

VATCOIN: THE GCC'S CRYPTOTAXCURRENCY

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Bitcoin is the world's first peer-to-peer cryptocurrency. VATCoin is similar, but it is used in tax compliance. 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 cryptotaxcurrency. Unlike Bitcoin, VATCoin will not be a speculative currency. It is always fixed to the home currency.

This paper proposes that the Gulf Cooperation Council (GCC)² adopt VATCoin in its VAT Framework.³ The GCC is expected to have multiple 5% VATs in place by January 1, 2018.⁴ There is an ample amount of time to install a VATCoin regime. If VATCoin is adopted by the GCC as the exclusive currency for payment of VAT in the GCC, it will eclipse (by about five years) the 2016 World Economic Forum's estimated timeline for the first use of blockchain technology in tax collection.⁵

Furthermore, if VATCoin is implemented by the GCC in conjunction with a Digital Invoice Customs Exchange (DICE),⁶ the Gulf States will have one of the most fiscally efficient, technologically advanced, and fraud-proof VAT systems ever established.

¹ The VATCoin concept is original with the authors. It was developed a direct result of chat conversations between the lead author and Mike Cheetham following the completion of the *Blockchain Might Solve VAT Fraud* paper. Ainsworth and Cheetham have been working together to offer solutions to VAT fraud for over a decade.

² The member states of the Gulf Cooperation Council are: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

³ Pierre Arman from Thomson Reuters indicating in advance of the GCC VAT Forum that the first public draft of the GCC Framework will be published near the end of October 2016. Nauman Asif Mian, *Experts in UAE look at benefits of VAT*, MSN NEWS, available at: <http://www.msn.com/en-ae/news/uae/experts-in-uae-look-at-benefits-of-vat/ar-BBw1zPk?li=BBqrVLO>

⁴ Per agreement of the Council, once two Members institute a VAT that conforms to the GCC's agreed Framework the remaining members must follow suit within one year's time. Saudi Arabia (*Gulf Finance Ministers Approve the Final Version of the Convention on Value-Added and their Application in 2018*, AAWSAT (May 4, 2016)), the UAE (Abdul Basit, *VAT will be a source of revenue in UAE*, KHALEEJ TIMES (July 19, 2016)) and Oman (Fahad Al Ghadani & K. Rejimon, *Oman Moving Towards 5 per cent Value Added Tax*, TIMES OF OMAN (February 29, 2016) have all indicated that they will install a conforming VAT by January 1, 2018.

⁵ Kimberly Johnson, *So, What Is Blockchain?* WSJ (June 20, 2016) at R6 in Journal Report: CFO Network. (reporting that more than 800 executive and technology experts were asked when they thought we will see a government collect tax with blockchain, and the answer was 2023.)

⁶ Richard T. Ainsworth & Musaad Alwohabi, *Blockchain (Distributed Ledger Technology) Solves VAT Fraud*, TAX NOTES INTERNATIONAL (forthcoming, 2016).

With DICE a granular, transaction-level record of commercial activity is captured. With VATCoin no tax is paid or held in real currency; VAT is paid, remitted and collected only in VATCoin. Only the government can convert VATCoin to real currency, and aside from the treasury function they will do so only in a limited number of instances.

BITCOIN

In 2008, a programmer known as Satoshi Nakamoto (a pseudonym) published a paper on a cryptography e-mail list that explained the Bitcoin concept.⁷ In early 2009 Nakamoto released software for exchanging Bitcoins. A volunteer open-source community coordinated by four core developers now maintains the software.

Nakamoto simply wanted to facilitate the exchange of money securely, and electronically without the assistance of third party intermediaries, but in the words of the European Central Bank, "... [the] database technologies [that Nakamoto developed], such as blockchain and other distributed ledger technologies (DLTs) could be the source of an imminent revolution [in financial institutions]."⁸

Bitcoin's blockchain is built entirely with established, well understood, technology. The genius of this innovation is not the technology *per se*; it is in the manner in which it combines technologies we have long understood. From a technological perspective, Bitcoin is an incremental (not an astronomical) advance. Bitcoin, though blockchain, connects peer-to-peer networks,⁹ cryptographic algorithms,¹⁰ distributed data storage,¹¹ and decentralized consensus mechanisms.¹²

How Bitcoin works. The installation and operation of Bitcoin can be explained in three easy steps:

- The Bitcoin client software is downloaded over the Internet. Once the software runs it will connect the user to the decentralized network of all Bitcoin users. The

⁷ Satoshi Nakamoto, Bitcoin, *A peer-to-peer electronic cash system* (2008) available at:

<https://bitcoin.org/bitcoin.pdf>

⁸ European Central Bank, *Distributed Ledger Technologies in Securities Post-trading: Revolution or Evolution?* OCCASIONAL PAPER SERIES, No. 172 (April 2016) available at:

<https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf>

⁹ Peer-to-peer networks date from the 1970's, although they only gained widespread acceptance in the 2000's. Usenet (introduced in 1979) is considered to be the "grandfather" of peer-to-peer. Andrew Oram, PEER-TO-PEER: HARNESSING THE BENEFITS OF A DISRUPTIVE TECHNOLOGY at 4-5 (2001).

¹⁰ Public key and private key encryption was developed very early on in the technology age. Consider the following introductions to the concept in the 1970's. Diffie Whitefield & Martin E. Hellerman, *New Directions in Cryptography*, 22 IEEE TRANSACTIONS ON INFORMATION THEORY 644 (1976); R.L. Rivest, A. Shamir & L. Ademan, *A Method for Obtaining Digital Signatures and Public-Key Cryptosystems*, available at: <http://people.csail.mit.edu/rivest/Rsapaper.pdf>.

¹¹ Decentralized, distributive data storage (like that offered by the source code management system Git, has been available for more than a decade. *A Short History of Git*, available at: <https://git-scm.com/book/en/v2/Getting-Started-A-Short-History-of-Git>

¹² Consensus mechanisms, such as the Proof of Work used in Bitcoin have been around since the 1990's. Adam Beck, *A Partial Hash Collision Based Postage Scheme*. Cited (but no longer available on the net) describing a proof of work system to eliminate e-mail spam, see: <https://en.wikipedia.org/wiki/Hashcash>

- software will generate a pair of unique, mathematically linked keys, which will be needed to exchange Bitcoins with any other client.
- One key is private (and kept hidden of the user's computer)
 - The other key is public (called a Bitcoin address). This key will be given to other people so they can send Bitcoins to the user.¹³
 - To transfer a Bitcoin, the Bitcoin software performs a mathematical operation that combines the other party's public key with the transferor's private key, and the amount of the Bitcoin that is being transferred.
 - The result is sent out across the distributed Bitcoin network
 - Bitcoin software clients not involved in the transaction will verify the transaction. Two checks are made:
 - Using to public key of the sender they will confirm that the true owner sent the Bitcoins (this is done by exploiting the mathematical relationship between that person's public and private keys); and
 - Reference is made to the public log of every Bitcoin, which is stored on every client's computer, to make sure that the sender is the owner of sufficient Bitcoins to make the transaction.
 - When a client verifies a transaction, it forwards the details to others in the network (so that they too can check the results).
 - Some of the clients (miners) will try to add the transaction to the public transaction log. This is a race to solve a cryptographic puzzle. The winner will be allowed to add the transaction to the transaction log, which will then be sent out to all computers on the network.
 - The transfer will be complete when the transferor receives an updated log containing his transaction (normally within 10 minutes, or less).
 - The mathematics involved make it very easy to verify a transaction, but almost impossible to generate a false transaction (that is, to *spend* Bitcoins that are not owned – known as the “double spend” problem).
 - Bitcoins are obtained by:
 - Purchasing them from an exchange;
 - Accepting Bitcoins in exchange for goods or services;
 - Winning the race to solve the cryptographic puzzle (above). A reward of “newly minted” Bitcoins is sent to the person who is allowed to complete the next “block” to the shared transaction log.

