FIGHTING CORRUPTION IN COMMODITY TRADING THROUGH BLOCKCHAIN TECHNOLOGY

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Abstract

Compared to upstream activities such as extraction, commodity trading sector has always been under the regulators' radar, though the corruption risks are especially large, mainly due to the existence of enormous number of intermediaries, their opaque structures, manual documentation and the regulatory lacuna. Blockchain, on the other hand, provides a unique opportunity to sanitize the sector, as a decentralized open ledger where transactions are recorded in blocks built upon by everyone in the platforms, and where transactions are self-executed upon fulfillment of predetermined conditions in the smart contracts.

Specifically, blockchain can transparentize the sector in the following four aspects:

i. ***Anti-corruption compliance***. Smart contracts in Blockchain can be designed to only facilitate transactions when a previous party complies with all anti-corruption requirements. Parties must attest to their compliance by putting things of value at stake, such as a certain percentage of profits or a future contract, otherwise it would lose everything it has staked. An absence of a transaction would also be noticed on the ledger, indicating intentional noncompliance.
ii. ***Supply chain transparency***. Current framework of oversight (such as financial regulations) cannot adequately address corruption in the sector, neither are banks in the best position to detect

corruption through due diligence due to various barriers. Blockchain provides an effective data management platform through smart contracts integration, where data are synchronized and shared with all parties in the transactional chain.

iii. ***Tackle trading-specific corruption schemes***. As facilitators and middlemen in a business model typical in the sector called “transit trade”, commodity trading companies (CTCs) administer the delivery chain and build connections with foreign officials. Quite often, bribe payments are hidden via a scheme in which the initial purchases of commodities is done by a small private CTC at a low purchase price, where the commodities will immediately be re-sold to a larger CTC at a higher price. The profits earned by the small CTS then goes into the pockets of its beneficial owners, who are often Politically Exposed Persons (PEPs). Blockchain-based records make it substantially difficult to alter the quantity and quality specifications provided by any CTC on the platform, and would rid of all unnecessary intermediaries acting as middlemen.

iv. ***Prevent fraud***. Forged documents on, say, amount of shipments, can be used by bad actors to defraud banks to obtain more bank loans with the nonexistence supply as collateral. Blockchain only allows commodity trading to continue when all distributed documents on the platform are consistent and verified.

Despite abundant literature on Blockchain, most focus on how Blockchain could increase efficiency and profit margin. Thus far no detailed and workable proposal on using Blockchain to target corruption in this specific sector has been put forward. This paper first identifies corruption typology in commodity trading and explain why current regulations fail to curb them. Then it elaborates the mechanics of Blockchain and why its features could be a solution regarding the above four respects. Lastly, the paper provides a realistic roadmap for stakeholders and influencers to build a supportive ecosystem around it.

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1. Problems Identified: Corruption in Commodity Trading

This section will first provides a brief introduction on commodity trading and its mechanics, and then explain why corruption would be a problem in the commodity sector, as well as some unique commodity trading specific corruption schemes.

1.1 Commodity Trading: An introduction

1.1.1 Basics of Commodity Trading

Commodities are naturally grown products; they can be either “hard” – such as oil, gold, minerals – or “soft” – like cotton, wheat, sugar (Etoro, 2012). However, the production and the consumption of commodities almost never occurs at the same time or place; integration of global economy gives rise to a sophisticated value chain encompassing refining, processing, storage, and shipping facilitated by commodity traders that transport and transform those commodities in form, space and time (Buchan, 2018).

Commodity trading takes place in both primary and secondary commodity markets. In the primary markets, commodities are extracted from nature and are prepared for transportation at the production site, where they then would be delivered to refineries or smelters for processing and then sold to energy users or manufacturers in the secondary markets. Through trading, commodities are transported often across continents from its production site to the destination where they are going to be consumed – this is the most obvious effect of commodity trading. It also balances supply and demand of commodities in the global market, as both supply and demand can fluctuate for a variety of reasons including seasons, production capacity, politics, among others. The way to do it is through a straightforward mechanism, i.e. storage during the time of high supply and drawing down inventories when demand is high. Moreover, trading can involve some level of industrial process, where, for example, blend or processed metal products or refined oil are transformed from the crude minerals or oil to meet the needs of the end-users (Buchan, 2018).

