BLOCKCHAIN, BITCOIN, AND VAT IN THE GCC: THE MISSING TRADER EXAMPLE

Boston University School of Law
Law & Economics Working Paper No. 17-05

Richard T. Ainsworth
Boston University School of Law

Musaad Alwohaibi
University of Florida, Fredric G. Levin College of Law

BLOCKCHAIN, BITCOIN AND VAT IN THE GCC: – THE MISSING TRADER EXAMPLE

Richard T. Ainsworth[1]
Musaad Alwohaibi[2]

Blockchain technology disrupts centralized ledgers. In blockchain parlance the term "disruption" is synonymous with change that improves efficiency, security and transparency. Simply put, when blockchain technology replaces a centralized ledger functionality improves. "Disruption" also suggests that there will be some short-term turmoil surrounding this change. This means that, at least some level, the analysis for change is not as clear as it should be when blockchain is replacing an operational centralized ledger.

Perhaps no centralized ledger system presents more challenges than that of the modern tax administration. The central data storage system of a modern tax authority contains all return, payment, and audit activity for all taxpayers arranged tax-by-tax for three years or longer periods of time. Blockchain is coming to tax administration and it will change these centralized ledgers.

Even though a majority of the executives and technology experts at the recent World Economic Forum held in Davos, Switzerland (January 20-23, 2016) believe that governments will be collecting taxes with blockchain by 2023, it is both difficult to see how a change of this magnitude will come about so quickly, and difficult to conceptualize what the changed systems will look like when they arrive. As Channing Flynn indicates in *Preparing for Digital Taxation in a Blockchain World,* tax-consulting firms "are keeping a very close watch on blockchain development."

So, what will we see as we get closer to 2023? Are there already signs that blockchain is coming?

It is easier to peer into the future if we narrow the scope of the inquiry. Instead of considering all taxes in a mature (fully developed) multi-tax system, this paper will examine one particularly difficult problem in one specific tax, placed in the context of a jurisdiction that (as of this time) has not decided to adopt either (a) a traditional centralized ledger regime, or (b) a distributive ledger regimen to monitor relevant tax data. This paper considers:

- missing trader (MT) fraud;
- in an EU-style credit invoice value added tax (VAT);
- within the six country Gulf Cooperation Council (GCC).

The GCC is comprised of the six Middle Eastern countries (Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain and Oman) that are moving toward adopting a

[1] Adjunct Professor of Law New York University and Boston University, Richard.Ainsworth@nyu.edu; VATprof@bu.edu.
[2] SJD candidate, University of Florida School of Law, m_wohaibi@hotmail.com

community-wide 5% credit-invoice VAT by 2018.[3] Contextualizing this examination in the GCC allows us to consider blockchain apart from the turmoil that it brings to established systems.

This paper will trace the authors' developing appreciation of how blockchain technology will impact tax compliance in he coming decade, beginning with the Digital Invoice Customs Exchange (DICE),[4] through a community-based blockchain system,[5] and then a direct application of Bitcoin (VATCoin)[6] to VAT compliance.

MISSING TRADER (MT) FRAUD

All destination-based VATs are susceptible to missing trader (MT) fraud. VATs adopted in an economic community are particularly susceptible on intra-community transactions where the fraud is known by the acronym MTIC for Intra-Community Missing Trader fraud. Destination VATs that are not in a community are less susceptible to missing trader frauds in goods, but they are fully vulnerable to the identical fraud in tradable services, known as MTEC, or Missing Trader Extra-Community fraud. The EU looses between €60 to €100 billion annually to these frauds.[7]

Because these frauds are carried on the back of apparently ordinary goods or services transactions there is always a problem culling the fraudulent activity from the legitimate transactions in real-time. The fraud is almost always discovered after-the-fact.

Technology has played a role in every known case of this fraud in recent years. The speed with which the fraud can occur can be seen in the phishing attack on the Czech registry for CO2 permits, where the theft of 500,000 permits worth an estimate €7 million on the morning of January 18, 2011.[8] A series of fraudulent transactions through 5

---

[3] Khalid Algharbi, *Riyadh is Heading for the Issuance of Instruments, and the Gulf is putting the Finishing Touches on the VAT today*, ALEQT (October 27, 2016) (indicating that the Saudi Finance Minister, Musaad Bin Fahad, announced that the GCC finance ministers met on this day and finalized the VAT Framework that will be used to put an EU-style credit invoice VAT in each country beginning in January 1, 2018) *available a*t: http://www.aleqt.com/2016/10/27/article_1097473.html?utm_source=dlvr.it&utm_medium=twitter (in Arabic).

[4] Richard T. Ainsworth & Goran Todorov, *Stopping VAT Fraud with DICE – Digital Invoice Customs Exchange,* 72 TAX NOTES INTERNATIONAL 637 (November 18, 2013).

[5] Richard T. Ainsworth & Andrew Shact, *Blockchain Technology Might Solve VAT Fraud*, 83 TAX NOTES INTERNATIONAL 1165 (September 26, 2016).

[6] Richard T. Ainsworth Musaad Alwohaibi & Mike Cheethan, VATCoin: The GCC's Crypto**tax**currency, TAX NOTES INTERNATIONAL (forthcoming).

[7] Europol, *Serious and Organized Crime Threat Assessment (SOCTA) 2013 (Public Version)* March 2013 at 27 indicates that MITC in all goods and services is estimated at 100 billion euro per year:

> MTIC fraud is a widespread criminal offence affecting many, if not all EU MS. The perpetrators of MTIC fraud are present both inside and outside the EU. Activities related to MTIC fraud can be directed remotely using the internet. MTIC deprives states of tax revenue required to make investments, maintain public sector services and service foreign debt. The EU is loosing an estimated 100 billion Euros of MTIC income.

[8] CO2 permits are deemed to be services in the EU. They are subject to the VAT in all Member States. VALUE ADDED TAX COMMITTEE, WORKING PAPER 443 REV 1, *Question Concerning the Application of*

countries in less than 90 minutes can be tracked (in hind sight) through the EU Emissions Trading System.[9] Technology is the only way to prevent these frauds. The solution involves real-time tracking of taxable transactions with centrally collected (securely encrypted) data flows that are risk-analyzed by artificial intelligence (AI).

