Ranking Member Beyer --

ABRAHAM: Turn your mic on there. Thank you, sir.

RUBIO: Chairman Abraham, Chairman Comstock, Ranking Member Beyer, Ranking Member Lapinski and distinguished members of the committee, thank you for the opportunity to testify before you today on how blockchain technology can be leveraged to provide greater supply chain visibility and possibly help combat the distribution of counterfeit products. I applaud the committee's efforts to get in front of this rapidly evolving technology, and this year before two subcommittees speaks to the importance of this issue.

With over 434,000 global employees delivering more than 19 million packages and documents every day in over 220 countries and territories around the world, we work hard to be United Problem Solvers. At UPS, our business processes are complex and our technology advanced, but our objective is simple: to ensure world-class service for our customers.

UPS has been researching the use of blockchain technology with the purpose of identifying ways blockchain may impact, disrupt and/or drive efficiency in the supply chain. Our goal is to engage in a

collaborative discussion with customers and policymakers on how blockchain technology can be utilized to further enable supply chain digitization, efficiency and security.

Blockchain as an enabler -- in terms of logistics applications, blockchain could bring together buyers, sellers, suppliers, payment companies and logistics companies to provide end-to-end supply chain visibility while addressing privacy and data security concerns. For government border agencies, blockchain could enable greater transparency of a transaction, possibly including what's in the box and who's buying it, how much they're paying for it, assurances that duties and taxes are paid, and possible confirmation that shipments are not under-declared, resulting in faster release and a more trustworthy product supply chain.

As a result of the technology underlying blockchains, UPS sees four key benefits for our company and our customers: integrity, transparency, interoperability and security. In particular, our large customers have the potential to benefit greatly from the adoption of this technology. Given the complexities of the modern supply chain, multinational corporations have invested large amounts of money in enterprise resource planning systems and supply chain management software, yet only have limited visibility and insight into where all of these products are at a given point in time.

However, it's not only large multinationals that will benefit. We also see the potential for small and medium size enterprises to realize the many benefits of blockchain. For example, by taking advantage of this technology, a small business would be able to ship its products globally due to the blockchain framework that enables multiple parties to share important trade information in a single ledger for the contents of that shipment.

As a protector of intellectual property rights, UPS and other express delivery service providers engage regularly with customers and governments to ensure that our network around the world only carries legitimate and legal products. However, there are practical limits to what we and other express delivery providers can do day-to-day. First, we're not the originators of information about shipments, and limitations exist on the quantity of information that we can obtain from customers. Second, we and other express delivery providers do not have the requisite expertise to identify counterfeit or pirated goods. And, third, we're not law enforcement agencies, which means we are subject to national data protection and commercial information and confidentiality rules.

This is where blockchain can potentially provide a solution. By having the ability to track any product from the beginning of its journey through the supply chain, blockchain may provide a solution to unknown or unverified product origins. In fact, we're already seeing this technology used to trace the origins of various products, from diamonds and mangoes. By creating a digital record of each individual item, the company and consumer are able to verify the authenticity of the product and ensure standards are met each step of the way.

The U.S. and international governments' role in fostering blockchain -- the U.S. Congress, federal agencies and our international counterparts will play a vital role in the adoption and success of blockchain in the supply chain. Governments must take a balanced and measured approach between regulating this ever-changing technology and allowing for its innovation and evolution.

RUBIO: As e-commerce and global trade flows continue to rapidly grow, the United States must work with our international trading partners to establish a common set of blockchain standards that are recognized throughout the world.

As I mentioned previously, UPS operates in over 220 countries and territories around the world and I know firsthand that a patchwork of global regulation would stifle innovation, slow the flow of goods across borders and increase the likelihood that illicit material would enter the country undetected.

Despite the potential upside to the widespread adoption of blockchain, a couple of key barriers exist that must be overcome. The first and biggest hurdle is the linking of all physical objects to the digital stream. Currently, individual items may be tagged digitally with RFID, near field communication or a 2-dimmensional barcodes.

However, in order for blockchain to realize its full potential, all products would have to be tagged digitally, requiring an overhaul in today's supply chain practices. Without an industry and supply chain-wide commitment to adopt this digitalization, many organizations will not make the investment in this technology.

Finally, the international community must come together to ensure there's one unified set of standards for blockchain. This will give companies the confidence they need to know the technology they adopt will be recognized throughout the world. Without these common standards, uncertainty will prevent the large-scale investment that is needed to make blockchain a success in the supply chain.

Thank you, once again, for inviting me to testify before you on the technology that could change the world understands supply chains. I look forward to any questions.

ABRAHAM: I thank you, Mr. Rubio. And I want to thank all the witnesses, again, for coming here and certainly bringing your knowledge base to the subcommittee. If I understand blockchain correctly, and I am in a steep learning curve, but it will revolutionize tracking of goods somewhat like GPS revolutionized navigation. So, I think this is a world-changing technology that we're dealing with. I'm going to ask some questions for five minutes.

Mr. Chiaviello, I'll ask you first. In your testimony, you detailed the issues your company and others are experiencing with counterfeit goods in the supply chain. What sort of impacts, either quantitative or qualitative, has this had on your business and on your customers?

CHIAVIELLO: Well, on -- on our business, it -- it certainly affects us on the order of millions of dollars a year. I mean, it's -- it's hard -- it is difficult to put an exact number on it because we don't know what we don't know. But based on -- on what we can determine from -- from what we have investigated, as I say, and it's growing. You know, five years ago we didn't really see this problem. And so, now, it's a million-dollar problem; whereas five years ago, it barely existed.

The direct effect is not only does it -- it costs us -- it costs us money, it affects our competitive situation as these pirates or counterfeiters, they don't bear the cost burden that we do in making sure that our products comply with the -- with the federal regulations. So they can compete against us with -- with a much lower cost structure.

Our products set the -- sort of set the price level, they come in just slightly underneath us. But because they don't have -- have our cost structure it's very, very profitable, which is what's driving -- what's driving this business.