BLOCKCHAIN

¹³ It is practically impossible (even with the most powerful supercomputer to derive someone's private key from their public key. This prevents impersonation. The public and private keys are stored in a file that can be transferred to another computer (in case the user wanted to upgrade their system, for example). A common P2PKH address begins with the number “1” and looks like:

1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2

The newer P2PSH address starts with the number 3 and looks like:

3J98t1WpEZ73CNmQviecrnyiWrnqRhWNLy

Blockchain is simply a software protocol. Its three notable features are that it is *disruptive*, *trustless*, and highly *efficient*. The heart of every blockchain is the *consensus mechanism* that verifies each transaction and cryptographically binds the blocks of the chain together. There are a number of different consensus mechanisms available for use.

It is critical that the consensus mechanism that is chosen closely “fits” the needs of a specific chain. As a result, the consensus mechanism for a *public distributive ledger* (e.g., Bitcoin, which employs proof-of-work) will not be that same as the consensus mechanism for a *private distributive ledger* (e.g., VATCoin, which will likely use proof-of-identity).

Blockchain technology creates a robust, secure, transparent distributive ledger.¹⁴ The technology is revolutionary, or *disruptive*; *disruptive* in the sense that it will replace any centralized ledger system that coordinates valuable information.¹⁵

Blockchain is also *trustless*; *trustless* in the sense that it does not require third party verification.¹⁶ Blockchain does not need a *trusted* third party (like a bank) to help it negotiate (exchange) value.

Blockchain is also highly *efficient* - substantially more efficient than the systems it replaces. Efficiency margins are higher for *private* (as opposed to *public*) blockchains. Three efficiency mechanisms are common to all blockchains.¹⁷ A fourth efficiency is derived from the *private* distributive ledger that VATCoin will use. The four cost efficiencies are:

1. *Moore’s Law*: the cost of processing digital information (speed), halves every 18 months;¹⁸
2. *Kryder’s Law*: the cost of storing digital information (memory) halves every 12 months;¹⁹

¹⁴ 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*.

¹⁵ Aaron Wright & Primavera De Filippi, *Decentralized Blockchain Technology and the Rise of Lex Cryptographia*, 4-8 (March 12, 2015) available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664.

¹⁶ 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>

¹⁷ Sinclair Davidson, Primavera De Filippi & Jason Potts, *Economics of Blockchain* (March 8, 2016) available at: <http://ssrn.com/abstract=2744751>

¹⁸ 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.

¹⁹ 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=3>

3. *Nielson's Law*: the cost of shipping digital information (bandwidth) halves every 24 months.²⁰
4. *Consensus efficiency*: Bitcoin's *public* ledger guarantees that its users are anonymous, and this compels the use of the costly Proof-of-Work (PoW) consensus mechanism.²¹ VATCoin however, utilizes far less costly consensus mechanism, and derive additional efficiency margins from this. Anonymity is not an option in tax matters. Taxpayers cannot be anonymous when remitting taxes.²² The consensus mechanisms available for VATCoin including:
 - a. Proof-of-Identity (PoI),
 - b. Proof-of-Stake (PoS),
 - c. Proof-of-Elapsed-Time (POET), and
 - d. Quorum Voting (QV).

Bitcoin's guarantee of anonymity, which compels PoW consensus, is costly. This cost is born by miners, not users. Tomaso Aste estimates the electricity costs of mining Bitcoins to be about \$8,333. A block was worth \$15,000 early in 2016. Thus, mining is profitable, but it comes with an annual electrical bill of roughly \$400 million.²³ VATCoin avoids this bill.

Cost of performance may be Bitcoin's downfall. In late 2013 Forbes reported that global Bitcoin computing power was 256 times faster than the top 500 supercomputers,

[0&articleID=000B0C22-0805-12D8-BDFD83414B7F0000](#). Mr Kryder was the senior Vice President of Research and the Chief Technology Officer at Seagate Corp.

²⁰ 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.

²¹ Tim Swanson, *Consensus-as-a-Service: a brief report on the emergence of permissioned, distributed ledger systems* R3 CEV (working paper, April 6, 2015) at 8:

For instance, if all parties to a transaction are known, do you really need to have the level of "proof-of-work" (PoW) or any type of proof-of-work, as used by Bitcoin, for this operation? Probably not. ... Proof-of-Work is all about defending against Sybil attack, which by definition is not an attack vector you have if validators are known.

²³ Tomaso Aste, *The Fair Cost of Bitcoin Proof-of-Work* (SSRN) June 27, 2016 available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2801048

Bitcoin's proof-of-work is very costly. Currently miners across the world are generating several billions of billions (10^{18}) of hashes every second. ... the computation of a billion hashes consumes, with state-of-the-art technology, between 0.1 to 1.0 Joule of energy. This implies that currently about a billion Watts are consumed globally every second (1GW/sec) to produce a valid proof-of-work for Bitcoin. Electricity prices change across the world ... we estimate that this amount of energy accounts for around \$50,000 per hour. Considering that the system is currently processing less than 10,000 transactions per hour, this results in a cost in excess of \$5.00 current change. According to the previous estimate the miner community consumes every 10 minutes an average of about $\$50,000/6 = \$8,333$ in electricity to produce a block and gets about \$15,000 in remuneration that makes the operation quite profitable even considering the hardware and infrastructure cost. Interestingly, the remuneration will be shortly halved to 12.5 Bitcoins leaving a very small margin for profit according to the above estimations. The overall mining electricity bill for a year of Bitcoin mining sum up to over \$400 million, which is a large amount and, somehow, a big waste.

combined.²⁴ Even if Bitcoin collapses of its own weight, the blockchain insight will remain. Aste concludes his study of the electrical cost of Bitcoin by pointing to the cost-efficiency of *private* distributive ledgers when he concludes:

Blockchains can be constructed through several other mechanisms that do not require computational intensity of proof-of-work. ... any mechanism that can verify identity ... [and] in any other way avoid uncontrolled duplications ... can reduce or eliminate completely the cost and even the need of a proof-of-work. However, these other mechanisms must relax ... anonymity, openness, or equalitarian distribution verification.

VATCoin is government-initiated private distributive ledger. For purpose of this study we assume a proof of identity (PoI) consensus mechanism will be applied when the GCC adopts VATCoin.²⁵ As a result, VATCoin will deliver a highly efficient system.

GCC VATCoin

VATCoins are like Bitcoins. They are a digital, not a physical currency. They are only recognized for payment of VAT.²⁶ Transactions in VATCoin will be chronologically registered on a GCC distributed ledger. The validity of each transaction will be verified by government (tax administration) nodes from each jurisdiction in the GCC. The number of nodes contributed by a jurisdiction will be proportional to the GDP of that jurisdiction relative to the aggregate GDP of the GCC. Each enterprise involved in a VATCoin transaction will have access to the transaction records of all the VATCoins it has held.

²⁴ Reuven Cohen, *Global Bitcoin Computing Power 256 Times Faster than Top 500 Supercomputers, Combined!* FORBES (November 28, 2013) available at:

<http://www.forbes.com/sites/reuvencohen/2013/11/28/global-bitcoin-computing-power-now-256-times-faster-than-top-500-supercomputers-combined/#26c0d01928b7>

²⁵ R3 CEV, a New York firm, specializes in assisting clients in the financial industry with implementing blockchains. See: Tim Swanson, *Consensus-as-a-Service: a brief report on the emergence of permissioned, distributed ledger systems* R3 CEV (working paper, April 6, 2015). R3 CEV is working with the Bank of Canada in “one of the first known tests by a major central bank about how it could use the nascent system known as blockchain.” Paul Vieira & Paul Vigna, *Bank of Canada Looks at Bitcoin’s Technology*, WSJ (Jun2 17, 2016 at C-4). The European Central Bank, and UK Government’s Chief Scientific Advisor made similar findings. European Central Bank, *Distributed Ledger Technologies in Securities Post-trading: Revolution or Evolution?* OCCASIONAL PAPER SERIES, No. 172 (April 2016) available at: <https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf> and UK Government Office for Science, *Distributed Ledger Technology: Beyond block chain* (2016) available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf.

²⁶ 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.

The blockchain constructed for the GCC will extend throughout all six Member States. Valid transactions will be aggregated in blocks, which will 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 in the GCC network.