MTIC fraud is a very easy fraud to understand. The key elements are almost always the same. A supply (good or tradable service) is imported, bought and sold along a chain of companies, and then exported. One link in the chain, commonly the first one, collects VAT, but does not file a return or remit the tax collected. By the time the government realizes that a return is missing the trader disappears with the tax money.

Although the amount of tax loss is a function of the VAT rate (the EU rate is commonly four or five times the rate proposed for the GCC), it is also a function of the price, speed, and volume of the supply. Missing trader fraud in the GCC will attract high value, intangible supplies (like CO2 permits) that are digitally transferred in huge volumes. But it will also attract fraud in ordinary goods (like designer handbags).

The fraud will be blocked if the tax administration convincingly communicates that it knows the details of every taxable transaction and can anticipate fraud patterns in real-time.

A precursor to the appearance of blockchain solutions to MT fraud can be seen in the enforcement efforts undertaken by Revenue Quebec in the restaurant sector. Mandatory use of Sales Recording Modules (SRMs) in 20,000 establishments (over 33,000 SRMs installed), under a subsidy from the government of $53 million and total implementation costs of $34.4 million yielded revenue gains of $940 million in 2015, which is anticipated to reach $2.1 billion by the 2018-19 fiscal year.[10]

The Quebec SRM records sales in secure memory, transmits sales information in a bar code that is placed with a secure digital signature on each receipt, standardizes accounting records across the restaurant industry, and produces a summary that is transmitted to Revenue Quebec each month.

Importantly, all of the data collected is stored in a central database that is analyzed by artificial intelligence to detect frauds. But also, the data is shared. Taxpayers and Revenue Quebec have equal access to the digital records, with limits on proprietary details so that one business cannot probe the business details of a competitor. In a similar system planned for Ontario the government plans on offering "anonymized" aggregate data to the pubic through the open government initiative which will help small

---

Community VAT Provisions: Greenhouse Gas Emission Allowances, TAXUD/1625/04 REV 1 (May 27 2004).

[9] Richard T. Ainsworth, *Phishing and VAT Fraud in CO2 Permits: The Digital Invoice Customs Exchange Solution*, 77 TAX NOTES INTERNATIONAL 357 (January 26, 215).

[10] Gilles Bernard, *Mandatory Billing in the Restaurant Sector,* at the Forum on Modernizing Sales Tax Collection (NY Senate Hearings, Albany, NY) April 6, 2016.

businesses plan things like where to open a shop, and the average prices for commodities in an area.[11]

Efficiency gains in Quebec are impressive. The cost to inspect a restaurant decreased from $4,410 to $190. An inspection that used to take 70 hours, now takes 3, and the number of annual inspections (with the same staff) has risen from 120 to 8,000 because most of the audit work can be done remotely.[12]

DICE – DIGITAL INVOICE CUSTOMS EXCHANGE

There are two elements to DICE – the *digital invoice* and the *customs exchange*. DICE consciously builds on the data security and central transmission of transactional data that can be observed in Quebec. However, DICE tackles a different fraud then the retail sales suppression fraud that concerns Quebec. DICE targets cross-border frauds. This is where MTIC and MTEC are most common. Much of the learning acquired from Quebec is applied in DICE, but the data collection is dual, coordinated, and occurs in real-time. DICE allows for a much faster response to fraud that is possible in the Quebec system.

In DICE paper invoices will be replaced with digital invoices. This is commercial practice in Brazil where an invoice is required to be digital to be enforceable.[13] Paper invoices are acceptable only as replicas or evidence of the true digital invoice. DICE follows the Brazilian model.

Eight steps explain the *digital invoice* and the *customs exchange* function under the DICE framework. The steps listed (below) can be followed on Figure 1 (further below):

1. The seller generates an electronic file containing all necessary contract terms for the sale of goods or services (a pro-forma digital invoice). The seller digitally signs the file (to assure integrity of the data and authorship).[14] The file is

---

[11] Personal email communication from Andrew Ogilvie, Ontario Ministry of Finance, October 17, 2016.
[12] Gilles Bernard, *supra* note 10, at 16.
[13] In Brazil the *digital invoice* has been used for securing internal data for cross-border supplies among the twenty-seven Brazilian states since 2006. It is part of the Brazilian tax modernization program called the *Sistema Publico de Escrituracao Digital* or Public System for Digital Accounting (SPED). When it began the NF-e pilot project. Progress was rapid. By April 2009 there were 25,000 NF-e issuers. The CT-e pilot project began October 25, 2007. It involved two states (São Paulo and Rio Grande do Sul) and 43 companies and transportation firms. By March 1, and April 1, 2009 respectively the firms in Rio Grande do Sul and São Paulo began issuing legally binding CT-e documents. Large-scale adoption of the CT-e began in 2010, and by the end of 2010 there were over 500,000 firms issuing digitally signed, cross-border NF-e invoices. The system is fully in place today. Newton Oller de Mello, Eduardo Mario Dias, Caio Fernando Fontana & Marcelo Alves Fernandez, *The Implementation of the Electronic Tax Documents in Brazil as a Tool to Fight Tax Evasion,* PROCEEDINGS OF THE 13TH WORLD SCIENTIFIC AND ENGINEERING ACADEMY AND SOCIETY (WSEAS) INTERNATIONAL CONFERENCE ON SYSTEMS (2009) 449, 453, *available at*: http://dl.acm.org/citation.cfm?id=1627575&picked=prox
[14] The digital certificate in Brazil is provided by Certsign at: http://www.certisign.com.br/ and Serasa at: http://serasa.certificadodigital.com.br/

transmitted (through the Internet) to the Origin tax administration. This transmission constitutes a "request for authorization" to use a *digital invoice*.[15]

2. The Origin tax administration will act on the "authorization of use" request. The process is: fully automated, available 24/7, only involves a basic check of the file for accuracy and completeness, and takes only a few seconds (probably only milliseconds).

3. (a) If the file is complete and accurate, the Origin tax administration saves a copy and an electronically signs a re-transmission to the seller. This electronic signature serves as an access key, and the document becomes part of a shared ledger for the transaction used for verification of the invoice by the buyer, seller, or the tax administration. The access key is a fixed-size alpha-numeric bit string. When reproduced on a paper invoice it may appear as a bar code, or QR code. In an audit context it will allow inspectors to immediately call up (in real-time) any invoice in the commercial chain with the press of a button.
   (b) Notification of the actions taken, along with a copy of full documentation and access keys will be sent directly to the Destination tax administration simultaneously with the Authorization of Use sent to the Seller.