1.1.2 The Commodity Trading Companies (CTCs)

Commodity trading companies (CTCs) provides vital support for the business model of trading. They conduct arbitrage across globe, acting upon price signals and mainly operate as middlemen in the global value chain.

CTCs possess some unique features:

First, CTCs serve to build relationships among counterparties in the trading. They act as intermediaries with comprehensive protocols and provide logistics for trading parties across the globe, administering the delivery chain for primary economic products from the extraction site to the ultimate buyers.

Second, it is common that CTCs primarily adopt a business model called “transit trade,” where they rarely have physical possession of the commodities, or register with customs authority of a country

as such trade only qualifies as an export of services. This model of transit trade has major implication for corruption detection and monitoring.

Third, CTCs typically help build connections between buyers and foreign officials and politicians, interacting with political exposed persons (PEPs). In particular, through loans pledged on future commodity deliveries, CTCs also pre-finance extraction activities by indebted governments, who otherwise would not be able to get loans from banks or other financial institutions. Emerging economies, for example, particularly find such commodity pre-payment via CTCs is a useful substitute for bank loans. The way for CTCs to do it is to present such pre-payment deals as security to negotiate a syndicated lending agreement with international banks.

1.1.3 Stakeholders in the Commodity Trading Sector

Trading sector is constituted of a wide variety of players and hundreds of contractual relationships that connected them. Typical players in the sector involve commodity producers, CTCs or traders, banks or other financial institutions, shipping companies or shippers, storage facilities, operators, inspectors, insurers, among others.

During the negotiation of the deal between traders and the producers, a third-party that understand the local dynamics or have valuable connections on the ground may be commissioned by the traders to identify the right products and people.

Banks are the major funding sources for commodity trading. They conduct due diligence on CTCs to see whether a CTC could meet its responsibility threshold.

Once the deal is concluded, an operator will be responsible for executing the deal, where he would coordinates with shipping, storage and all other aspects of logistics in the supply chain. An independent inspector would also be appointed to assess and monitor the quality of the commodities – as the volume and quality of commodities may be subject to changes while in transit – and issue cargo certification.

Despite that hundreds of contractual relationships are established to delineate their boundaries of responsibilities and hold all stakeholders accountable, information asymmetry and trust are two biggest issues. They oftentimes do not know – let alone trust – each other. Moreover, the huge volume of activity makes monitoring and managing risks extremely difficult, which would require a transparent, coordinated system with well-designed procedures. Otherwise, the complexity of relationships exacerbated by a lack of transparency would inevitably become a breeding ground for corruption.

1.2 Corruption in the Sector

1.2.1 Opacity of the Commodity Market and the High Corruption Risks

The reality for the commodity market is, perhaps unsurprisingly, highly opaque: particularly in the markets for “hard” commodities like oil, gas, or minerals, where CTCs would frequently interact with foreign governments and state-owned enterprises, the risk of corruption is alarming. PEPs would also take advantages of the opacity of commodity trading to launder illicit proceeds derived from corruption, which is termed trade-based money laundering. A few recent cases have put the issue of corruption in

commodity trading under the spotlight. For example,

- The Serious Fraud Office in the UK launched a bribery investigation against the Swiss trading giant Glencore over its dealings in Congo with the Congolese President, which allegedly deprived Congolese people more than 0.5 billion dollars in potential revenues. (Wild, 2018).
- Glencore Ltd, a subsidiary of Glencore PLC was subpoenaed by the U.S. department of Justice to produce documents regarding its operation in Nigeria, the Democratic Republic of Congo and Venezuela from 2007, with respect to its compliance with the money laundering statutes and the Foreign Corrupt Practices Act (FCPA). (Glencore, 2018).
- A former employee of another commodity trading giant Gunvor had stricken a plea bargain with the Swiss law enforcement and received an 18-month suspended sentence for his corruption practices in the Republic of Congo and Côte d'Ivoire over oil deals. (Swissinfo, 2018).