The following materials assume that the GCC's VATCoins will be "minted" centrally at the GCC computer center in Riyadh, Saudi Arabia for use throughout the GCC. This is a one-way street for the most part. Businesses will purchase VATCoins for use in their commercial transactions. The VATCoins will remain in their "account" in the GCC Cloud, and transfer among businesses as commerce goes forward. VATCoins can be converted into local currencies only at government request.

There are two distinct legal provisions in this proposal, which need 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*²⁷ embedded in invoice documentation.

²⁷ 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).

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

- 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 be the norm. The waiting period (after which a person will be absolutely certain a transaction has gone through, will be measured by the time it takes to add 6 additional blocks to the blockchain after the last VATCoin referenced on a return has been added to the blockchain. A risk analysis based audit inquiry may delay immediate refunds in some instances.

A common example will help in developing the GCC VATCoin proposal, and is set out below.

Common Example

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, a DICE provision for digitally collecting transaction data, and employs a one-stop-shop when dealing with intra-Gulf supplies.

“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 purchase (SAR) 1,000,000 in cement from supplier “B” in Bahrain,²⁸ and (SAR) 40,000,000 in heavy construction equipment from supplier “A” in Japan.

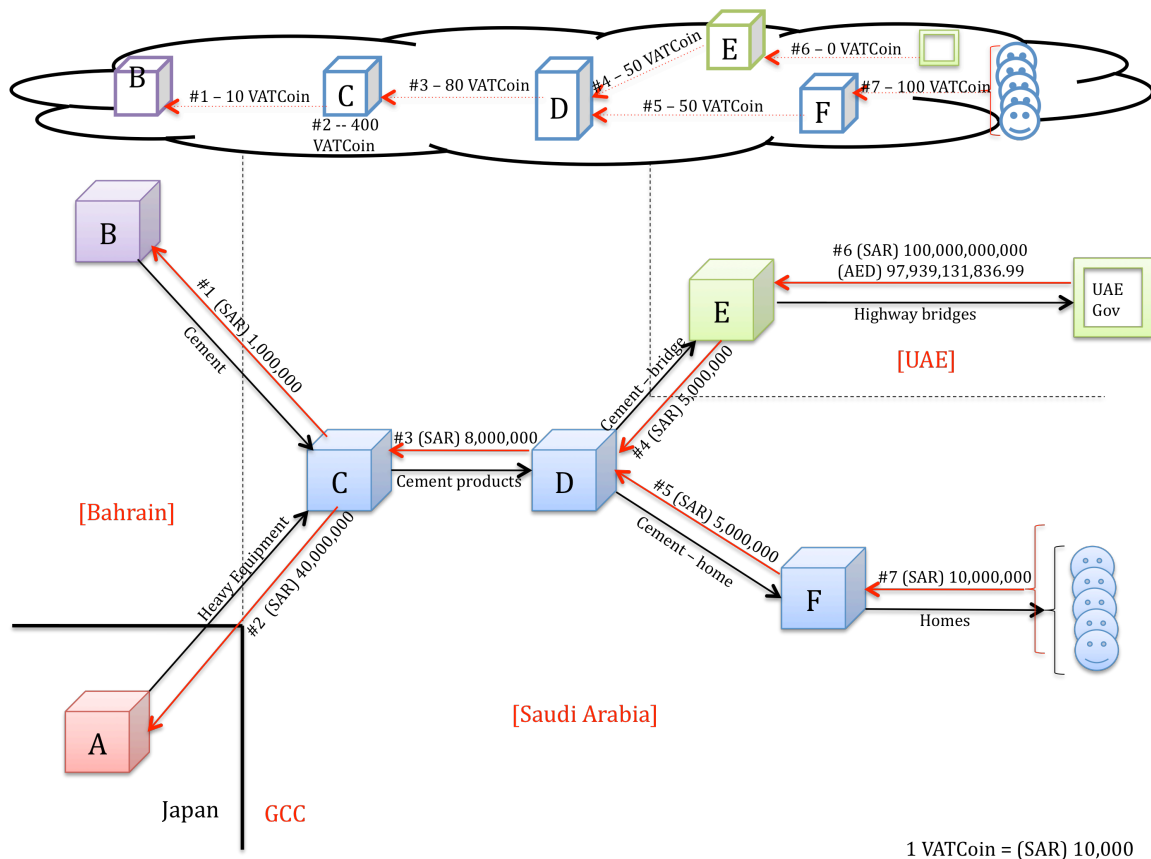
All of “C’s” output is sold for (SAR) 8,000,000 to “D,” a Saudi distributor of building supplies. “D” re-sells half of its inventory for (SAR) 5,000,000 to contractor “E” in the UAE that is building highway overpasses for the UAE government. “D” re-sells the other half of its inventory for (SAR) 5,000,000 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.

²⁸ 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.

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

Figure 1: The Common Example



The diagram makes a number points more clearly than might be apparent in the text materials. At least 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
- Code is Law – regulation of the VAT is in the computer code
- The VAT 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.

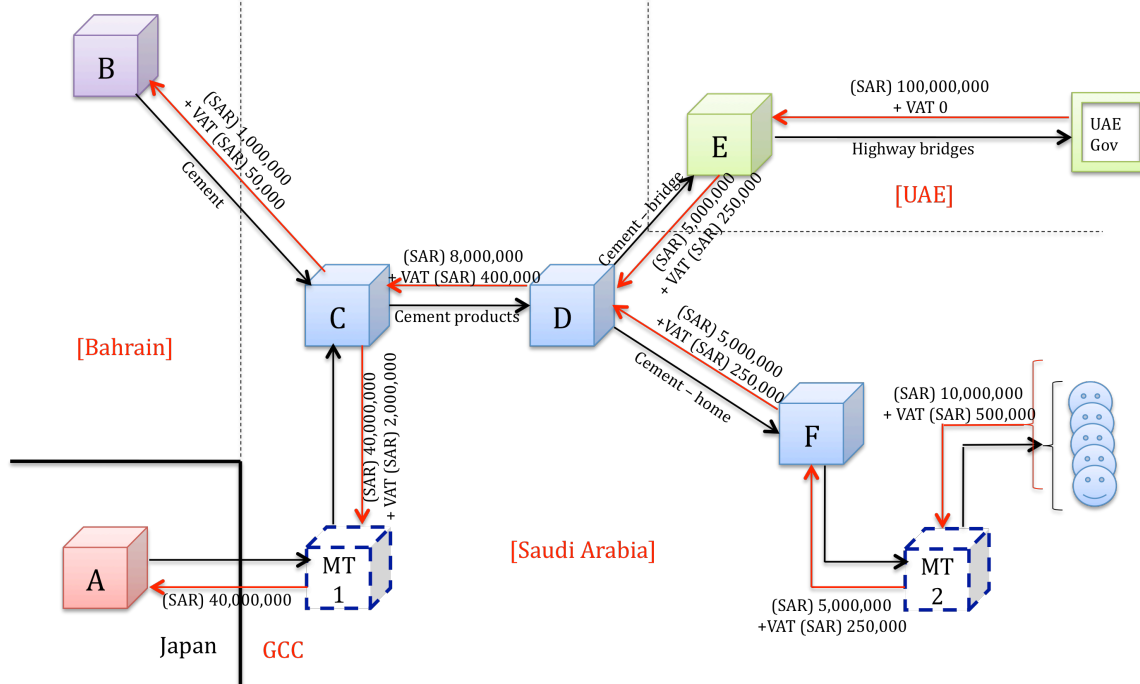
In the common example, and assuming the GCC VAT follows the contours of the EU VAT, the classic places for a fraudster to put a missing trader are (a) between “F” and the homebuyers, or (b) between “A” and “C.” In (b) a missing trader is possible only if the facts are changed slightly so that “A” is selling *tradable services* not tangible property. Customs would stop the import of tangible property and assess the VAT and prevent MTIC in construction equipment. However, if access to VoIP (a tradable service) is being sold into the GCC, then a missing trader fraud could occur.