4. (a) The seller will compose a proposed invoice. It will include all of the data from the file along with the access key.
   (b) The seller will transmit the proposed invoice to the buyer.

5. The buyer can use the access key to check the validity of the invoice. The buyer will then replicate the steps taken by the seller (above).
   - Buyer will digitally sign the file;
   - Transmit the file to the Destination tax administration;

6. The Destination tax administration will verify the file sent by the buyer, digitally sign it, save it, and produce a second access key. The files from seller and buyer should match.

7. (a) The Destination tax administration will transmit an authorization of use to the buyer that will contain the second access key.
   (b) The Destination tax administration will simultaneously notify the Origin tax administration of the authorization and transmit a copy of the file along with the second access key.

8. (a) The buyer retains a copy of the file, and transmits an acceptance to the seller with both access keys attached. A VAT invoice is issued containing all of the contract data and both access keys.

---

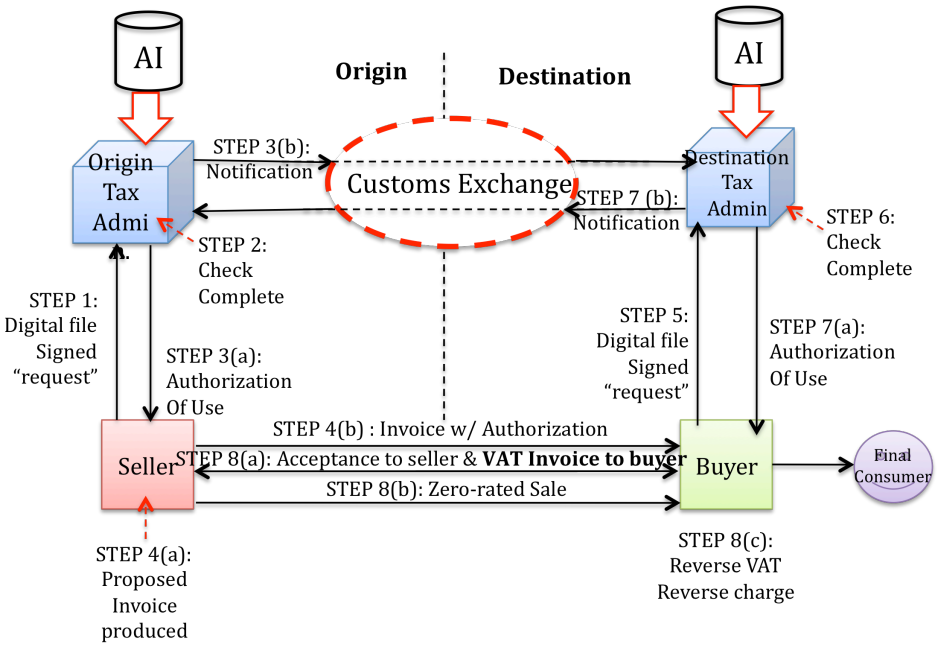
[15] In Brazil this transmission is to the State Tax Administration for *Impostos Sobre Circulação de Mercadorias e Prestação de Serviços* (ICMS) verification. The ICMS is the state sales tax and the rate varies depending upon the industry and the Sate. In a VAT/GST jurisdiction this transmission would be to the national tax administration.

(b) The seller zero-rates the transaction on the invoice.
(c) The buyer performs a reverse charge.

Under a DICE regime, both Origin and Destination tax administrations have complete digital files of every transaction within their jurisdiction, as well as all intra-community, and extra-community transactions involving their taxpayers. Artificial Intelligence (AI) programs will be employed by both tax administrations to risk assess transaction as they occur.

The tax administration will have the ability to immediately stop (invalidate) any commercial transaction in the jurisdiction by denying digital invoice certification.

Figure 1: DICE – Digital Invoice Customs Exchange



Rwanda has phased in DICE. It mandated the use of Electronic Business Machines (EBMs) in all businesses this year after a gradual introduction that began in 3013. EBMs transmit encrypted transaction data to the tax administration in real-time. Beginning in 2013 Rwanda saw VAT revenue grow by 6.5%, followed by 12% in 2014, and 20% in 2015.[16] What's more, this year Tanzania and Rwanda are taking steps to establish a single revenue collection center. If this center comes to fruition we may see the first intra-community customs exchange between these two members of the East African Community.[17]

[16] Eugene Kwibuka, *RRA: Use of EBM will soon be Mandatory for Every Business*, THE NEW TIMES (October 10, 2016) available at: http://www.newtimes.co.rw/section/article/2016-10-10/204315/
[17] Maureen Odunga, *Dar, Kigali for One Revenue Center*, DAILY NEWS (July 2, 2016)

BLOCKCHAIN – CONSENSUS IS CRITICAL

Blockchain technology creates a robust, secure, transparent *distributive* ledger.[18] The technique is revolutionary. Blockchain is a software protocol based on cryptography. It was devised in 2008, and was announced simultaneously with its most famous application – Bitcoin.[19]

Blockchain technology is *trustless,*[20] in the sense that it does not require third party verification. Instead of trusted intermediaries, blockchain uses powerful consensus mechanisms with cryptoeconomic incentives to verify the authenticity of transactions in the database.[21] Depending on the application this incentive mechanism can change. It is very different for *permissioned* blockchains, like destined for employment by tax administrations, than it is for *permissionless* blockchains, like that used by Bitcoin.[22]

The consensus mechanism makes the database safe (highly *trustworthy*) even in the presence of powerful or hostile third parties trying to manipulate the registry. For this reason, *The Economist* called blockchain, "The Trust Machine."[23]

---

[18] A ledger, as used in this sentence and in this field generally, means a value recording and transfer system. Simply stated, a ledger is an accounting tool that keeps track of who owns what. The ledger itself is a very old technology that has not changed much since its development by the Venetian Republic in the 15th century. Ledgers have long been digitized (in the 20th century), but it was only with blockchain that they have been *decentralized*. Prior to 2008 ledgers were only understood as *centralized*.