ABRAHAM: So, building off that, Mr. White and Mr. Rubio, how can your companies, with the application of this blockchain technology, help a company that Mr. Chiaviello represents? What can you guys do to combat that counterfeiting of goods?

WHITE: Well the platform we're putting together between Maersk and IBM initially is one that helps identify the sources of information. So, we use blockchain to help establish who are the -- it's a blockchain solution which is permission blockchain, which means that the entities that are involved are known to each other.

And if the documents created from origin are sent to anybody else who are party to that transaction, if any of those documents change, it's immediately identified that the document has been changed. And that could work from a change from when it goes to a customs authority, or another government agency, when that's been certified and the document is therefore sent down the path.

So, the ability to identify any changes in the documentation of what's been shipped or any new entities that are involved in the party is immediately identifiable. So, it helps identify the potential risk of fraud, I think much easier, much earlier, and for everybody involved in that transaction to see when the document is different from what was -- the rest of the documents that they had seen up to that point.

ABRAHAM: Mr. Rubio?

RUBIO: Yes. And what we can envision is an environment where you can have a provision -- a permissioned network of -- of traders. And in this permissioned network of traders, you could have the different actors in the supply chain exchanging information.

And, as they exchange information fraud can, you know, immediately be detected via the technology, and then those that fall outside could be, you know, scored negatively and removed from the networks, et cetera. So, the -- the technology really lends itself to -- to advancing the intellectual property rights protection. And we see that as a possibility going forward.

ABRAHAM: Dr. Maughan, could the DHS potentially leverage this blockchain as a tool to combat the importation of counterfeit goods?

MAUGHAN: Yes, certainly. And, in fact, if you -- if you look at the Customs and Border Protection, they are just one person or one organization involved in the whole transaction, along with companies like Maersk, and UPS and others. And so, that is the work we have been looking at is, in the pilot phase how could we use the blocking technology to detect a counterfeit goods more easily.

ABRAHAM: Are you seeing any obstacles that we of the federal government or throwing up in your path to prevent you from using that technology in an efficient and productive way?

MAUGHAN: To date, no. As I pointed out in my testimony, the one area that does concern us is a shortage or a lack of standards. And so, we have been focusing on specifications towards that end. And I think, when we have a full network of standards that everybody can live by, then I think that we be even more useful for all involved.

ABRAHAM: Thank you, Dr. Maughan. I will now recognize Ms. Bonamici for five minutes.

BONAMICI: Thank you very much, Mr. Chairman, and thank you, to all of our witnesses, for your testimony today. There is certainly a wide range of possible applications for blockchain technology; some quite fascinating. For example, safeguarding ownership of creative works or voting technologies, there's a lot of potential there.

These and other possible uses are important, but the health and safety of Americans is, of course, something that is of paramount importance. So, I'd like to focus on one particular area where blockchain

may offer benefits, namely drug abuse prevention. I recently had a series of community meetings in northwest Oregon about the toll of the opioid epidemic on our families and our communities. And one issue that came up not infrequently was the influx of dangerous drugs from foreign countries, especially fentanyl from China.

BONAMICI: So, it seems that blockchain could be used to prevent the importation of illicit drugs, or the unlawful diversion of legitimate medications. Parcels that are shipped from foreign countries are a major source of illegal substances, including opioids and, as I mentioned, fentanyl.

I understand that Homeland Security, particularly Customs is as concerned about this as I am. And I know there are several legislative proposals to combat this problem. For example, one of the bills I'm cosponsoring is the Synthetics Trafficking and Overdose Prevention Act that would require foreign postal operators to provide electronic data, enabling Customs and Border Patrol to better target and screen high-risk shipment.

So, Dr. Maughan, might there be uses for blockchain technology in verifying that imported goods are legal and do not pose a threat to public health or safety? And, are you aware of efforts or discussions specifically around using blockchain to prevent illegal drug activity, whether it be that interdiction or preventing diversion?

MAUGHAN: So, I am unaware of any activity to date that is looking at this issue. But I certainly believe that it has a very interesting opportunity for us. As I mentioned in my testimony, there are other pilots that we are looking at with CBP to -- to address counterfeit goods. We just haven't had the conversation about the opioids, fentanyl and other illicit drugs in those types of pilots. In the end, the goal here is to be able to track goods not only...

BONAMICI: Right.

MAUGHAN: ... the -- you know, using industry providers as well as government participants. And I certainly believe there is opportunity to look at that, in the in the same example.

BONAMICI: I -- I -- I think that would be some welcome. Also, Dr. Maughan, of course, food safety which you mentioned and had been mentioned in the testimony, the FDA and Centers for Disease Control recently warned us all about E. coli contamination in romaine lettuce, for example. Would you be able to comment on how blockchain might improve that ability to ensure food quality and safety?

And you mentioned pilots, I know there's a couple of pilots going on and trial projects regarding seafood traceability, working with organizations so that -- that customers, when they're shopping for fish, can know exactly where that came from and trace that. So do -- are you aware of that work?

MAUGHAN: I am not aware of that work. But the -- one the other witnesses mentioned mangoes. There have been -- and avocados.

BONAMICI: Right, OK.

MAUGHAN: There have been other examples of -- of cases where we've tracked food and -- and -- and goods. And I certainly believe the application areas are unlimited as to how we would use the technology to -- to provide food safety for the nation.

BONAMICI: Mr. Rubio, I understand that UPS already requires a kind of electronic registration data from foreign shippers. Could you comment on whether blockchain could play a role in this area?

RUBIO: Yes, most definitely. We see the opportunity, again, leveraging the potential of blockchain to -- to provide permissioned to access for -- for the exchange of information. And then leveraging the information that -- that can be collected to perhaps, maybe score customers and then provide access to, you know, secure supply chains.

BONAMICI: Terrific. And -- and, I don't know who wants weigh on -- in my next question. As we are talking about this great potential from blockchain, we also understand and talk about, in this committee a lot, quantum computing and whether at the development of blockchain is -- is really and keeping up with what is happening with quantum computing.