Figure 2 modifies Figure 1 to illustrate where missing traders would be located in a traditional VAT. VAT is paid among the parties directly, not virtually in the GCC Cloud.

A missing trader (MT1) is placed between “A” and “C.” “MT1” purchases VoIP access from a Japanese firm, “A,” without paying VAT. “MT1” then collect VAT of (SAR) 2,000,000 from “C” as it re-sells VoIP access. Similarly “MT-2” is placed between “F” and the home-buyers. In this case “F” builds homes for consumers, but sell to “MT2” at a low price. “MT2” re-sell to consumers at the market price, collecting VAT and not reporting the sales or remitting the VAT.

In each case, the fraud is enabled by the VAT rule that allows “MT1” and “MT2” to hold VAT for the government. In a VATCoin scenario all the VAT is virtual, and held on account in the GCC Cloud.

Figure 2: Missing Traders (added to traditional VAT pattern)



(2) *Real-time VAT – Daily tax remissions and refunds.* When VAT is working properly businesses do not bear the burden of the tax. VAT paid on inputs is deducted from VAT collected on outputs. If there is a profit margin, the difference between input and output VAT is a positive number, and this amount is the tax due based on the commercial value added.

The most common reasons for not having a positive difference between input and output VAT are: (a) in export transactions the full, accumulated VAT is refunded to the exporter (in a destination VAT), and (b) when the commercial market produces sustained losses for a business. Losses like this can arise because of a general market collapse where profit outlook is dim for the foreseeable future. They also arise when the timing of inputs and outputs are out of harmony (for example, when inputs run ahead of sales because of a short term market slowdown or because of the cyclical nature of the sector). In both of these cases negative VAT-flows can become financial burden. The measure of the burden is the time value of money for the period that the flows remain negative. When this occurs businesses are financing the VAT.

VATCoin mitigates this flaw in the traditional VAT. 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). With VATCoin's blockchain, *smart contracts* can easily be constructed so that refunds are paid immediately (subject to verification in the blockchain). The record of daily VATCoin balances will be rolled forward into a monthly return, but the daily burden of businesses financing the VAT through an economic downturn will be quickly relieved.

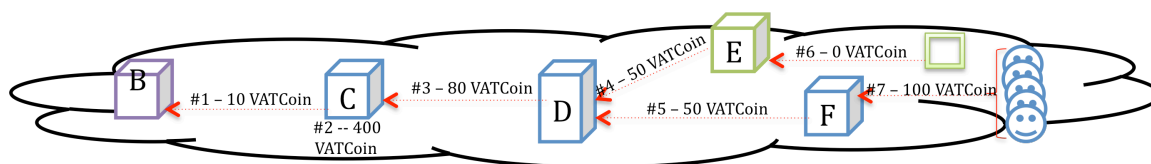
For example, assume in figure 3 that all of the transactions in the common example happen on the same day. A daily account for each entity is presented. All VATCoin transfers happen in the GCC Cloud.

The only area of concern is the refund that is determined for "C." If risk analysis finds nothing problematical, and if all the VATCoins involved are verified (added to the blockchain), then a *smart contract* would immediately process the refund. The daily VATCoin assessments are:

- "B." The 10 VATCoin collected by "B" are remitted from the Bahrain account in the cloud to the Saudi account, because a one-stop-shop is presumed to operate in the GCC. "B's" return will be filed with the Bahrain Tax Administration, but the VATCoin will be on deposit with the Saudi Treasury.
- "C." "C" has a real interest in securing a refund of 330 VATCoin as soon as possible. A *smart contract* will do this at the end of the day, subject to two conditions:
 - That input and output VAT was paid in full (confirmed through the blockchain), and

- That the transaction occurred as represented in the invoices (confirmed through risk analysis of the granular details of the transaction captured through DICE).
- “D.” The net 20 VATCoins collected by “D” is remitted to the Saudi Treasury.
- “E.” The transaction “E” engages in with the UAE government is exempt.²⁹ Because of a one-stop-shop mechanism in the GCC, “D” will file a return in Saudi Arabia specifying that this transaction represented consumption in the UAE. As a result the Saudi account in the GCC Cloud will record a transfer of 50 VATCoins from the Saudi Treasury account to the UAE Treasury account. This should be processed through an inter-government *smart contract* tied to the blockchain.
- “F.” The net 50 VATCoins collected by “F” is remitted to the Saudi Treasury.

Figure 3: VAT Accounts



B	C	D	E	F
10	80	100	n/a	100
<0>	<410>	<80>	<50>	<50>
<u>10</u>	<u><330></u>	<u>20</u>	<u>n/a</u>	<u>50</u>
Bahrain	Saudi	Saudi	UAE	Saudi

(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 *cryptotaxcurrency*. Lessig argues that technology (the Code) will regulate – in other words, the computer code will compel compliance.

These lessons I summarized in a slogan. “Code is law.” I meant this originally in a metaphoric sense, but we are beginning to see the same idea in quite a literal sense as well. Metaphorically, in that the code controls behavior as law might control behavior. You can’t easily rip the content of my DVD because the code locks it tight. The code functions as a law might function: Telling the user what she can and cannot do.³⁰

²⁹ This example assumes that this is an exempt transaction without right of deduction. In other words, this is not a zero-rated transaction. “E” is functionally a final consumer of the cement bridge structure it has purchased from “D.”

³⁰ Lawrence Lessig, *Cyberspace and Privacy: A New Legal Paradigm?* 52 STANFORD LAW REVIEW 987 (May, 2009) (referencing the conclusions he reached in his book, *CODE AND OTHER LAWS OF CYBERSPACE* (1999)).

VATCoin does the same. VATCoin not only demands verification of the legitimacy of the *cybertaxcurrency* for an exchange in VATCoin to be processed, it incentivizes self-verification by the users. All parties are strongly motivated to prove the authenticity of the VATCoins involved in an exchange. Stolen or counterfeit VATCoins will be immediately identified by the blockchain. Attempting to engaging in a “double spend” fraud (knowingly or un-knowingly) in the past would directly impact the risk analysis, and would likely delay *smart contracts* tied to the daily account balancing, flag a transaction for audit, and hold up any related refunds in the commercial chain. Businesses in a VATCoin regime have exceptional efficiency incentives (tied directly to corporate VAT-flows) to make sure they operate in “clean chains.”

A VATCoin regime can encourage the *Code is Law* phenomena by sending out regular notices to taxpayers (positive and negative) if their VATCoins fail or pass verification and are added to, or rejected from the blockchain. Real-time oversight will bring real-time compliance, because complying with the *Code* will be compliance with the *Law*.

(4) *Immunity to cyber-attack*. VATCoin is cryptocurrency. It has no material representation. It exists only as computer code stored in a secure computer system in Riyadh, Saudi Arabia. In this respect, VATCoins are no different from CO2 permits (carbon emission allowances) that are actively traded in the EU.

There have been notorious hacks of secure sites in the EU that store CO2 permits. After a bomb threat on the morning of January 18, 2011 thieves stole in excess of 500,000 emission allowances valued in excess of €7 million from the Czech Republic’s secure emissions registry.³¹ The computer code (i.e., the CO2 permits) were quickly sold and re-sold through a chain of companies in four countries between 9:32 am and 10:59 am that morning ending up in the UK in Shell Trading International, Ltd. The final resolution of this theft is not public. Four individuals were sentenced to between 32 and seven years in jail, but whether or not the €7 million was recovered is not clear.