[19] Satoshi Nakamoto, Bitcoin, *A peer-to-peer electronic cash system* (2008) available at: https://bitcoin.org/bitcoin.pdf (note: Satoshi Nakamoto is a pseudonym).

[20] The trust element is very important to the adoption of blockchain in tax compliance areas. It needs to be stressed that trusting the blockchain technology is different than trusting Bitcoin. Europol contends that it is not blockchain, but the "… Bitcoin [application that] is establishing itself as the single common currency for cybercriminals within the EU." Europol, 2015 INTERNET ORGANIZE CRIME THREAT ASSESSMENT, *Key Findings* available at: https://www.europol.europa.eu/iocta/2015/key-findings.html

[21] Tim Swanson, *Great Wall of Numbers Cryptoeconomics for beginners and experts alike*, citing Vlad Zamfir of the Ethereum project at the Cryptocurrency Research Group conference (brainstorming session) on Cryptoeconomics as posted January 30, 2015 at: http://www.ofnumbers.com/2015/01/30/cryptoeconomics-for-beginners-and-experts-alike/. Cryptoeconomics is:

> A formal discipline that studies protocols that govern the production, distribution and consumption of goods and services in a decentralized digital economy. Cryptoeconomics is a practical science that focuses on the design and characterization of these protocols.

[22] Cryptoeconomic incentives are most strongly associated with cryptocurrency systems. Bitcoin *mining* is such an incentive system. This is because Bitcoin uses pseudonymous and anonymous nodes to validate transactions, whereas a basic distributive ledger that engage entities with legal identities (banks, financial institutions, government agencies) will use "permissioned" nodes to validate transactions. This proposal of DICE on a blockchain uses permissioned nodes. For this reason, a basic distributive ledger is able to host off-chain assets (smart contracts) due to their authenticated, permissioned approach to validation. Tim Swanson, *Consensus-as-a-Service: A Brief Report on the Emergence of Permissioned, Distributed Ledger System* (April 6, 2016) *available at*: http://www.ofnumbers.com/wp-content/uploads/2015/04/Permissioned-distributed-ledgers.pdf.

[23] THE ECONOMIST, *The Promise of Blockchain: The Trust Machine* (October 31, 2015) available at: http://www.economist.com/news/leaders/21677198-technology-behind-bitcoin-could-transform-how-economy-works-trust-machine.

Only recently have decentralized, distributive ledgers been possible. Advances in technology, computing capacity, and connectivity (post-2000) have made this happen. Replacing very expensive *centralized ledgers* with *decentralized distributive ledgers* captures huge cost savings and efficiencies.[24] Decentralized distributive ledgers ride three exponentially declining cost curves:

1. *Moore's Law*: the cost of processing digital information (speed), halves every 18 months;[25]
2. *Kryder's Law*: the cost of storing digital information (memory) halves every 12 months;[26]
3. *Nielson's Law*: the cost of shipping digital information (bandwidth) halves every 24 months.[27]

Consensus is the critical difference between DICE and tax-based blockchain applications. Where DICE secures real-time transactional data and stores it in central databases located at each tax administration's computer center for later risk analysis, blockchain performs risk analysis in real-time. The blockchain consensus mechanism is the last stage before the issuance of the formal VAT invoice.

Example

Assume a manufacturer in the origin jurisdiction produces 100 widgets for export that are sold to "Seller A" for 10,000 currency units each (a domestic sale). "Seller A" reaches agreement with "Buyer B" in the destination jurisdiction to acquire 10 of these widgets for 11,000 currency units each (an intra-community cross-border sale). After import "Buyer B" re-sells the cars to a Dealer in the destination jurisdiction who sells on to individual final consumers.

Assume that a distributed VAT ledger records all the transactions involving each of the 10 widgets from the manufacturer to "Buyer B." It records the acquisition of materials to produce the 100 widgets (Block 1), which are transferred to "Seller A" (Block 2).[28] We are concerned with the cross-border sale to Buyer B in the destination

---

[24] Sinclair Davidson, Primavera De Philippi & Jason Potts, *Economics of Blockchain* (March 8, 2016) *available at*: http://ssrn.com/abstract=2744751

[25] Gordon E. Moore, Cramming More Components onto Integrated Circuits, Proceedings of the IEEE, Vol. 86, No. 1, January 1998) reprinting the same title from Electronics, 114-117 (April 19, 1965) available at: http://www.cs.utexas.edu/~fussell/courses/cs352h/papers/moore.pdf. Mr. Moore is the founder of Intel and Fairchild Semiconductor.

[26] Mark Kryder, *Kryder's Law*, SCIENTIFIC AMERICAN (August 2005) *available (as a reprint) at*: https://web.archive.org/web/20060329004626/http://www.sciam.com/article.cfm?chanID=sa006&colID=30&articleID=000B0C22-0805-12D8-BDFD83414B7F0000. Mr Kryder was the senior Vice President of Research and the Chief Technology Officer at Seagate Corp.

[27] Jakob Nielson, *Nielson's Law of Internet Bandwidth*, NIELSON NORMAL GROUP https://www.nngroup.com/articles/law-of-bandwidth/. Mr. Nielson was an engineer at Sun Microsystems.

[28] A blockchain is simply a chronological database of transactions recorded by a network of computers. Each block is encrypted and organized into smaller datasets referred to as "blocks." Every block contains information about a certain number of transactions, a reference to the preceding block in the blockchain, as well as a consensus notation indicating that the current block has been validated. Thus, each block contains the hash of the previous block, which thereby fixes the current block as the sole antecedent. All operations in the bockchain are validated through a digital fingerprint created through a particular hash function (SHA256 is used by Bitcoin). All transactions incorporated in the blockchain are mapped into a fixed-

jurisdiction (Block 3). If consensus is reached Block 3 will be bound to Block 2 in the same manner as Block 2 was joined to Block 1 in the distributed VAT ledger.

When "Seller A" and "Buyer B" agree to the terms of the sale/ purchase of the 10 widgets for 11,000 currency units each, the rules of the distributed VAT ledger will require both parties to transmit this tentative agreement (a *pro forma* invoice) in an encrypted digital file to their respective tax administrations. From there it will pass to the cloud, and then to each of the assigned nodes in each jurisdiction.