Such attention on CTCs' corrupt activities comes rather late compared with the focus on corrupt activities of companies engaged directly in extractive activities, as well as by the ultimate purchasers upstream. Intriguingly, "Publish What You Pay" (PWYP) laws – laws that usually mandate payment disclosures relating to exploration, extraction, and processing of hard commodities such as oil and minerals – often explicitly exclude payments related to "commodity trading-related activities" (Publish What You Pay, 2016). Corruption activities taking place on a daily basis in commodity trading can therefore always fly under the radar, and the opacity of the sector conveniently covers them up.

1.2.2 Special Corruption Schemes

1.2.2.1 Flipping

The first special corruption regime that is usually used in commodity trading is called "flipping" (Chen, 2018). The scheme works like this: A small private CTC arranges for the initial purchase of commodities from governments or national oil companies (NOCs) at a low purchase price, and then immediately resells these commodities to a larger and better-known CTC at a higher price.

The small CTCs are incentivized to participate in this scheme because they can only manage much smaller operations themselves with very limited access to a global market, yet the profit margin of reaching the global markets for their commodities is extremely high and tempting. And these small CTCs can achieve this competitive advantage with some help from the bigger CTCs.

In this regime, the small CTC would claim to provide logistics services or other expertise to parties of the trade, in fact, the true owner of the small CTC is a government official or that official's close associates, and the profits earned from the "flip" are, in effect, bribe payments orchestrated by the large CTC. Moreover, these small CTCs act as buffers that dissociate the bigger CTCs from fishy deals, so these larger, more reputation-conscious firms need not disclose in their filings transactions with corrupt governments or high-risk regions.

The right solution to fight corruption like this scheme should be able to make their formation more difficult, and all parties of the trading should be able to have access to payment information which

would enable them to monitor CTCs, and more specifically, to compare the purchase price of commodities sold to the small CTCs with those “flipped” to the big CTCs, exposing such suspicious transactions and making bribery more difficult to hide.

1.2.2.2 Swap deals

Swap deals is another type of high-corruption-risk transaction particularly common in commodity trading that facilitates kleptocratic behaviors (Crude Oil Swap, 2017). In a swap deal, rather than conducting a monetary transaction, the CTC swaps refined products (such as gasoline) for a primary product (such as crude oil) of equivalent value with the producing country, or the CTC lifts a certain amount of crude oil from the country, refines it offshore, and delivers the final products back to the country. In-kind payments such as in swap deals are highly context-specific, with the terms negotiated by the parties (Inside NNPC Oil Sales, 2017), and there is no benchmark estimate or other objective standards against which to measure their value. NOCs can only publish high-level figures for the products supplied by the CTCs or the crude oil that has been lifted; therefore, without getting access to information from the CTCs, there is no way to compare NOCs’ figures with the value of the refined products. Any discrepancy between revenue remitted to the country and the actual value of the crude indicates a loss of national oil wealth, from which many CTCs are profiting. This lost wealth, unsurprisingly, often finds its way into the pockets of kleptocrats who are the true beneficial owners of the CTCs.

Any solution to fight corruption scheme like this should be able to allow relevant parties, auditing or investigative authorities to compare the accounts of NOCs and those of CTCs, which would shed light on crucial questions such as whether CTCs have supplied all the crude that has been lifted under the swap contract, and whether they have done so with a fair value. If discrepancies between the two accounts are not due to differences in timing of payments and cannot be explained by the disclosing CTCs, they are likely red flags for oil theft or corruption.