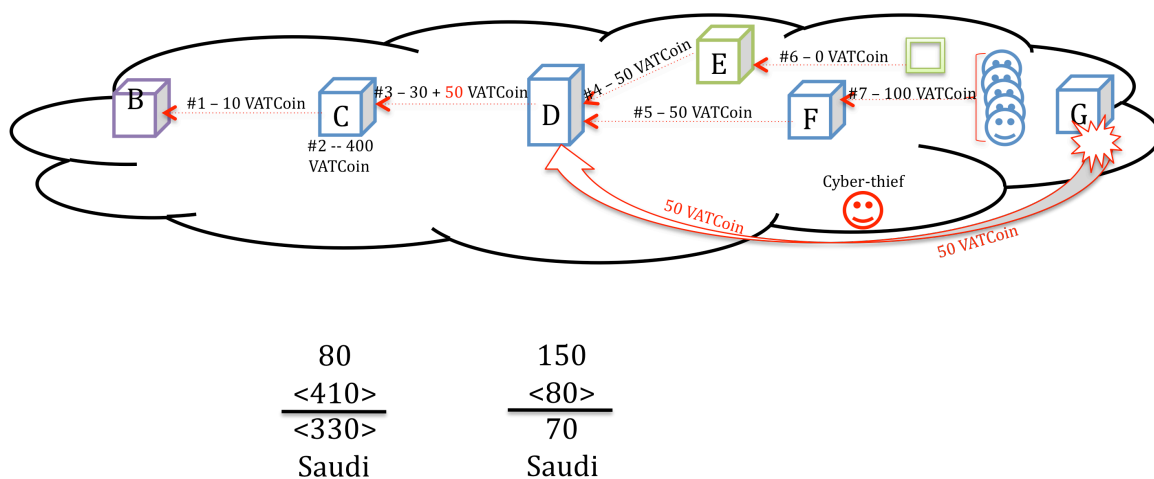
VATCoins are not vulnerable to cyber-attack. If VATCoins are stolen they immediately become worthless. A black market for VATCoins is not possible. Two factors re-enforce this observation: (a) VATCoins are non-redeemable currency, convertible into cash only by the government. Any purchase or sale of VATCoins would be illegal; and (b) if a successful cyber-thief transferred a stolen VATCoin to an enterprise, and if that person attempted to use it in satisfaction of a VAT obligation, then the blockchain would reject it. The lineage of the stolen VATCoins would be immediately obvious, the underlying transaction would stall, the stolen VATCoins would be cancelled, and an audit would be triggered. Any refund set to occur through a *smart contract* would be automatically cancelled.

Figure 4 (below) assumes that a cyber-thief is able to break into the VATCoin accounts of another Saudi enterprise “G” and takes 50 VATCoins worth (SAR) 500,000

³¹ Richard T. Ainsworth, *Phishing and VAT Fraud in CO2 Permits: The Digital Invoice Customs Exchange Solution*, 77 TAX NOTES INTERNATIONAL 357 (January 26, 2015).

(\$133,307).³² Because all VATCoins are held in the GCC Cloud, the cyber-thief would need to take virtual possession of 50 of “G’s” VATCoins, and then arrange to virtually transfer them to “D” through a fraudulent sales transaction. For example, the cyber-thief might agree to purchase a low value item, maybe worth (SAR) 1,000, for (SAR) 1,000,000. The VAT on this transaction would be (SAR) 50,000, which is equal to 50 VATCoins. This transaction would need to be timed to occur on the same day that the “D” to “C” transaction is scheduled, so that the 50 stolen VATCoins can be immediately presented to “C” as part of the 80 VATCoins due on the “C” to “D” transaction.

Figure 4: Cyber-theft of 50 VATCoins



There are a number of places that this transaction should be caught by the artificial intelligence (AI) that the GCC and each of the Member States will be using to oversee the VAT. If it even got this far, it is highly unlikely that the cyber-thief’s fraud would escape detection as he moved forward. Even without blockchain cyber-theft of virtual assets is detectable reasonably soon. For example, with respect to the Czech CO2 permits, we know that individuals unaware of bomb scare, and unaware of the virtual break-in discovered the cyber-theft of the Czech permits in less than 24 hours. Here are the most obvious points where an attempted theft of VATCoin would be uncovered:

- First, because the 50 stolen VATCoins would be officially registered in “G’s” name, not the fraudster’s name, the transaction from the cyber-thief to “D” would involve un-registered VATCoins. That is, the system *knows* that the cyber-thief does not own the VATCoins, and it *knows* that he cannot transfer them. The cyber-thief could dodge detection at this point by constructing a false trade between “G” and the cyber-thief. (This would be noticeable in the daily accounts

³² In the Czech Republic cyber-attack the thieves took 500,000 EUA’s from the account of CEZ, a state-owned public utility. “EUA” is the official title of the carbon credits, or the pollution permits that are traded on the European Union’s Emissions Trading System (EU ETS).

of “G,” and should be detected by a security algorithm. The fraud should be uncovered).³³

- Second, if the passage of the 50 VATCoins from “G” to the cyber-thief manages to escape notice then “D’s” daily account balance would be 70 VATCoins (not 20 VATCoins) and the full amount (including the stolen 50 VATCoins) would be remitted to the Saudi Treasury. This is not the outcome that “D” or the cyber – thief would want, so it will become necessary for “D” to construct another offsetting (fraudulent) transaction to remove the 50 VATCoins from the daily balance. This fraudulent transaction should also be detectable (a purchase by “D” that would require payment of 50 VATCoins).
- Third, if for some reason all of the above fraudulent transactions escape notice, then “C” would be presented with 30 legitimate VATCoins from “D’s” accounts and 50 VATCoins that had a questionable lineage. “C” has a strong interest in not accepting stolen VATCoins. “C” wants to receive an immediate refund of 330 VATCoins through the *smart contract* set up to process automatic refunds. Through the blockchain “C” will have access to the lineage of each of the VATCoins presented to it by “D” and should be able to easily trace them. Stolen VATCoins *self-identify* as stolen in a blockchain. Accepting stolen VATCoins would prevent the *smart contract* from engaging. “C” has a vested interest in checking the validity of every VATCoin it takes into possession.

DICE BLOCKCHAIN

DICE (Digital Invoice Customs Exchange) was developed and proposed initially for the EU.³⁴ It was subsequently applied to the GCC.³⁵ DICE is a technology-intensive tax compliance regimen for VAT that utilizes invoice encryption to safeguard transactional data exchanged between sellers and buyers in both domestic and import/export contexts. It simultaneously notifies concerned jurisdictions of the essential transaction details in real-time.³⁶

There are a series of steps undertaken among contracting parties and the tax administration in the *digital invoice* part of DICE, which are followed by several more steps to complete the *customs exchange*. Those steps are set out in *Stopping VAT Fraud with DICE – Digital Invoice Customs Exchange*. An operational *digital invoice* system

³³ In the case of the stolen Czech CO2 permits the theft occurred during the morning of Tuesday, January 18, 2011. Employees of CEZ GROUP, the government energy company, discovered it at 7:00 am the next morning. It should be far easier for an AI system that is programmed to look for this kind of theft to find it. See: Joshua Chaffin, *Carbon Trading: Into this air*, FINANCIAL TIMES (February 14, 2011).

³⁴ Richard T. Ainsworth, *Stopping EU VAT Fraud with a Third Invoicing Directive*, 72 TAX NOTES INTERNATIONAL 545 (August 5, 2013).

³⁵ Richard T. Ainsworth & Musaad Alwohaibi, *GCC VAT: The Intra-Gulf Trade Problem*, TAX NOTES INTERNATIONAL (forthcoming).

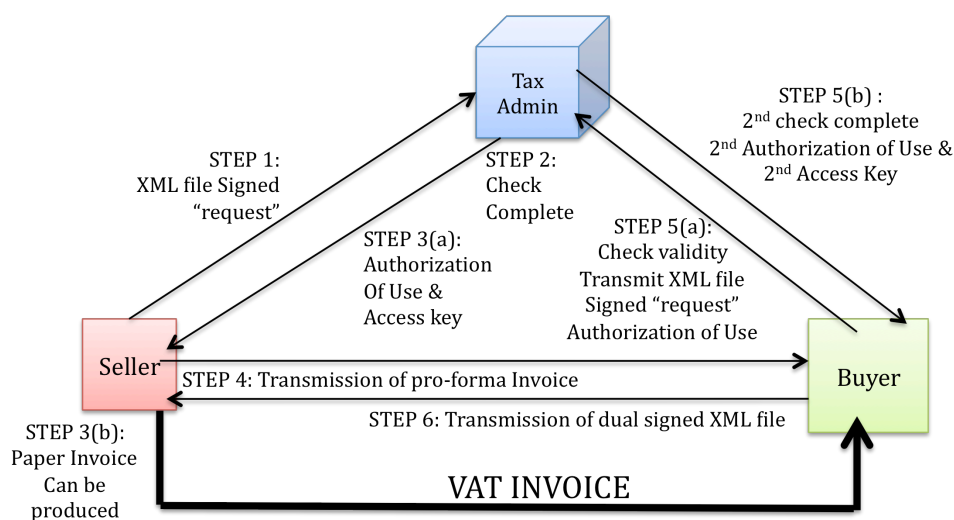
³⁶ Richard T. Ainsworth & Goran Todorov, *Stopping VAT Fraud with DICE – Digital Invoice Customs Exchange* 72 TAX NOTES INTERNATIONAL 637 (November 18, 2013).

can be seen in Brazil, and Chile. A *customs exchange* is being established in Rwanda, and is under consideration in Nigeria and Mozambique.