The consensus mechanism verifies (through AI-based risk analysis) the appropriateness of the cross-border transaction. This example is modeled on a transaction where the origin jurisdiction is France with a GDP (2015) of €2,183.6 billion, and the destination jurisdiction of the Netherlands with a GDP (2015) of €678.5 billion. If the consensus mechanism requires a commitment of computational resources comparable to the relative GDPs of the two jurisdictions, France will be required to dedicate 21 computer "nodes" to this exercise, and the Netherlands will be required to provide 6.

Each of the nodes will be asked to approve or disapprove the proposed transaction.[29] If we further assume that the consensus threshold is set at 75% of the French nodes and 75% of the Dutch nodes, then consensus would be registered (automatically) if approvals at this level were reached.

The invoice is the most critical VAT document. A blockchain-based regime will require that every valid VAT invoice must display a digital fingerprint derived through the VAT blockchain consensus process. In this case, the fingerprint will identify that Block 3 is permanently linked to Block 2. The entire history of the commercial chain (forwards and backwards from this cross-border transaction) will be able to be followed. A hand-held scanner (similar to the scanners used in Quebec) that is connected to an approved tax-auditing program would be all that is needed to immediately pull up the entire commercial chain for an item from a valid invoice.

To perform its function each node will need to have immediate access to all standard invoice-level data about both parties (name, address, VAT ID, price of each item, volumes involved). In addition, all nodes will be able to conduct independent AI-facilitated risk analysis. The best AI systems allow these inquiries to be made in natural language, and the AI operators will be trained auditors who know the industry involved.

---

length string of data. Any differences in input data will produce differences in output data (and thus a different digital fingerprint). See: Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*, at 6-7, *available at*: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664

[29] SmartCloud Inc. performs risk analysis for 60,000 taxpayers handling 2 million transactions per day. AI of this quality installed at each node could more than handle the commercial transactions on a DICE blockchain. Personal communication, Paul Lindenfelzer, Partner, VP Sales and Operations, SmartCloud, Inc., (Bedford, MA) July 11, 2016 (plindenfelzer@smartcloudinc.com).

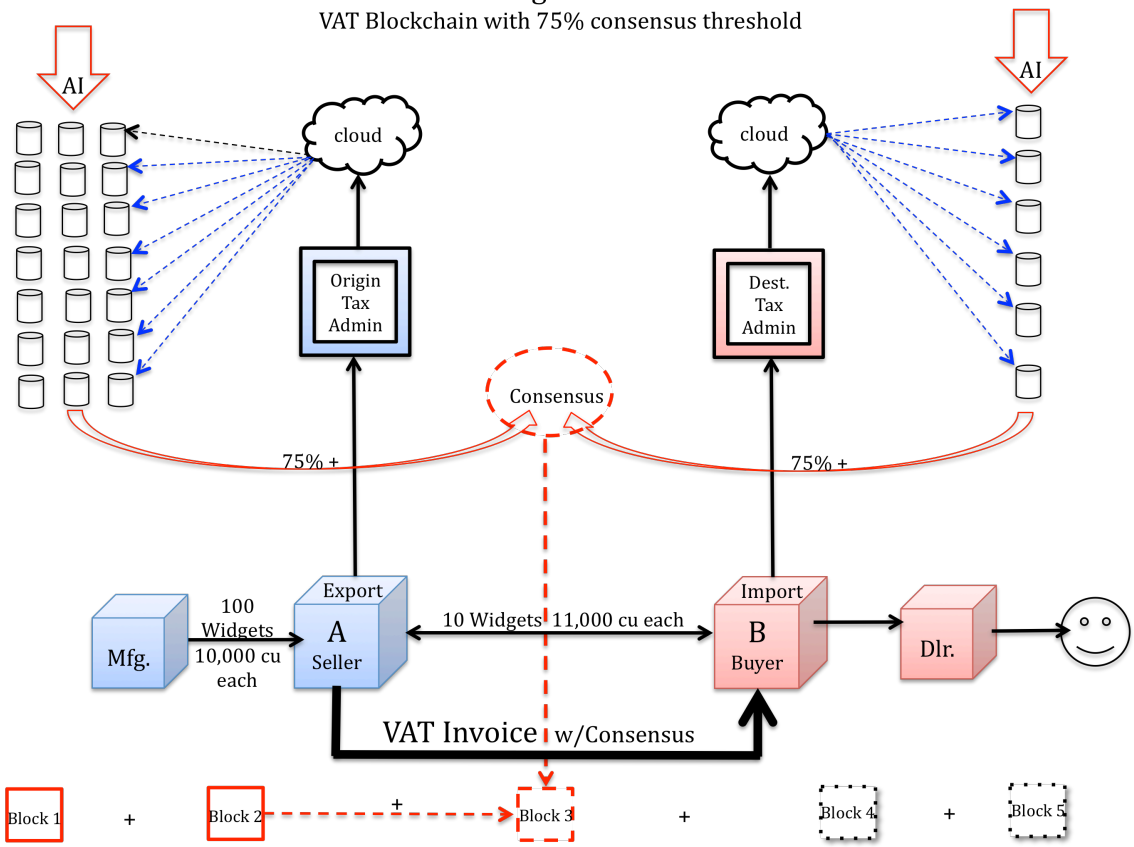
Because this regime employs government-nodes, each node will have access to large numbers public and private databases. Statistical anomalies will be identified in real-time, and authorities will be alerted. AI will move (or be directed) through available data points. Analytical approaches preferred by node managers will guide the analysis. For example, points of inquiry could include:[30]

- Are the prices charged below market?
- Is the buyer or seller a newly registered taxpayer with insufficient capital to engage in transactions like those proposed?
- Has either tax authority specifically notified one party that previous deals involving the supplier had been traced to a VAT loss and/or had involved carousel movements of goods?
- Has either tax authority specifically notified one of the parties to the current transaction that other MTIC VAT fraud characteristics (such as third party payments) have occurred in other transaction chains by this taxpayer?
- Are the buyer and seller current on other tax obligations (income tax, property taxes, payroll taxes)
- Based on available payroll records do the buyer and seller appear to have a sufficient number of employees to justify the transaction volumes on the proposed invoices?
- What is the buyer's/supplier's history in the trade?
- Does the deal carry no commercial risk – e.g., no requirement to pay for goods until payment received from customer?
- Does the deal involve consistent or pre-determined profit margins, irrespective of the date, quantities or specifications of the specified goods traded?
- Does the supplier (or another business in the transaction chain) require 3rd party payments or payments to an offshore bank account?
- Are the goods adequately insured?
- Are goods of high value offered with no formal contractual arrangements?
- Are high value deals offered by a newly established supplier with minimal trading history, low credit rating etc?
- Can a brand new business obtain specified goods cheaper than a long established one?
- Does the volume purchased (or sold) fit within normal trading patterns for these companies?