1.2.3 The Compelling Need for Transparency in Commodity Trading

The above description is just a tip of the iceberg, but it is enough to make a case that opacity in commodity trading sector contributes to a huge corruption risk. Some of the bigger and more transparency-conscious CTCs have already started to make a business case for CTCs to disclose payments to government, and by voluntarily disclosing such payments (Trafigura, 2015). Some regulators, including the EU in its new *Markets in Financial Instruments Directives* (MiFID II), have started to extend reporting obligations under financial regulations to CTCs. But this approach is extremely technical, costly, and challenging, and still leaves lots of leeway for CTCs to stay under the radar. Reform such as mandatory payment disclosure by the CTCs, as effective and straightforward as it sounds to achieve better transparency in the sector, may be facing huge political pushback.

It is hence imperative that policymakers and anticorruption advocates think of innovative and practical ways to foreclose the possibilities of CTCs gaming the system. Disruptive technology such as Blockchain may have just provided us with a new opportunity to crack this age-old problem.

2. Revolutionary Role of Blockchain and Smart Contracts: How they fit in?

2.1 Current Use of Blockchain Technology: Limited Usage on Increasing Efficiency and Removing Bottleneck

This paper is not the first to make the connection between Blockchain technology and commodity trading sector. In commodity trading, the actual exchanging of assets and payments can take fairly long time, and the complex contractual relationships enabled by millions of paperwork makes errors inevitable, and the delays in submitting documents and exchanging information is also commonplace. In the eyes of trading experts, Blockchain can be the answer to resolving issues such as human errors and inefficiencies. And so far, this has been the main connection between commodity trading sector and Blockchain.

Neither is it the first time that Blockchain is discussed in the context of anti-corruption. Features of Blockchain such as immutability and permanent record keeping draws attention of the anti-corruption specialists. Decentralised system such as Blockchain cannot be controlled by a single party, but cross-verified by all parties on the relevant network, with information stored in immutable form. This means any corrupt party who delete or alter entries of data would inevitably leave a visible trail.

Together with Blockchain technicians, anti-corruption experts developed multiple promising platforms that can be used in places most susceptible to corruption and contamination, such as land registry. For example, Georgia has used a Blockchain-based platform called “Exonum” for land registry in the country, and the government of Andhra Pradesh in India also explore using Blockchain to resolve fraudulent transfer of title deeds and misuse problem in land registry, where alteration of data can only be done through standard protocols and proper authority and manipulation of data becomes very difficult. Same happen in Brazil, where land is registered in different regions by more than 3,000 privately owned agents (“cartorios”) in the Blockchain-based system known as “Ubitquity”, which has a tabbed interface allowing users to input and transmit data with a permanent trail of changes (Mendes, 2018).

Admittedly, however, the use of Blockchain for now in commodity trading is rather confined to increasing efficiency of trading operation; and the anti-corruption mandate inspired by Blockchain’s special features seem not to have anything to do with commodity trading. Hence it begs the question: can Blockchain be used in the commodity trading sector for purposes of anticorruption?

2.2 How Blockchain Technology Could Be Steered Towards Fighting Corruption in Trading Sector

The above examples where Blockchain is used to fight corruption has shed some lights on when Blockchain can be most useful for anticorruption. Therefore, it would make sense for us to analyse the aspects making Blockchain a fit for certain industries or causes, then see whether commodity trading could provide such opportunities for Blockchain being applied.

Blockchain is most fit in scenarios where:

- There are multiple players in the system
- Establishing trust in the system is rather difficult
- The system is susceptible to contamination or is easily corruptible
- Eliminating information asymmetry and improving transparency is conducive to the well-function of the system
- Preventing record from being tampered with is a crucial goal

Applying those standards to commodity trading, it seems it ticks all the box. Commodity trading is a dispersed system with multiple stakeholders who do not know or trust one another; the sector is extremely opaque where corruption can happen between any two ends of a relationship and monitoring corruption in the sector would incur formidable cost, and such efforts may still turn out to be futile.