I know NIST, the National Institute of Standards and Technologies, is looking at this, sort of incorporating some quantum cyber-security measures along the way. Because, everything I have read said that that is the big threat eventually, that if we don't -- as we're developing blockchain if we don't keep up with what's happening with quantum computing. Does anybody know about the work that's going on there, as blockchain is developing? Are we developing this quantum-resistant, anybody able to answer that?

MAUGHAN: I'll -- I'll give you a shot and try. But -- so, if you look at the blockchain technology, at its core is cryptography and the ability to secure the data. And the concern is that our cryptographic systems eventually can be broken using quantum computing.

And so, the concern is how do I make my cryptographic algorithms at the core of the blockchain technology, something that can be quantum computing-resistant, or at least allow the cryptography to be -- to last a lot longer? And the concern is if our adversaries are using quantum cryptography to break our cryptographic algorithms, they would actually be able to break the blockchain technology.

BONAMICI: That is certainly something we can discuss further. Thank you. My time's expired, I yield back. Thank you.

ABRAHAM: Ms. Comstock.

COMSTOCK: Thank you. Mr. Chiaviello, as a mom and a grandmother now, your testimony about the challenges of knockoff children's products was certainly troubling. So how might these a blockchain technology help a company resolve this problem? And what other tools might be useful in helping companies and consumers combat counterfeiters, particularly in this area?

CHIAVIELLO: Well, I think the primary goal would be to control -- control access. In other words, as the term is been used, a permissioned access. And so, when a -- when a consumer is -- is -- well, let me give you an example. Teethers are regulated by the Food and Drug Administration and require that any -- any factory where a teether is manufactured has to be registered with the Food and Drug Administration. It has to -- has the pass extensive health and safety evaluations.

And -- and then once -- once the factory passes of those tests, the factory is given a number. And that number then identifies the source of all the teethers that originate from that factory. And so, that number can -- could act as a stamp of approval, like USDA approval on hamburger, on beef products -- and can go with the product, using a blockchain technology to assure the consumer that the product they are buying is a authentic product. In other words, it's been -- it's been, I don't want to say certified, but it originates from a certified location. So I think there's a great opportunity, in that respect.

COMSTOCK: OK, thank you. And then I guess, to our other witnesses, if any of you work -- does any of your work involve coordinating with NIST or leading any type of collaboration with other industries regarding standards for blockchain technology?

WHITE: From Maersk and IBM, we're looking to embrace existing standards, industries wherever there are standards available so that we can make sure that we adopt and embrace it. In our view, to have a platform that really helps to accelerate the digitization global trade, we need to be completely open and neutral. And we need to take advantage of having common standards around the world.

So, here in the U.S., we're looking into the BiTA which is -- is trying to look at some of the standards. Also, we're working with other agencies as they develop across the global economy to understand where those opportunities are. Also, we look to be embracing not only DHS and CBH here -- CBP here in the U.S., but also other customs and WCO to understand what direction they are going because we think it's really important, this interoperability. We need to make sure that everybody can avail themselves of this platform and exchange information in a transparent way using blockchain, that -- that provides that immutable trust.

RUBIO: Yes, and UPS is also involved in the BiTA alliance. And we're clearly interested in advancing standards in blockchain.

COMSTOCK: OK. And have your companies recognized any cyber-security benefits in the development and implementation of blockchain technologies across various applications? That's for any of you.

WHITE: At this point, we're still in the pilot program of putting together the -- the platform and, again, waiting for regulatory approval. So, it's a little bit early on in that. But I think it was mentioned, using cryptography and having a permission blockchain, I think it's a -- it's a 32 character alphanumeric sequence. It has to be attached to the previous documents in there.

So, so far, it seems that it's -- it's pretty trustworthy in terms of getting that information across there. It's a little bit early to see about the broader applications for cyber-security but that's obviously high on our list at Maersk Line, considering some of the challenges we went through last year, and just making sure that we continue to keep that high on our agenda because it's critical to global supply chains.

COMSTOCK: OK, anyone else on that? Oh, well, I'll yield back, Mr. Chairman.

ABRAHAM: Thank you, Ms. Comstock. Dr. Marshall.

MARSHALL: Thank you, Mr. Chairman. Let me, first of all, brag on my two grandsons. So, congratulations, to Ms. Comstock, on a new granddaughter?

COMSTOCK: Yes. I've got grandson and granddaughter as of last year, yes.

MARSHALL: Well, good for you. We're -- we've both got two each up here. This doesn't count against my time, does it?

I want to start with Mr. White. How important is NAFTA to Maersk?

WHITE: Well, NAFTA's important all of us. I think at Maersk, we're were obviously supporters of global trade and trying to make sure that, you know, there's opportunities to promote that.

In terms of North America, South America most of our shipments are international by water. So there's some that's -- that's moving via that route, but most of that's moving over an overland border. So we, of course, are interested in monitoring that. And, we...

MARSHALL: OK.

WHITE: ... We just support whatever the regulations are and make sure that we can make trade as easy as possible under the regulations that are available.

MARSHALL: Mr. Rubio, how important is NAFTA to UPS?

RUBIO: It's very important. Canada's one of our largest trading partners. And, of course, we move lots of products between the U.S., Canada and Mexico. So, we're also involved with the CBP on some pilot work related to NAFTA.

MARSHALL: Yes, China -- I mean, Canada, actually is our largest trading partner. We export $280 billion a year to Canada, $230 Mexico, China's a distant third at about half of those. Blockchain technology, as we are modernizing the NAFTA agreement do you feel like we're you doing anything that'll help empower you all? Either one, Mr. White or Mr. Rubio, that -- are we taking blockchain technology -- have you had any conversations with administration, if you're allowed to, what would allow you to better use blockchain as we modernize is NAFTA agreement?

RUBIO: We're -- yes, as I mentioned, we're working right now with CBP on a pilot related to NAFTA and it's progressing very well. We think that we'll have a pilot up and running in the fall timeframe. So, I think we're getting great support from CBP in this area.

MARSHALL: Great, Mr. White, anything to add there?