[30] For other examples see the due diligence requirements listed at: HM Revenue and Customs, *VAT Notice 726: joint and several liability for unpaid VAT* available at: https://www.gov.uk/government/publications/vat-notice-726-joint-and-several-liability-for-unpaid-vat/vat-notice-726-joint-and-several-liability-for-unpaid-vat

Figure 2

VAT Blockchain with 75% consensus threshold



VATCOIN

The prior discussion of blockchain proposes a blockchain of the supplies as they move across borders. It moves DICE to the cloud and apples blockchain technology to create a secure train of commercial activity. There remains an element of the centralized ledger in that discussion, because it is not clear how freely governments will share data-bases.

The origin jurisdiction may perform its AI risk analysis with data that is confidential, and may not allow the destination jurisdiction to access this material when it performs its own analysis. The consensus that these jurisdictions reach may predominantly be of their own taxpayers, and it may be the threshold will need to be raised in some instances to arrive at an acceptable level of trust.

This is not the case with the VATCoin proposal we made to the GCC. VATCoin is modeled on Bitcoin. Both Bitcoin and VATCoin are distributive ledger *applications* built upon blockchain technology. Bitcoin's ledger is *public*; VATCoin's is *private*. If adopted, VATCoin could well become the world's first government-mandated crypto**tax**currency. Unlike Bitcoin, VATCoin will not be a speculative currency. It is

always fixed to the home currency. VATCoin could be implemented in conjunction with DICE or a blockchain of the supplies (discussed above).

VATCoins are a digital, not a physical currency. They are only recognized for payment of VAT.[31] Transactions in VATCoin will be chronologically registered on a distributed ledger. The validity of each transaction will be verified by government (tax administration) nodes from each jurisdiction. The number of nodes contributed by a jurisdiction will be proportional to the GDP of that jurisdiction relative to the aggregate GDP of all jurisdictions in the economic community involved. Each enterprise involved in a VATCoin transaction will have access to the transaction records of all the VATCoins it has held.

In the GCC proposal the VATCoin blockchain extended throughout the six Member States. Valid transactions would be aggregated in blocks, which would be cryptographically sealed and attached to the next block in the chain approximately every 10 minutes. The verification and sealing mechanism is by 75% vote of the active nodes of the network.

There are two distinct legal provisions in the GCC proposal, each of which needs to be implemented in each Member State:

- Currency rules:
    - Throughout the GCC, VAT must be paid (and received) only in VATCoin. VATCoin payments will be made by *smart contract*[32] embedded in invoice documentation.

---

[31] For a layman's explanation of what a Bitcoin (or a VATCoin) looks like see: Carlos Bueno, *What a Bitcoin Looks Like*, available at: http://carlos.bueno.org/2012/07/paper-bitcoins.html

> [Bitcoins are] a huge disappointment. Looking at the numbers on a screen didn't move me. That's it? What does it *really* look like? What can I show my children? It turns out that Bitcoins (more precisely, a "wallet") can be represented in less than a hundred bytes. Everything else is contained in a giant shared database, a chain of signed blocks of data, on computers all over the internet. But there's no reason why that representation can't be printed and exchanged just like physical money. All you need is a standard format. So I designed one.

[32] There are a range of opinions on smart contracts, from the clinical, technological definition and no more (Swanson), to a balanced pro and con that wants to wait for more evidence (UK Chief Science Advisor), to an enthusiastic, visionary advocate who can see the world changing rapidly because of them (Wright & De Philippi).

> A smart contract is a simple rules engine; cryptographically assured business logic that has the ability to execute and move value.

Tim Swanson, *Consensus-as-a-Service: A Brief Report on the Emergence of Permissioned, distributed Ledger Systems* (April 6, 2015).

> Smart contracts are contracts whose terms are recorded in a computer language instead of legal language. Smart contracts can be automatically executed by a computer system, such as a suitable distributed ledger system. The potential benefits of smart contracts include low contracting, enforcement, and compliance costs; consequently it becomes economically viable to form contracts over numerous low-value transactions. The potentials risks include reliance on the computing system that executes the contract.

UK Government Chief Scientific Advisor, Government Office for Science, *Distributed Ledger Technology: Beyond Block Chain,* at 18 (December 2015).

- Throughout the GCC, VATCoins must be recognized as non-redeemable currency, convertible into cash only by the government. Governments will need to issue cash refunds in instances where a VAT return has a verified negative VAT due.

- Tax rules:
  - Throughout the GCC, VATCoins paid with inputs and received with outputs will be verified in real-time and added to the blockchain.
  - After a waiting period, a *smart contract* will issue refunds (daily) whenever a taxpayer's account shows a *negative VAT due* balance. Daily balancing of VATCoin accounts will the norm, but rules may be implemented to delay significant refund amounts until a more thorough risk analysis/ audit is performed.

Example

A reasonably through example was designed for the GCC to bring out application issues in a VATCoin scenario. That example follows.

Assume all six members of the GCC have adopted a 5% VAT conforming to the GCC Framework. Assume further that the Framework includes a VATCoin provision.

"C" is a business in Saudi Arabia that manufactures a range of concrete building materials – from standard cement blocks, to specialty concrete structures, and large reinforced concrete beams for highway bridges. "C" has large supplies of sand and water in Saudi Arabia, but needs to purchases (SAR) 1,000,000 in cement from supplier "B" in Bahrain,[33] and (SAR) 40,000,000 in heavy construction equipment from supplier "A" in Japan.