3. Achieving Transparency in the Sector: the Mechanics

3.1 Three Relevant Features of Blockchain

3.1.1 Traceability and Identity Proof: Cryptographic Keys

An important issue in commodity trading is trust, and establishing trust involves proving one is who one says he or she is. Blockchain has a solution to the identity authentication issues among multiple players through the use of cryptographic keys. Moreover, the proved and recorded identity can help stakeholders to trace and capture data along the supply chain.

In a Blockchain platform, identity can be created, verified and distinguished through a digital signature matched to a specific wallet, which contains pair of a public key and a private key. The signature – or the public-private key pair – is associated with an address that can, for example, receive funds. The signature proves ownership of one's assets and allow one to control the funds. The private key is used for encryption of transactions, while the public key is used for decryption and is shared with third parties in the platform. A typical scenario is that the sender of the funds encrypts the transaction with a private key and the recipient decrypts it with a public key. If the transaction fails to go through, it can only mean that this transaction is not from that particular wallet, i.e. the identity is false or is impersonated, and some party is trying to defraud the others.

Goldman Sachs has provided an example of ticket verification to help explain cryptographic keys. A ticket is issued and registered in a Blockchain-based system and is sold to buyers. When the ticket is first sold it is assigned to an address – a string of data publicly visible online. The owner of the ticket is given a private key which is used to unlock the address. If the owner sells the ticket, a new address and a new private key will be assigned, and this new transaction is added to the Blockchain. As long as a buyer can unlock an address with a private key given to him or her without a problem, it can be safely established that the ticket is authentic.

This function seems to be particularly relevant when the provenance of a product or the identity of an owner is deemed important in a transaction, such as in diamonds or wine industry, or during

transfer of funds. It helps build an ecosystem of trust and confidence among parties to the transaction.

3.1.2 Tampering-resistance: Hash Function, Proof of Work (PoW) and Consensus

Hashes are used together with digital signature to ensure the integrity of data on Blockchain. Hash is a one-way cryptographic function, a method of transforming large quantities of data input into numbers and codes that are hard to decipher. Bitcoin network normally uses Secure Hash Algorithm (SHA). An important feature of hashes is that a tiny change of input data would alter the output in a significant way.

The relationship between public and private keys is determined by hash function: the public key is mathematically derived from the private key, but to reverse the process would take supercomputers trillions of years to crack, making it impossible in reality. This feature ensures that the digital signatures and Bitcoin address would be resistant to any tampering.

Proof-of-Work (PoW) is yet another function to ensure the integrity of information on the Blockchain (Tar, 2018). PoW is used to confirm transactions and add new blocks to the chain, where miners compete to get rewards by generating valid blocks of transactions, including collecting all relevant transactions, verifying them through running all data via the SHA algorithm, and arranging blocks. This is the process of mining. The hash of each block contains the hash of the previous block; changing the data in the block means regenerating all successor blocks and redoing all the computing work done through previous mining – this is practically infeasible to achieve.

3.1.3 Transparency: Distributed Ledger Technology (DLT) and Single Source of Truth

Another unignorable benefits of having a Blockchain platform is that once a transaction is validated, it is synchronized among all nodes and all ledgers in the network, in other words, it becomes public record. Since there is no single control in the network and parties are dispersed, consensus provides protocol for its operation. This results in a transparent and open platform nearly tailored for global trade. For example, solutions such as the Blockchain-based shipping and logistics platform TradeLens enables all players in the supply chain to benefit from a shared ledger that updates and validate instantaneously with each network participant.

Consensus of nodes ensures the integrity of the system by isolating and eliminating those who tries to defraud the rest. For example, if one party denied having received the payment, he will not be trusted as every party in the network has a proof of such transaction, and under the consensus algorithm, the data is still reliable and trusted by parties in the network – this is how a single source of truth is maintained in Blockchain. Essentially, Blockchain acts as a global notary to verify authenticity of credentials and transactions.