WHITE: Yes, likewise. We're working with Canadian customs and CBP here in the U.S. to try look at the documentation that's required for a certain specific commodity segment of that, and to see if that can be applicable there, and can we actually make that a standard elsewhere. So, we're early days, but we're working together on that.

MARSHALL: So there's a spirit of cooperation, in anticipation of this technology from this administration?

WHITE: Absolutely.

MARSHALL: That's great to hear. Dr. Maughan, let's talk -- talk to you for a second. One of my biggest concerns as I go to all my different meetings, different committees, talk to different folks is when it comes to cyber-security, let alone blockchain technology is I'm worried that every department's doing their own thing. Would you -- is DHS the leader on these issues, would -- is there some cooperation between your department and the other departments in the administration, whether it's blockchain technology or cyber-security?

MAUGHAN: So, I'll answer from two sides. From the Science and Technology side, there's a lot of coordination and collaboration going on in the interagency, and particularly in the blockchain area where we share what's going on across the different agencies. You have NSF, and NIST, and others also funding research and development in blockchain.

On the operational side, DHS does have the lead on the cyber-security as well as with the NIST cyber-security framework, and (ph) how it explains cyber-security. So, both operationally and R&D, DHS has a strong position there.

MARSHALL: Is there a cooperation with the military and what they're doing in these areas with DHS?

MAUGHAN: That I am aware of, on the research and development side there is -- because I'm involved in it...

MARSHALL: OK.

MAUGHAN: ... And -- and we do things from an interagency perspective. I don't know the details on operationally. I would expect there is, but I do not know the details.

MARSHALL: OK. It's -- it's been said -- I'll stick with you, Dr. Maughan, is that China steals $400 billion to $600 billion of our technology every year through copyrights, or computer software, whatever it is. How -- explain to me again, you all have touched on it, go a little bit deeper. How can blockchain technology impact that? And be specific, like give me examples if you could.

MAUGHAN: Sure. So, the -- if you -- if you look at how a blockchain works, and the ability for organizations or individuals to put their cryptographic stamp on the data. Right? Now, if -- if I use it in that way, you, as the Chinese or others, wouldn't be able to counterfeit and --

MARSHALL: So, Nike -- so, Nike would have their unique encryption. And you knew if you are Nike shoes from someone that doesn't have that unique encryption, you as a producer, would -- I mean, not a producer -- you, as a wholesaler in America, would understand -- would see that?

MAUGHAN: Correct. And if it's not -- if it doesn't have the correct data, doesn't have the correct integrity on the data, then someone would be able to tell that you're not the legitimate producer or supplier.

MARSHALL: OK, thank you. I can ask one more question, if you're not quite ready. Tell me, you know, fentanyl is one of my big concerns. Fentanyl is 100, 1,000 times more potent than -- than the typical opioids coming across. You can make this in -- in your garage. It's coming over by the truckloads from China, I'm told. How can blockchain, UPS or DHS -- maybe Mr. Rubio, you're the UPS guy, any thoughts how blockchain could impact that?

RUBIO: That's a tricky issue because it's -- it's ultimately what -- what gets packed in a carton, and I think that -- that becomes a challenge for us. Blockchain certainly provides the framework for us to begin investigating the contents, and then perhaps scoring transactions and then -- and then eliminating them from the supply chain. So, the framework is there and it's -- it's an area that will require work, and --

MARSHALL: Can we trace it backwards, you know, perhaps to the origin...

RUBIO: Absolutely.

MARSHALL: ... A little bit better?

RUBIO: Yes, absolutely, using the same techniques that Dr. Maughan explained. That's -- that's exactly the way we would go.

MARSHALL: Thank you, Mr. Chairman, and I apologize. I went over. I yield back.

ABRAHAM: That's quite all right, Doctor.

Mr. Hultgren, five minutes.

HULTGREN: Thank you, Chairman. Thank you all, appreciate you being here.

This is a really important, interesting, challenging topic and I'm grateful to learn from you all. And I've also been grateful I've been able to see a number of great ideas coming out of Illinois, my home state, with many investments in the financial sector coming out of Chicago.

There are also some efforts at the state-level to look at many innovative solutions to state and local government, with the Illinois Blockchain Initiative, a consortium of state and county agencies who issued their first report just in February.

I've also been encouraged through the work that I've been able to do on the Tom Lantos Human Rights Commission at the way in which new technologies like blockchain can better secure and validate supply lines in conflict regions, as well as better manage the disbursements of aid through the federal government and other NGOs.

The transparency of something like a distributed ledger can also give new tools for individuals to finally assert basic property rights when governments deny the rule of law, or access to the legal system in other countries. If I can address of first to Mr. White, Mr. Rubio, then Dr. Maughan, previous witnesses before the committee of detailed how thoughtfully inserting blockchain in appropriate projects already funded would ensure we stay at the forefront of this transformative technology.

Have you taken the approach -- this approach to analyze blockchain's potential for appropriate projects? And, in your opinion, what are some examples of where would be appropriate or not be appropriate to implement blockchain technology? And what's the distinction of where would work likely, and where would likely not work?

WHITE: Well, from a Maersk Line perspective, one of the opportunities we see are global supply chains. So, global supply chains are some of the most complex, multi-party networks in the economic landscape today. So, by definition, you have a number of companies that are involved, transmitting sensitive information for the cargo across different channels.

I think blockchain is -- is especially suitable for that because you can enable, through this permission blockchain, the entities that should have a right to see and have access to that information, to access that information, to make sure that they can see it and trust that the information has not been tampered with, or modified in any way, shape, or form. And then you can tie the visibility of the sort of end-to-end in-transit information. And have that simultaneously with the documents or the data on that, to actually enable smoother the supply chains, but also in a trusted, immutable way.

So, we -- we think, for that, blockchain is very much fit for purpose. And I think it can be a game changer because it provides that immutable trust through the distributed ledger, through smart contracts and through a permission blockchain. So, we think there is a great opportunity.

HULTGREN: Great. Mr. Rubio or Dr. Maughan.