All of "C's" output is sold for (SAR) 8,000,000 to "D," a Saudi distributor of building supplies. "D" re-sells half of its inventory for (SAR) 5,000,000 to contractor

---

> Blockchains are not just powering digital currencies. They are also enabling the creation of smart contracts, one of the first truly disruptive technological advancements to the practice of law since the invention of the printing press. Using a distributed database like blockchain, parties can confirm that an event or condition has in fact occurred without the need for a third party. … To date, smart contracts have mostly been created to automatically execute derivatives, futures, swaps, and options. … The development of smart contracts is expanding rapidly. Over the past several months, a number of open source projects – such as Ethereum, Counterparty, and Mastercoin – have been developed to create programming languages that enable the creation of increasingly sophisticated smart contracts. Using these programming languages, smart contracts could be used to enable employees to be paid on an hourly or daily basis with taxes remitted to a governmental body in real time.

Aaron Wright & Primavera DePhilippi, *Decentralized Blockchain Technology and the rise of Lex Cryptographia*, (March 12, 2015) (unpublished manuscript) *available at*: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664

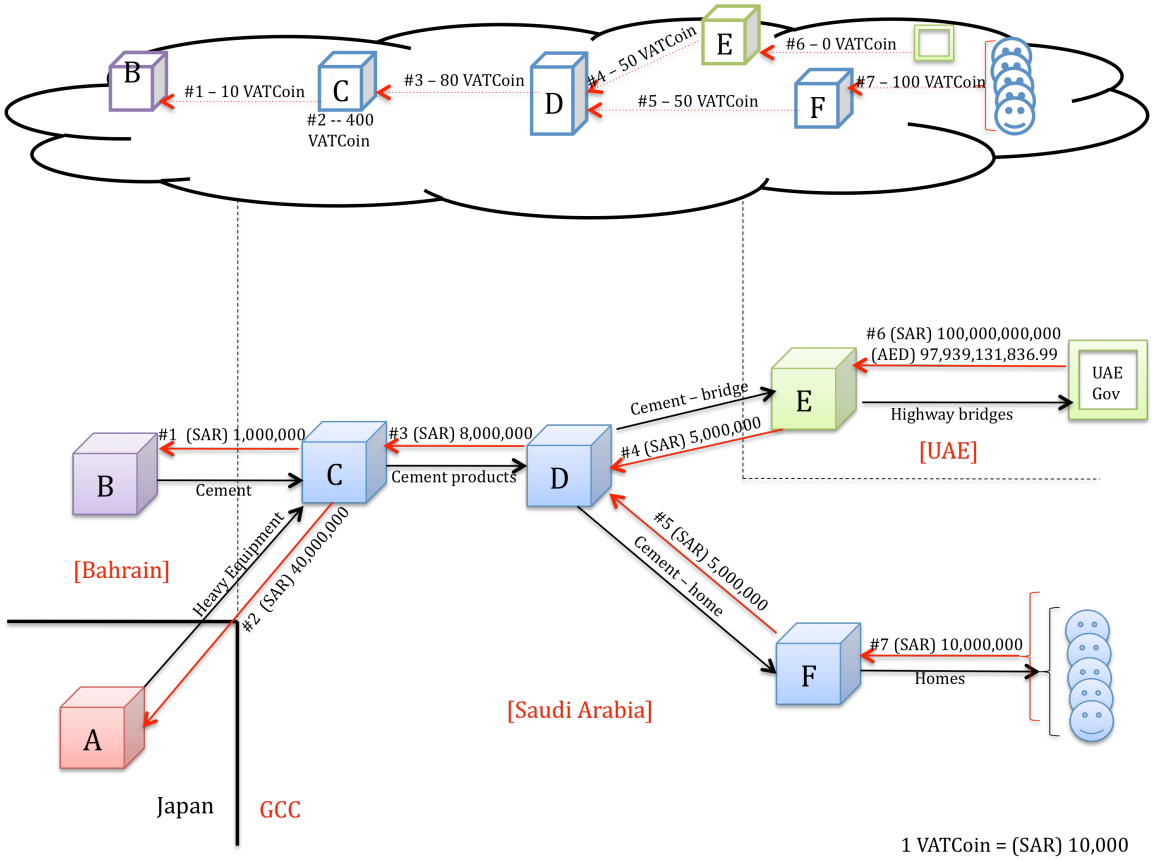
[33] In reality, Saudi Arabia is a producer of cement at very competitive prices, although the price may be attributed in large part to energy subsidies. Firms in Saudi Arabia are pressing for export licenses. The government is considering an export tax to recover the subsidies. This example assumes that there is a temporary shortage of Saudi cement, and imports are needed from Bahrain to cover the shortfall.

"E" in the UAE that is building highway overpasses for the UAE government. "D" re-sells the other half of its inventory for (SAR) 5,000,000 to contractor "F," in Saudi Arabia who is building personal residences in Riyadh.

The UAE pays (AED) 97,939,131,836.99 for bridge construction, which is equal to (SAR) 100,000,000,000. The five personal residences built by "F" sell for (SAR) 2,000,000 each.

Figure 3, below diagrams the supplies of concrete products in the common example, and the payments made for the supplies. It also shows the flow of VATCoins in the GCC Cloud associated with the each of the supplies. It assumes that 1 VATCoin = (SAR) 10,000.

Figure 3 – GCC VATCoin



The diagram (above) makes a number points more clearly than might be apparent in the text materials. At lest four are worthy of immediate notice:

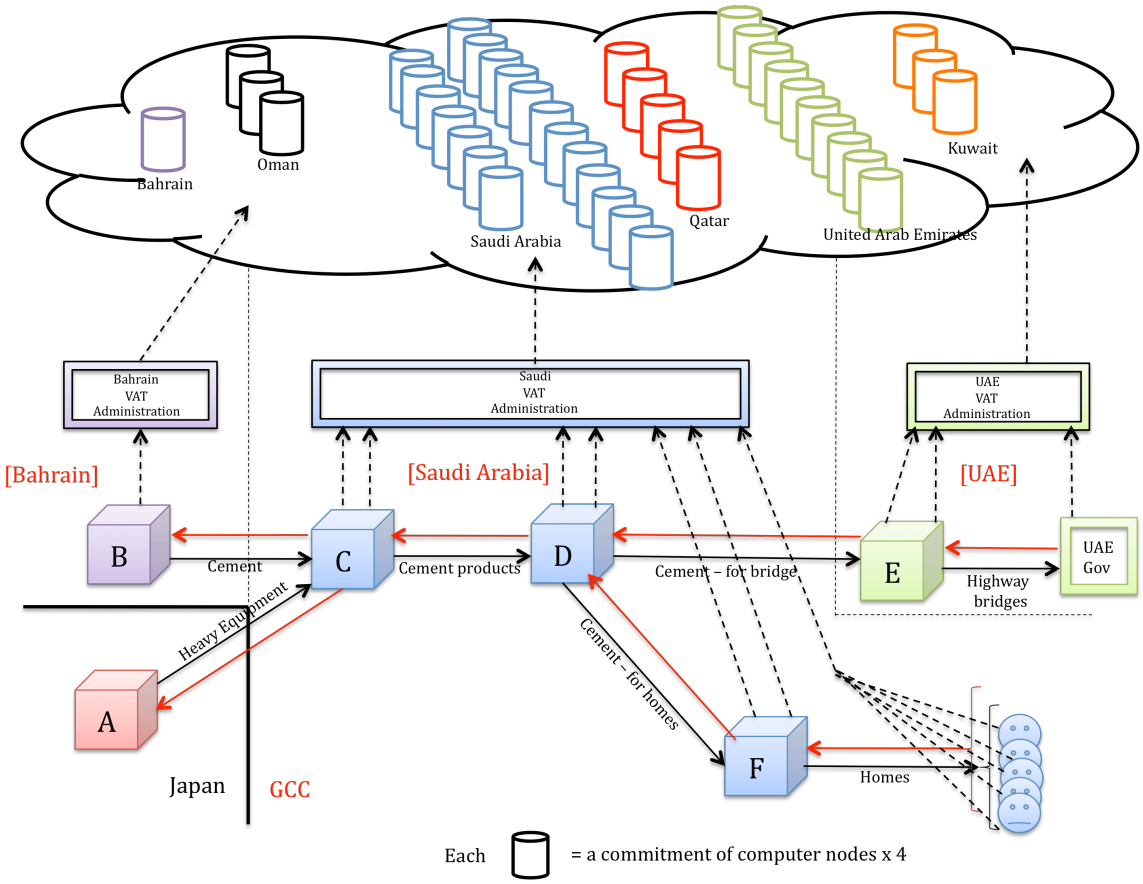
- No trader holds VAT – its all in the cloud
- Real-time VAT is possible – daily tax remissions and refunds occur
- Code is Law – regulation of the VAT is in the computer code
- The GCC VAT in this diagram is Immune to Cyber-attack

(1) *No trader holds VAT*. All VAT is held in the GCC Cloud. Traders never hold VAT. Missing trader frauds always revolve around a trader who holds VAT on behalf of the government who then disappears without filing a return and remitting the tax. VATCoins solve this fraud by taking VAT out of the hands of the traders.
(2) *Real-time VAT – Daily tax remissions and refunds*. With VATCoin each taxpayer's VAT account will be balanced daily in the GCC Cloud. Funds will be remitted to the Treasury daily (from the accounts where the balance is positive). Refunds can be determined just as quickly (from accounts where the balance is negative). *Smart contracts* facilitate these payments.
(3) "*Code is Law*." Lawrence Lessig's assessment of law in cyberspace anticipates the commercial response to a VAT built around blockchain with a mandated *crypto**tax**currency*. Lessig argues that technology (the Code) will regulate – in other words, the computer code will compel compliance.[34]
(4) *Immunity to cyber-attack*. VATCoin is cryptocurrency. It has no material representation. If VATCoins are stolen they immediately become worthless. A black market for VATCoins is not possible.

Similar to the consensus mechanism employed in the blockchain imposed on supplies (above), there is a consensus mechanism in VATCoin that verifies the transfer of the VATCoins. Transactions in VATCoin are relayed to the tax administration, and then forwarded to the GCC Cloud where nodes with AI functionality track and approve the transfers. Diagramed below.

Figure 4 – VATCoin consensus

[34] Lawrence Lessig, *Cyberspace and Privacy: A New Legal Paradigm?* 52 STANFORD LAW REVIEW 987 (May, 2009) (referencing the conclusions he reached in his book, Lawrence Lessig, CODE AND OTHER LAWS OF CYBERSPACE (1999)).



CONCLUSION

Blockchain is coming to tax compliance. In instances where blockchain technology and distributive ledgers replace centralized ledgers there will be some disruption (turmoil) surrounding the change, but the overall movement will be toward ever-greater efficiency, security and transparency. It is likely that blockchain will come first to jurisdictions like the GCC, where there is no pre-existing tax system to be "disrupted." This is the familiar technological "leap-frog" effect where jurisdictions without an established infrastructure in place can quickly move to new technologies without needing to pass through the entire development process. This is a common occurrence in African economies.

For those who are attentive to the coming blockchain disruption there are some precursor developments already visible. In the restaurant sector, Quebec mandates encryption of transaction data, requires the monthly submission of a digital summary report, performs AI-base risk analysis on the aggregate data streams to identify fraud patterns, and completes most audits remotely. Rwanda has gone further. It implemented a DICE compliance regime for all businesses, and requires full transactional data transmission daily (not just summary reports submitted monthly). Rwanda performs the same AI-based risk analysis for fraud detection. In addition, Rwanda appears ready to adopt a cross-border DICE system with neighboring Tanzania.

None of this is truly bockchain, but it is getting very close. Data is digitally preserved and encrypted for security purposes. The difficulty is that Quebec and Rwanda sends the data to a central location where it is stored and AI scrutinizes it for fraud patterns. Blockchain requires the same degree of data scrutiny, but instead of using it only as a springboard for in-depth audits, blockchain uses it to validate the transaction itself. With blockchain – the code is the law. Technology forces compliance. Non-compliant transactions do not go through.

No jurisdiction has taken this "next step" – blockchaining either the supply-side or the VAT payment-side of all commercial transactions. However, the path from Quebec's limited application to Rwanda's DICE suggests that this step will be taken soon.

The authors believe that the GCC is the ideal candidate to take this step. There is no centralized tax ledger in the GCC, so there is no ledger to disrupt, just a cutting-edge way to design a VAT system that takes advantage of the newest technology and world-class insights into how best manage a multi-jurisdictional VAT. It is easy to imaging that the 2018 adoption of a VAT in the GCC may come with one or both of the blockchain applications discussed here. There will be no disruptive turmoil when the blockchain is introduced. Nothing was there before.