DICE mandates digital invoices. Digital invoice are encrypted, digitally signed and exchanged among buyer, seller and the tax administration. There are checks for completeness and an exchange of access keys that will allow all parties to review documentation in the cloud. Artificial intelligence oversees the orderly processing of data exchanges, and performs risk analysis on the transactions in a continual search for irregularities. Contract details are preserved. Figure 5 (below) outlines the steps taken to produce a qualifying *digital invoice* under DICE.

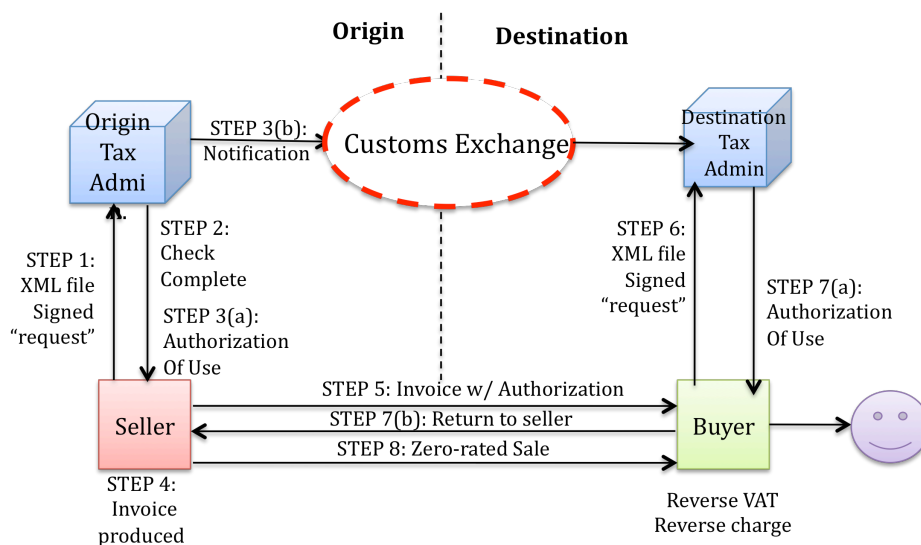
Figure 5: Digital Invoice

Reprinted from: Richard T. Ainsworth & Goran Todorov, *Stopping VAT Fraud with DICE*
– *Digital Invoice Customs Exchange* 72 TAX NOTES INTERNATIONAL 637, 630, at Figure 1 (November 18, 2013).



The *customs exchange* element of DICE involves the transmission of the contract data captured by the tax administration to the cloud (or in some cases to a central server run by a community). The intent of the customs exchange is to allow *on demand, real-time*, data sharing (through the exchange of access keys) with another tax authority when the transaction involved crosses borders. Figure 6 below outlines the steps taken to produce a qualifying *customs exchange* under DICE.

Figure 6: Customs Exchange
Reprinted from: Richard T. Ainsworth & Goran Todorov, *Stopping VAT Fraud with DICE*
– *Digital Invoice Customs Exchange* 72 TAX NOTES INTERNATIONAL 637, 643, at Figure 4 (November 18, 2013)



DICE can be placed on a blockchain. When this is done the blockchain takes the goods or services being transferred in a VAT system, and links the buyers and sellers through their supplies. *Within* a multi-national enterprise (MNE) this linking of entities along an extended supply chain has always occurred. The vehicle for doing this has been the MNE's central ledger.

Blockchain *disrupts* (replaces) centralized ledgers. It does so *trustlessly*, and with exceedingly high levels of *efficiency*. DICE simply puts a multi-enterprise central ledger on a blockchain.

Essentially a DICE blockchain is the tax authority constructing a commercial supply chain as if all enterprises in the economy were part of a large MNE. This assists with domestic audits, but is very helpful is when goods or services cross borders. This is, in fact, what the EU's VAT Information Exchange System (VIES) endeavors to accomplish, but at a more rudimentary level. Today we have the computing power to do what VIES attempted to accomplish in 1993.

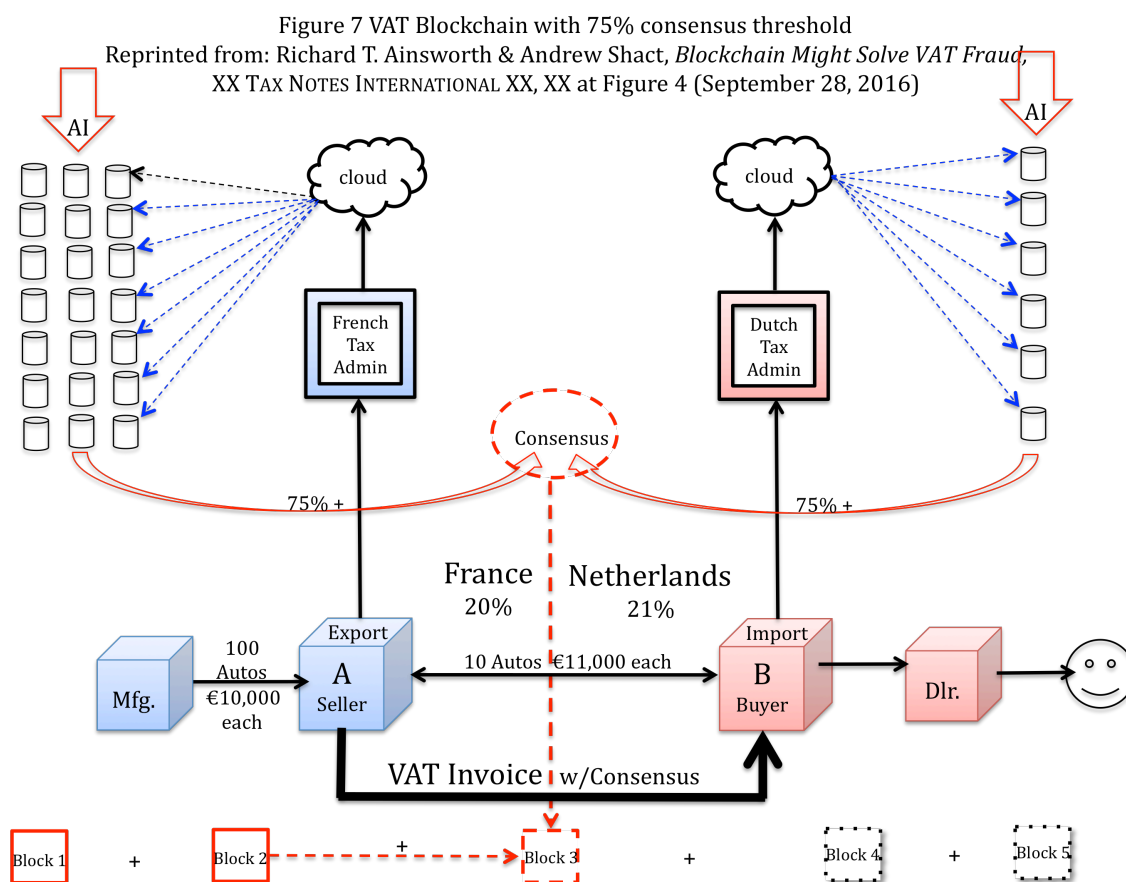
Figure 7 below presents a portion of a DICE blockchain. The example involves cars manufactured in France are sold (a) to a French distributor/ exporter, (b) then to a Dutch Importer, (c) then to Dutch Dealer, and (d) then on to a Dutch final consumer. The transaction data is placed on a digital invoice, encrypted, and sent to the tax authorities that authorize the issuance of a valid VAT invoice (an invoice that will contain both party's digital signatures and appropriate access keys).