RUBIO: Yes, from our side, really it's -- it's about reducing friction in the supply chain and streamlining the exchange of information. So, what blockchain provides is the opportunity to digitize transactions and then share that information through the network. And as we can collect information in near real time, that will just speed up supply chains and provide, you know, fast-moving product.

HULTGREN: That's great. Dr. Maughan.

MAUGHAN: Sure. As I mentioned in my testimony, there other additional ones from a DHS perspective in addition to the supply chain, but certainly the ones we've been working on is the -- the data and sharing of imagery on the border with CBP, and in order to be able to share that and ensure the authenticity and integrity of that data. And I think that has tremendous value, as we think about IoT devices that are doing -- that are collecting data and sharing that data, we'll be able to protect that. There are others that have to do with passenger processing and other aspects that I think are potential uses as well.

HULTGREN: Yes. Any that jump to mind that you feel like, this just would not work; it's just not the right place for this? I guess, if that comes up, let us know because we -- we definitely respect your thoughts and opinions. Let me move on in my last minute here, again to, Mr. White, Mr. Rubio, and Dr. Maughan. Do you collaborate or coordinate with any domestic or international standards, bodies on blockchain?

WHITE: Yes, so from a Maersk Line and IBM association, we're working together and looking to work with BiTA here in the U.S., and also looking to work with other entities around the world. We think it's very important to have, sort of, a common definition of standards where standards exist. And, where standards don't exist or need to be improved, want to work collaboratively with others to make sure that we get the right standards so that we can all -- and make sure that we can talk more easily through a digitized environment going forward.

RUBIO: UPS is also a member of the BiTA and we're very interested in driving standards to improve this technology.

MAUGHAN: And -- and we're actively involved with both the World Wide Web Consortium, the W3C; and OASIS, the Organization for Structured Information systems for some of our standards work as well.

HULTGREN: Great. My time is expired. Thank you, again, for your work. Thank you, chairman, for holding this hearing.

ABRAHAM: I thank you. Mr. Beyer.

BEYER: Thank you, Mr. Chairman. Dr. Maughan, in your briefing you said, and I quote, "Most organizations don't need a blockchain." Can you tell us why most organizations don't need a blockchain?

MAUGHAN: So, we've worked through a, kind of a process to ask some questions of people about what they are trying to do. And -- and they oftentimes don't need a blockchain. They can solve their problems with a database or other accounting instruments. And it takes a little bit of a discussion to get to a point -- a lot of times people are thinking just in a single organization they'll use a blockchain, while they do not really need one.

The blockchain and the -- its attributes include multiple parties, trust relationships, and different types of the sharing of information and storage of information. And you really need to actually walk through a

certain set of questions to decide whether you really need a blockchain. And, in a lot of cases, people don't need a block chain.

BEYER: You know, there have been lots of anxiety the last couple elections -- and not just 2016, 2004 or 2008 about of the security of voting machines. And -- and there's a move to online voting, but only if it's secure. Is voting someplace where blockchain might be relevant? Or is this, again, a place where there are other, simpler technologies?

MAUGHAN: I -- I think we're early days. I don't know that we've done the real diligence that we need to look at that. But, I actually believe that voting is probably not a place where we would use blockchain technology.

BEYER: Would every voter have to have their own blockchain key, and?

MAUGHAN: Right. Well, the question is, is how --it who am I sharing my vote with? I'm only -- I mean, the only person I really want to share my vote with is my local voting establishment. And so, I think the complexity there is -- is even worse than what we have today in just paper and normal elections.

BEYER: Thank you. Mr. Chiaviello, you are a -- I very much empathize with the problems of your company. I -- I'm an automobile dealer, so counterfeit parts have plagued me for more than four decades. But, are any of the companies that you represent now pursuing blockchain technology? And, do you -- on the other hand, if you complain about reselling the counterfeits through a big company, on Amazon, do they have to be a participant in the blockchain with you to make this work?

CHIAVIELLO: I -- we are -- we are not pursuing blockchain at this point, directly. But it would -- it would appear that the retailer, the Amazons of the world, would have to be a participant in blockchain technology and -- and we would have to be participants as well.

As we see it, where this is going is that the blockchain -- the key to a blockchain would be like a digital hologram or an equivalent to a trademark or watermark that you might find on paper identifying the product itself as an authentic, legitimate product that would have to be established by someone like us, the designer or manufacture. But then, it would have to pass through the entire supply chain. And, ultimately, we would need a method for the consumer to be able to verify that that product is a -- is a legitimate, authentic product.

BEYER: Interesting. Mr. White, you have your -- a global perspective with Maersk, obviously. And I -- I strongly believe, just based on this committee's interest, that America should take the lead in blockchain innovation research.

But we have -- we see what a lot of the other nations are doing. China recently launched what they call the Trusted Blockchain Open Lab. Dubai says it will be the world's first blockchain-powered government. Singapore is exploring it.

Russia's state-run bank, Sberbank, announced it's going to team up to do blockchain for document transfer. The European Union launched its E.U. Blockchain Observatory and Forum. Where is the U.S., compared to the rest of the world in terms of our blockchain leadership and research?

WHITE: Well, I think -- I think the U.S. is leading in lots of ways on blockchain. Maersk and IBM coming together for our collaborative effort that we're seeking regulatory approval in different authorities around the world to -- to launch this global digitization platform. I think is evidence of the largest marine

transport container shipping company in the world and the technology giant of IBM that's a leader of blockchain coming together to have some innovative uses of blockchain.

And it's not -- I think, I would say, blockchain is not a solution looking for a problem. It is specifically fit for purpose for global supply chains. And we talk about this large distributed network, multiple parties transmitting sensitive information across not only organizational, but also geographical boundaries.

Having some way to do that in a secure manner, I think helps facilitate trade. I think it helps to certainly identify fraud much earlier in the process, which is a significant disincentive to it. And I think we can -- we can create safer, better, more efficient supply chains by deploying this technology. And I think the U.S. is right in the -- right in the forefront of that.

BEYER: That's encouraging. Thank you. Mr. Chairman, I yield back.

ABRAHAM: Thank you. Mr. Loudermilk.