3.2 Two Relevant Features of Smart Contracts through Blockchain

Neither smart or being a full-fledged contract in the legal sense, a smart contract is a piece of computer code with pre-defined set of rules that describes a transaction step by step. It sets the

conditions under which all parties to the smart contract agree to interact with each other. It can connect to multiple Blockchains and track multiple assets, hence it can swap those assets as needed to execute the transaction. Smart contracts would unlock the cryptographic keys as long as the conditions are met. Such automatic execution of agreements eliminates the needs for intermediaries, who are often brought into the picture to build trusted relationships.

3.2.1 Eliminating Intermediaries: Automatic Execution

As mentioned earlier, it is unimaginable that one enters a contract or a business transaction without knowing or even meeting the other party. Transactions require a lot of trust from parties for it to be conducted and completed. If meeting and knowing each other is implausible or the cost becomes too high, parties will rely on a credible third-party intermediaries to build the needed trust and facilitate the transaction.

Like a third party, a smart contract can build trust by formalizing their relationship by defining conditions of transactions as well as parties' rights and obligations. The transaction conditions are formed by simple opt-in actions from the parties, then digitalized and become readable by computers. Hence a transaction can be automatically executed as long as the conditions are met. In other words, any outside influence will not be able to reach or alter the transaction because they are not written into the rulests where conditions are agreed upon.

In so doing, the monitoring of performance can be achieved in real-time, triggering instant compliance and control. The self-verifying, self-executing and interference-proof feature of smart contract then eliminate the intermediaries while still build trust among parties. This is especially promising for industries like commodity trading where intermediaries are one of the weakest links for corruption.

3.2.2 Standardizing Record-keeping and Verification: Oracle

When a smart contract executes a transaction, the conditions are either agree upon by the parties, or come from certain third party services. However, Blockchains cannot access data outside; and yet conclusion of certain transactions require input from the physical world – such as the action of completing a payment, weather conditions, price of certain stocks, among others.

This is when Oracle comes in.

Unlike a third-party intermediary, an Oracle is part of the Blockchain, and links the outside world with the Blockchain. It brings in external data and triggers smart contract executions. It fills in the blanks in the pre-defined conditions where external information is needed.

Some Oracles can read data from hardware such as a Radio Frequency Identification (RFID) sensor – which is usually used in supply chains industry – and then report the readings to the smart contracts through Blockchain network. Surprisingly, a lawyer can also be an Oracle. Whenever in the transaction a legal analysis is involved, or that certain title needs to be confirmed, lawyers can sign off on the external information before they are brought into the Blockchain.

Then how can we ensure the objectivity or authenticity of the information provided by Oracles?

First, an Oracle also needs to sign the smart contract before any transaction in relation was executed. This is how an external information gets verified before making it way to the network. In so doing, the data provided becomes transparent and known to all parties in the Blockchain – just as any other input from parties.

Second, Oracle can also be based on Consensus. This means a smart contract can use different Oracles as external data providers, and the final output of such information will only be determined by the majority of them, such as when 4 out of 6 Oracles agree on the same data outcome.

These features of Oracles ensures that third-party information would not be easily tampered with, and any such attempt would not just happen without being noticed by any party of the network.

3.3 Blockchain Plus Smart Contract: What Does it Mean?

A combination of features of Blockchain and Smart Contracts means that at all levels and everywhere on the platform, tampering with the transaction becomes extremely difficult, if not at all impossible. At each node on the Blockchain, smart contract makes sure any action is taken based on the pre-defined conditions, properly recorded and stored in the blocks and shared among all parties in the Blockchain. Compliance happens on the fly and subject to constant monitoring from everyone. And on the network level, the cryptopgraphic keys ensure identity of the owner or provenance of the products, and disable any attempt to reverse engineer the wallet or digital signature or to alter any segment of the transaction through the hash function.