The example does not assume a EU Cloud. Instead it uses separate French and Dutch clouds for data storage. Because there has been an exchange of access keys both

the French and Dutch Tax Authorities will have real-time access to the data stored in the opposing cloud, on an “as needed” basis.

Consensus is by Proof-of-Identity (PoI). Government employees man nodes that validate transactions. Their identities are known; they are responsible and accountable to the government. An AI engine comparable to that placed in service by SmartCloud Inc. in Ceará, Brazil assists the nodes in searching for irregularities. The French have more nodes (computer facilities validating transactions) than do the Dutch because the obligation to establish nodes is directly proportional to the Member State’s GDP.

The consensus standard requires that 75% of both French and Dutch nodes validate the transaction for it to be added to the blockchain.



VATCoin & DICE INEROPERABLE BLOCKCHAINS

If the GCC implements VATCoin in conjunction with a DICE blockchain in the Framework Agreement, the Gulf States will have one of the most fiscally efficient,

technologically advanced, and fraud-proof VAT systems ever established. There will be two interoperable blockchains reinforcing the results of each other operating throughout the GCC.

DICE will provide a real-time, granular, transaction-level record of commercial activity, and VATCoin will insure that no taxpayer holds VAT in real currency. The benefits from this technology are many:

- It will be impossible for any trader to “go missing” with the VAT in hand. VATCoin is virtual and remains in the GCC Cloud.
- The cash-flow burden that the VAT imposes on businesses will be negligible for those that operate cleanly. Delays will only come into the system when government risk analysis believes it sees an issue that requires immediate attention, thereby delaying the passage of VATCoins or making a conversion of VATCoin into cash unwise.
- The VATCoin/DICE regime is comparable in every way to a “real-time VAT” (RTvat),³⁷ or a split payment VAT.³⁸ The transfer of tax payments to the government and among the businesses is immediate, smoothly facilitated, secure, transparent and highly auditable. Transfers are *without* the transaction costs of the RTvat or the Split payment VAT, both of which are constructed on cash (bank transfer) payments (for a fee).
- Recordkeeping burden for both VAT exchanges and invoice reconciliation are transferred to the government (GCC Cloud). Accounts are balanced daily. Buyer, seller and government authorities can pull down from the GCC Cloud the details of any transaction securely and un-altered. The blockchain will hold multiple (encrypted) copies of each transaction in every node in the chain. The system cannot be compromised. A compromised node would simply be refreshed, the stolen VATCoins extinguished, and new VATCoins issued for use.
- VAT returns will be completed by the government through an *administrative assessment system* (where the government prepares the return for taxpayer review) rather than through the relatively more burdensome *self-assessment system* (where the taxpayer prepares the return for tax authority review).

³⁷ The RTvat was conceived in March 2006. Personal email communication, Chris Williams (Chairman, RTvat Executive Committee, (Feb. 22, 2011) (on file with author). Chris Williams, *RTvat: Outline of proposed real-time VAT collection system to increase efficiency of collection, maximize revenue, minimize fraud and reduce administrative burden on business* 4 (December 5, 2009) (unpublished manuscript, on file with author); RTvat Information brochure *RTvat: An Introduction to a Real-time Solution for Improving the EU VAT System* 9 (March 2009) (powerpoint slides, on file with author)

³⁸ See for example the PVAT (pre-paid VAT) proposal. Satya Poddar & Eric Hutton, *Zero-rating of Interstate Sales Under a Sub-national VAT: A New Approach*, in NATIONAL TAX ASSOCIATION PROCEEDINGS: NINETY-FOURTH ANNUAL CONFERENCE (2001) 200-07. Two other split-payment proposals were advanced at the Ifo Institute in 2003, (1) the nonchash payment (trust account) models and (2) the cash payment (tax stamp system) model. Ifo Institute, *Value Added Tax Evasion and Model Approaches for its Avoidance* (Sept. 29, 2003) available at http://www.cesifo-group.de/portal/page?_pageid=36,385339&_dad=portal&_schema=PORTAL&item_link=steuer-gemeinschaftskonferenz-2003-bericht.htm (English and German). For short summary of these approaches and some others, see: Richard T. Ainsworth, *Tackling VAT Fraud: 13 Ways Forward*, 45 TAX NOTES INTERNATIONAL 1205 (March 26, 2007).

- Both of these blockchain systems (VATCoin & DICE) do not burden business or the consumer. Compliance is greatly facilitated by technology. Businessman or consumer can easily download a free compliance app on any mobile device.³⁹ The app will establish a VATCoin account for the user, record, encrypt, and transmit the invoice to the GCC Cloud.

The key to both DICE and VATCoin are the installation of high quality artificial intelligence (AI) to perform critical risk analysis at the various Proof-of-Identity (PoI) nodes used in the DICE and VATCoin blockchains. Fortunately this is not just a theoretical point of interest. SmartCloud Inc. has installed an operational VAT risk analysis system in Ceará, Brazil for their VAT administration to do precisely what DICE and VATCoin require.

Michael W. Barnet, the head of Knowledge Engineering at SmartCloud Inc. indicates that the Ceará program, called CRex, scales linearly (for more capacity you simply add more CPUs).⁴⁰ Data for CRex with 1 CPU (2.53 GHz, 8 GB RAM, 8 Cores) is that it has the capacity to import invoice data, store it, and perform risk analysis tests at a rate of 131,000 invoices (with 784,000 invoice items per invoice) in 220-270 seconds. This is a processing rate of 3,735 records/sec (or 1,172,790 bytes/sec). Ceará has allocated 16, 8-core machines to the CRex project.

Perhaps the most telling aspect of the Ceará installation is that it is operating way under capacity, much like a race horse walking. Ceará wants the results of its risk analysis *daily*, but the SmartCloud Inc.'s CRex can produce results in seconds. CRex is derivative of the US Bulk Power Situational Awareness system SmartCloud Inc. designed and installed for the North American Electric Reliability Corporation (NERC), Federal Energy Regulatory Commission (FERC) and various US Regional Entities.⁴¹ That system returns results in *6 seconds*. The Ceará program has the potential to deliver truly real-time risk analysis. If the government wants it faster, SmartCloud, Inc. can deliver it.

Assuming that the GCC determined that each Member State would be engaged in a 75% PoI validation process, and also assuming that each State would contribute nodes to the VATCoin and DICE blockchains in proportion to their relative GDP's, then the allocation of nodes in the GCC Cloud would roughly be in the following proportions:

Saudi Arabia	19
United Arab Emirates	10
Qatar	5
Kuwait	3
Oman	3

³⁹ The use of a free app (available on the iTunes store) was demonstrated by Goran Todorov of Data Tech International to the Ontario Ministry of Finance on July 19, 2016, personal e-mail communication (July 22, 2016) Goran.todorov@dti.rs. (available with author).

⁴⁰ Personal e-mail communication (September 14, 2016) mbarnett@smartcloudinc.com (available with author).

⁴¹ See discussion at <http://www.smartcloudinc.com/situational-awareness-chc1>

Thus, as transactions occur throughout the GCC, invoice data will be digitized, signed and encrypted (on both the buyer and seller's side) and sent by the reporting tax administration into the GCC Cloud. Nodes within the GCC Cloud operated by identified individuals will assess the validity of the transactions with the assistance of AI that responds to real-language inquiries.

For example, many systems could be programmed to automatically "kick out" transactions where the transaction just did not seem right. For example,

1. Where the size of the proposed transaction was 150% the size of any previous transaction; or
2. Where one side involved is a bankrupt party; or
3. Where the seller had only reported purchases into inventory of 50% of the amount it was engaged to sell-on; or
4. Where the purchaser was a newly registered company and the size of the purchase exceeded a measure deemed "normal" for a new firm this line of business.