LOUDERMILK: Thank you, Mr. Chairman. And -- and, first of all, I want to thank the chairman for holding this hearing. I've kind of felt a little bit like a voice in the wilderness on blockchain -- excuse me -- after spending 20 years in the -- 20 plus years in the IT industry.

And I've often said, for the last couple of years, if we can get over the stigma of cryptocurrency and look at the technology beneath it, it could be a solution to a lot of our cyber-security and data protection issues. And so, I -- I appreciate the chairman having this hearing. I was very excited when I saw it because I think we're beginning to make some progress from -- from -- at this side of the dais in looking at this incredible technology.

Mr. Chiaviello, you talked about counterfeit and knockoff products, as -- as a -- as a problem, the sale and distribution of those. Can you elaborate a little bit on how the sale and distribution of these -- these counterfeit goods makes it difficult and costly to police and enforce I.P. rights -- intellectual property?

CHIAVIELLO: Yes -- yes, the big problem that we're facing now is that the -- the pirates, the knockoff companies, are now located overseas. And we have no way of identifying them. They establish an online -- an online store with typically a fake name and no identifying or contact information. The -- if they have a domain name, it's hidden behind a proxy server, privacy proxy.

And so we have -- we, or the consumer, have no way of identifying where that -- where that entity is located. Products that are shipped in to this country, often they use fake -- fake addresses, the return addresses on the packaging are -- are fake. And so, we and the -- and the U.S. consumer is essentially left without a remedy.

There's -- there's, as you know, you -- to bring an action in a federal court, or even a state court, you need personal jurisdiction over the -- over the seller.

LOUDERMILK: Right.

CHIAVIELLO: And if we don't even know who the seller is, much less where they're located, we cannot get personal jurisdiction. And any default judgment would be essentially valueless, trying to -- to enforce it.

LOUDERMILK: What would be the long-term consequences of failing to address the issue, both to business and to the consumers?

CHIAVIELLO: Well, it puts -- it puts domestic companies at a -- at a financial disadvantage. We're competing with people who don't incur the cost for the R&D, don't incur the cost for the regulatory compliance. And it -- it, at the least, it limits our growth. We are not as -- we cannot be as big a company as we should be, based on -- on this type of foreign unfair competition. And to the extent it continues, it -- it threatens domestic industries.

LOUDERMILK: OK, thank you. Let me steer a little closer back to Georgia, with our -- our good corporate partner from Atlanta. Mr. Rubio, you've stated or actually wrote that blockchain could make large multinational companies, such as UPS, more efficient and could, and I quote, "Leave them better equipped to handle the continued growth of e-commerce." Can you elaborate a little bit more on -- on the e-commerce aspect of that and how it can help these companies be more efficient as well as more secure?

RUBIO: Sure. The promise of blockchain is that it allows for the digitization of transactions within the supply chain. And in the e-commerce space, oftentimes documentation is required to clear customs around the world.

And so, what blockchain can do is it can provide the vehicle for us to digitize transactions, collect that information, and make it simpler for the consumers and then eliminate this friction in the supply chain. So by posting information in real time to supply chain, data can be shared among the different players and that would streamline the flow of goods.

LOUDERMILK: What -- what's the benefit to the consumer in that?

RUBIO: The benefit to the consumer is -- is that they can receive their product quicker, without any interruption.

LOUDERMILK: All right, thank you. Mr. Chairman, I yield back.

ABRAHAM: I thank you. A fascinating subject, so we're going to have another round of questions here. I am sure volumes have been written on the efficiency of both Maersk and UPS as far as moving goods, phenomenal companies.

But, Mr. White, in your testimony you said that blockchain technology could increase global trade by up to 15 percent. That's a phenomenal figure, and certainly we want to move that forward. One barrier to the widespread adoption of blockchain technology is a linking of the physical object to the digitization. Can you guys, Mr. White and Mr. Rubio, can you all elaborate of how we can actually make that happen, how we can link those physical dots to connect?

WHITE: I think it's well cited. Actually during our evaluation of supply chains, we looked at some of the most, sort of, complex supply chains, as I mentioned. You have a challenge to both the physical end-to-end transport of the goods, which is one thing, and the visibility of the events, the real time access of that information as to where that, that container in our case, is physically located at any one point time, and then the disconnect that we see from a paper-based documentation flow.

So linking the two of them together with digitization, so you have the opportunity to have more real time visibility as to where our shipment is. So with our platform, we have a shipment --a shipping information pipeline. So we can actually see more events of what's happening with that container. For everything from when it is out-gate (ph) empty for loading, to when it's stuffed, to when it's back at a terminal facility, to when it's loaded on board a vessel, and on to transshipment, through customs clearances on both end, and getting to delivery.

WHITE: But also having the capability with this platform to have digitized documents, as Mr. Rubio has said, it enables us to have them in a structured way, in a format that the government agencies require so that they can actually process them. So you have the capability of having both together. In our supply chain evaluation, the one shipment of avocados I mentioned was a 34-day end-to-end transit from when it was actually farmed at the farm and then put to the -- to the truck to be loaded into a container, until it was ended up being delivered.

Of that 34 days, 14 days -- two weeks of it, it was sitting there waiting for documentation for processing. So you've got -- you've got an opportunity to actually improve supply chain cycle times. And the efficiency, as I mentioned, over 200 individual exchanges of document and information, with the certifications that were required, they actually are stamped by one -- by one authority and moved by a courier, by motorbike to another authority for another stamp, and then come to the port. So you're physically moving documents instead of transmitting electronically.

ABRAHAM: Mr. Rubio, you want to weigh in on that?

RUBIO: Sure, yes. The big challenge, of course, is making the physical world connect with the information world. And that really is a -- is a key challenge that -- that will need to be overcome in order to achieve the ends that -- that you're asking about. But there are technologies that can speak to the data, like RFID, as I mentioned, and potentially even X-ray technology.

So X-ray technology, you know, the possibilities exist for interpretation of X-rays to understand what is actually in a carton. And then leveraging that information with what's physically been communicated by the different players. And the supply chain can then further support the validity of what has been claimed on the transaction. So those are the kinds of techniques that can be used to -- to link up the two. It's a very tricky issue, but that would be how it could possibly unfold.

ABRAHAM: All right, thank you. Dr. Maughan, we have consistently heard that in order to effectively foster the adoption blockchain solutions to supply chain problems, there must be a common set of standards. And we've addressed that somewhat here today, that are globally recognized. How can such standards be promulgated and adopted?

MAUGHAN: First is the development of standards, which we're working on with some of our partners. Then, I think, it is a -- it's an education game. As you can tell, we're fairly early on in the blockchain world. And it becomes up to companies like Maersk and UPS as they use it, to educate others.

And as we -- and I think we are in a leading position within the -- within the world, that we, the U.S., can take a leadership role and continue to push blockchain and...

ABRAHAM: Sure.

MAUGHAN: ... And educate people on the -- on the use of it.

ABRAHAM: So, you agree that the U.S. should lead that -- that charge?

MAUGHAN: I certainly believe we should take a leadership role. I don't know if we're going to be out in front because you can't do blockchain by yourself.

ABRAHAM: Right.

MAUGHAN: Right? I mean, what we want to do is have this conversation, both government to government and have a conversation with our government partners so that they are also on board because it is a global community.

ABRAHAM: Yes, thank you. Mr. Beyer.

BEYER: Thank you, Mr. Chairman. Mr. Rubio, you talked about how UPS is committed to blockchain and you also talked about some of the obstacles. One of the things I read is that Visa, right now, can process 56,000 transactions per second but the Bitcoin blockchain is only about five transactions per second. Do you see this transaction processing power an obstacle to making UPS effectively use blockchain?

RUBIO: Well, I'm unfortunately not in a position to qualify any statements on Bitcoin. But certainly, the blockchain itself, we certainly see the capability to share information, streamline the information and process it in real time, and absolutely by exchanging information rapidly that will streamline the supply chain and allow trade to happen efficiently.

BEYER: If you adopt blockchain, will UPS drivers be allowed to turn left?

(LAUGHTER)

RUBIO: Hardly.

BEYER: Oh, OK. Dr. Maughan, one of the things that, you know, when we had our last blockchain technology we got all excited for two hours. Then somebody pointed out that when quantum computing comes, that it goes so fast that it'd actually break the blockchain keys. How soon do you see this coming? Does it make sense for us to make all of this huge investment in blockchain if quantum computing is going to make it irrelevant once it arrives?

MAUGHAN: You know, that's a very good question and, I think, we don't know yet when quantum's going to be here. Right? I mean, it depends on who you talk to. Quantum is 10, to 15, to 20 years out and there's still, I think, a lot of research and development to be done, even to get us there.

And I think the issue is, blockchain today, can use cryptographic algorithms of today, and still provide us the security and the privacy we need. And, I think we're going to have to figure out how this competition, if you will, between blockchain and quantum, how that plays out over the next decade or two.

BEYER: Blockchain at least, is a lot more intuitive. Than...

MAUGHAN: It -- it is, and easier...

BEYER: ...Than quantum entanglement and things like that, so.

MAUGHAN: ... That's right, bit easier to understand.

BEYER: So you have this beautiful education, a PhD in computer science. The president still does not have a national science director, head of the Office of Science and Technology Policy at the White House. Are you -- should you apply? It'd be -- would be the first computer scientist ever to be the White House chief scientist.

MAUGHAN: I don't think I can comment on that.

(LAUGHTER)

BEYER: I'm talking to my friend here, the chairman. I yield back, sir.

ABRAHAM: Thank you, Mr. Beyer. Mr. Hultgren.

HULTGREN: Thank you again, chairman. Moving on to a couple other questions I had, so first I'm going to address this to Dr. Maughan. Other experts in the field have noted the potential opportunity for nurturing future blockchain projects within SBIR -- the Small Business Innovation Research program. Do you see any other areas within the federal government that could help facilitate the establishment of a blockchain projects or pilots, certainly within DHS but other spots as well?

MAUGHAN: I think the applications are almost limitless. And I think the question is really up to the departments or agencies as to how they to try to address that. We have, from a Science and Technology perspective we have taken a very good leadership position so far within the government.

We are talking about other applications where blockchains might be usable. And we have also used our Silicon Valley Innovation Program to fund startup companies to look at some of these techniques and technologies. In fact, the -- the pilot we're doing with the border patrol on the data imagery is with a startup company out of Texas.

HULTGREN: Great, thank you. Mr. White and Mr. Rubio, specifically with respect to collaboration and standardization, what are some of the lessons your companies have learned that will help you utilize blockchain technology at scale?

WHITE: So in terms of -- of lessons, I think this -- this item of standardization is -- is -- is critically important. We need to understand what standards are out there. For instance, you know, if -- if we look at just end-to-end supply chains, UNECE (ph) codes -- or the way that we define inland points varies depending on what geography you're in. And also, are they specific enough to really nail down, you know, what the geography is that you're -- if you're talking about multiple facilities within a common ZIP Code, for instance.

So, the ability to sort of embrace and tackle some of those challenges, I think, as an industry we have to do it. It's -- it's something, of course, Maersk and -- and UPS can do individually, but then if we're both calling it something different, it makes it -- it makes it a challenge. So I think coming together through these advisory boards and these standards committees, I think it's really important to prioritize what are the most important standards to -- to get alignment on, and how can we move that forward.

And, in addition to -- to joining these established organizations between Maersk and IBM, with our new platform to establish an industry advisory board, you know, making sure that we have participants from ports, terminals, other carriers, inland carriers, customs entities if we can to make sure that we -- we look at it from a collaborative, multi-perspective position.

HULTGREN: Thanks.

RUBIO: And the lessons that I'm learning personally in this space is being involved in some of these working committees. But as you sit through and you look at defining standards for how we're going to communicate and collaborate via blockchain, there are painstaking issues over data that you will exchange.