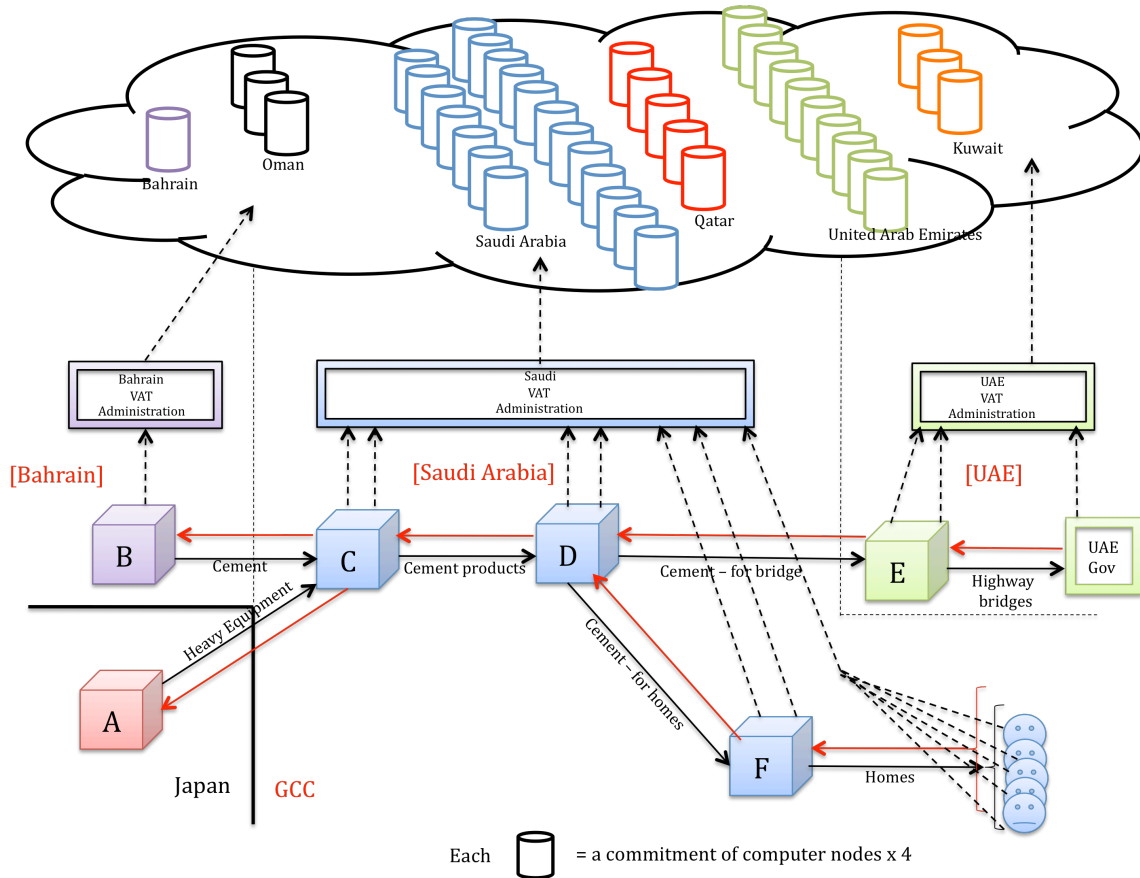
Sophisticated risk analysis probes more deeply. To perform well, the agents in the nodes will make further inquiries of the system, asking the AI program to pull up data from other data-bases or the larger AI network itself about a suspect transaction. For example, if a transaction was pulled aside because it appeared that the seller was committing to sell more *widgets* than it reasonably had in inventory (3 above) then AI could be asked to:

- compare this firm to its competitors; or
- determine if this company had functioned as a middleman; or
- search for potential hidden suppliers (selling off the grid), or
- search for other enterprises in the same or similar economic sector having the same inconsistency between purchases and sales, or
- provide historical data on this company and its executive management to determine if these individuals had been involved in high risk ventures previously.

The idea is that AI is not a static program. The AI behind Seará Tax Authority is dynamic. It *learns* as continuously performs more granular risk analysis. Each node, using a separate instance of AI may over time develop unique insights or fraud detection approaches. As a whole the system will develop far greater fraud detection expertise than the individual (human) expert.

Based on the common example, the deployment of nodes by the GCC will look like Figure 8 (below). This commercial chain of the common example crossed into three jurisdictions. The data for both the buy and sell parties throughout the chain are sent to the GCC Cloud where nodes from each of the Member States will assess the validity of a proposed transaction. Once consensus is reached the transaction is added to the DICE blockchain, and the VATCoins will pass along the VATCoin blockchain. VATCoin and DICE are interoperable blockchains.

Figure 8: Allocation of nodes in the common example verifying DICE and VATCoin blockchains



CONCLUSION

VATCoin works to prevent serious VAT frauds. It works like Bitcoin, but it is a specialized *cryptotaxcurrency*. It works in tandem with the DICE blockchain to make the VAT, secure, transparent, and highly efficient.

It is a strange twist to realize that the fraudsters who have been abusing the EU VAT for years have used almost the same technology as is employed in VATCoin to divide the profits of a fraud among the participants. Fraudsters used a device called a *payment platform*. The major difference between VATCoin and a payment platform is that payment platforms operate in real currency.

A payment platform is commonly a bank account at an established banking institution where a number of fraudsters hold (un-official) sub-accounts. Funds are transferred among the sub-accounts without ever being visible to the banking institution,

or outside regulators.⁴² Payment platforms did not use cryptocurrency. They pre-date Bitcoin.

The commonality between VATCoin and payment platforms is that the account holders can watch the trades through their copy of the complete ledger. It is a distributed ledger. Everyone can see account balances rise and fall as transactions occur and agreed algorithms make allocations. But, they cannot easily pull their money out, like a normal bank account. The key to a payment platform is that the aggregate account balance must stay very stable to avoid scrutiny.

Samir Aziz, who was extradited from the US to Germany because of his participation in a number of MTIC frauds, was a small player in his 20's who was given a 2 to 3% cut of fraud proceeds. Even though he was not a king-pin, he could see everything on his copy of the ledger.

Every company participating in the fraud received a so-called Payment Batch Report [distributed ledger] for each payment from the corresponding platform or from the bank where the platform was held. There it was apparent what happened with the money. These Batch Reports were hidden and should still to be found on the computer of the company *iTrading/iCell*. For example it could be seen, when the company *iTrading* [a company set up and controlled by Azizi] paid €4,136,958.00 to the company Global Reach [a Payment Platform], that from this amount four times 500,000 USD, and once 600,000 USD and an amount of 1,536,958.00 GBP were transferred from the platform. You could also see where the money was going. Therefore the fraud must be quickly understood, as e.g., these 1,536,958.00 GBP were paid to the company SVS Securities PLC, although this company was not a supplier of the companies *iTrading* or *iCell*. All the other amounts then went to the companies of the men pulling the strings. All amounts transferred in USD were sharing out of the loot and the amounts in GBP or EUR were amounts that flowed back into the fraud chain.⁴³

It would be ironic if the VATCoin solution to MTIC fraud adopts the same kind of distributed ledger technology, this time connected to a *cryptotaxcurrency*, to stop the frauds that were greatly facilitated by fraudsters who employed distributed ledgers to carry out their frauds.

⁴² Marius-Christian Frunza, *FRAUD AND CARBON MARKETS: THE CARBON CONNECTION* (2013) at 49; Center for the Study of Democracy, University of Trento, Teeside University, *Financing Of Organized Crime* at 301-404 (discussing the early payment platform the First Curacao International Bank (FCIB) which existed from 2004 through 2007).

⁴³ *In the Matter of: the Extradition of Samir Azizi, Formal Request for Extradition*, 5:14-xr-90282-PSG (official English translation) at 37 (note: Azizi appears to have oversimplified the details in his example, as it is unlikely that USD and GBP were trading at one-to-one at any time during the alleged fraud).