And so, it's -- it's fascinating to listen to the different players and their perspectives of what information would be useful to exchange and what information would not. So -- so, it is -- in driving the standards, it's not a trivial task, but it's an important task. And in the end, you end up with a very sound product. And my first-hand experience is that's how we did it with CBP and you guys should be proud that they've done so far.

HULTGREN: Absolutely, thank you. One last question, again, Mr. White, and Mr. Rubio, and Dr Maughan, given its jurisdiction over NIST, what can this committee do to ensure that the U.S. is cultivating a supportive environment for blockchain technology projects? Dr. Maughan, let's start with you.

MAUGHAN: Well, I think -- I mean, certainly in our role within DHS, we work a lot with NIST and the roles there. They've published documents identifying blockchain overview and how that all works. And, I think, just a continued participation in the standards community is an important part for NIST participation, and we've certainly been working with them on that.

HULTGREN: Great, thanks.

WHITE: The interaction we've had with -- with DHS and CBP has been very positive. We've been working with the E.U. CORE Project for the last 18 months to try and understand how they're approaching digitization. And CBP and DHS have been supportive of that. And then, also, as we're developing our platform trying to learn from those lessons, their continued support, and looking to how we can work with other partner government agencies, I think they've been very constructive in that process.

HULTGREN: Great. Thank you all so much. I will yield back.

ABRAHAM: Thank you, Mr. McNerney.

MCNERNEY: I thank the chairman and I thank the panelists. Mr. Rubio, can you walk us through why blockchain technology is useful for identity verification and why this is important for chain logistics?

RUBIO: So, it's -- it would be important for identity verification in that it would help secure our supply chains. And so, understanding who the actors are in supply chain that are exchanging product or information would be critically important so that we can maintain security, and it can also be leveraged for potential intellectual property rights types of issues.

MCNERNEY: Good, thank you. Mr. Maughan, is the U.S. Government currently using blockchain technology to mitigate cyber-security threats?

MAUGHAN: I'm not aware of actual deployed blockchain technology. As I mentioned in my testimony, we have a number of pilot deployments where we're testing out some of the technology to see how it will be used, and -- and the scale at which we can use it.

MCNERNEY: Are there any potential risks associated with using blockchains to reduce cyber-security threats?

MAUGHAN: I don't know if there are that many risks. I mean, I think we're, you know, when you start talking about cyber-security, it is about the data, and can I ensure integrity and authenticity. As long as the technology is implemented correctly, then I think the risks are -- they're mitigated by the

technology itself; a lot of times in cyber-security, the problem is implementation and people implementing it incorrectly.

MCNERNEY: I understand. I'm not sure which panelist asked, but could someone discuss the energy implications of expanding applications of blockchain technology and how can it be mitigated? Who would be the right person to address that? What are the energy implications of blockchain, widespread application of blockchains?

MAUGHAN: I believe your question is probably related to if you look at -- from an energy standpoint, are you talking about computing power?

MCNERNEY: Right.

MAUGHAN: Yes, so if you look at the way cryptocurrencies are used -- and there's an awful lot of computing power in the background of cryptocurrencies to actually make them work. And so the -- I think the -- the question and the discussion is about, if I start to do large-scale blockchains, I now have -- I now have computing infrastructures that I also have to operate.

And -- and the question is, does that make it a difficulty for a small business or someone else to ensure that they have the -- the adequate power to do their blockchain technology, because you do have to check. I mean, there's checks all along the way in the data to ensure that it hasn't changed and that -- and...

MCNERNEY: Right.

MAUGHAN: ... It is authentic. And there is a computing infrastructure that goes along with this. It doesn't just happen.

MCNERNEY: So, what -- I mean, what can be done to mitigate the energy usage implications of widespread application of blockchains?

MAUGHAN: I actually believe you're going to see companies like Maersk and UPS, probably have their own large infrastructure. From a computing standpoint, I think you have a potential for service companies to provide, which is what happens in the cryptocurrency world. There are what are called Bitcoin miners and they -- they run the infrastructure that does a lot of the calculation.

MCNERNEY: Right.

MAUGHAN: You could very easily see something similar in the blockchain world, where someone else is doing -- offering a technical capability to provide you a service and be the computing infrastructure if you're a small business.

MCNERNEY: Mr. White, I have in my district the Port of Stockton. It is the largest inland port on the West Coast and it's the third largest port in the -- in the State of California. What steps is your company taking to increase adoption of blockchain technology?

WHITE: Well, we're working with ecosystem participants, from ports and terminals to major rail operators, we're in -- already in discussions with four of the seven Class I railroads in the U.S., and also with trucking communities because we think by everybody participating in this -- in this new global platform, we have the capability of making it more visible in terms of the seamless and -- and more efficient movement of cargo.

And, by using blockchain, make sure that those who are permissioned -- it is a permissioned blockchain, so those who are party to the shipment can see the information, others cannot. And those that can see it can get better real time information. So, in terms of moving cargo efficiently through ocean or inland terminals, getting better visibility as to when cargo is available, will be available, and enabling more efficient use of the land-side (ph) equipment that moves cargo between the ports and the shippers, or the -- or the consignees, NDCs, and warehouses.

MCNERNEY: Sounds like a lot of advantage.

WHITE: I -- I -- we think it's a -- it's a great utility for everybody. I think this industry has not really trained since the 1950s, since containerization has come around. And I think this technology affords us an opportunity to look at things differently. And what we're seeing is a lot of engagement from everybody involved in the -- in the supply chain because I think the industry's ready for change.

MCNERNEY: Thank you. I yield back.

ABRAHAM: Thank you, Mr. McNerney. Well, once again, I thank the witnesses. And members had some great questions. Robert, tell everybody in Monroe, Louisiana, my -- give them my regards. I'll be home shortly.

Mr. Rubio, is that your family behind you?

RUBIO: It is. That's right.

ABRAHAM: I tell you, I've been watching those two young people. They are our future and they have been listening intently. So they are our future blockchainers and quantum computer tacticians. So I appreciate their presence very much here.

RUBIO: Thank you, Mr. Chairman.

ABRAHAM: The record will remain open for two weeks for additional comments and written questions from members. This hearing is adjourned.