4. Application of Blockchain Technology in Commodity Trading: Roadmap towards a Supportive Ecosystem

4.1 Resolving Trading Specific Corruption Schemes: Three Scenarios

4.1.1 Streamlining Verification Process

The most direct application of Blockchain to patch up the weak link inviting corruption in trading is to get all parties in the supply chain to operate in a Blockchain-based platform. How to achieve this? Here is one simple example involving a seller, a buyer, a bank and a shipping company.

Usually the bank will serve as buyer's guarantor by providing the seller a letter of credit (LoC), indicating that the buyer would pay up upon delivery of the cargos, otherwise the bank would have to pay on behalf of the buyer. The shipping company on the other hand will present a bill of lading (BoL) to the buyer upon delivery of goods, manifesting a transfer of title of ownership of goods to its rightful holder. Only after this, the payment for the goods can be made. This scenario involves multiple parties that may not know each other, multiple contractual relationships, various conditions that can be coded into smart contracts, and clear execution in transaction such as payment.

A Blockchain-based platform would ask every party to upload the proof of completing their job and share this information simultaneously with the rest of the parties. This may include seller initiating the transaction by confirming the goods are transferred to a shipping company, bank confirming issuance of a LoC to the seller, and the shipping company confirming that goods have been loaded.

Every single action of parties on the Blockchain would be recorded and formed a block to be added upon the previous block. Meanwhile smart contract would only release the funds when all conditions – including shipping companies' proof of delivery and presentation of BoL, confirmation of delivery from the buyer – are satisfied.

This watertight verification and transparent system effectively leaves no chance for any party's attempt to commit corruption along the way – because simply, the cryptographic keys and the self-execution makes any tampering implausible and infeasible.

4.1.2 Inter-entity Accounts Reconciliation

Blockchain will also come in handy for reconciling accounts among different entities, targeting the special corruption schemes such as flipping and swap deals. Inter-entity account reconciliation is about making sure records in different entities – meaning all balances owed to and from entities – are in agreement.

Known expenses will be evidenced by receipts, thus in theory, all parties can record their expenses by uploading receipts and remittance information as ledgers on Blockchain with their unique digital signature, which will then be synchronized among all parties. Any other party that is either required or would like to verify this information can download it via a private key. The reconciliation of accounts will be instant and in real-time. Simply, money leaving an account from one party should be going into the account of another party – if there are unreconciled inter-entity accounts or discrepancies without reasonable explanation, it will signal high risks for corruption, fraud or misappropriation. Moreover, the transaction may not even be able to proceed if the reconciliation of accounts is designed as a condition for further action, as the smart contract will not execute the transaction when the pre-defined condition is not met.

The volume of transactions taking place among the entities in the trading sector is extremely high across different geographic locations, time zones, applying different tax regimes and regulatory compliance rules. Corruption risk is high at the conjunction point where one regime or sets of standards need to be adjusted to another. A plausible solution via Blockchain can be that an auditing oracle also sign the smart contract and be added to the chain, especially when adjustment of transfer pricing or accounting methods is needed. In so doing, a transaction will only move along when the block where the auditor submitted the proof of any adjustments is added to the chain and where consensus is reached among parties on the platform confirming the adjustment the result of reconciliation.

4.2 Space for Regulatory Agencies (such as CFTC) in the Blockchain-based Trading Platforms

Blockchain would make it much easier for the regulatory authorities such as Commodity Futures Trading Commission (CFTC) to oversee regulatory reporting from the entities and ensure compliance.

CFTC polices derivative markets of commodity trading for various abuses and manipulation, especially in the swap execution facilities, derivative clearing houses, among swap dealer, futures commission merchants, among others.

It is thinkable that one node on the Blockchain is connected to CFTC's reporting system,

providing CFTC a real-time window into market activities. Moreover, reporting can also be designed as a condition in a smart contract, and compliance will automatically trigger the events followed. Blockchain can also be used in a more sophisticated way for CFTC to detect trade-based money laundering. For example, a typical carousel transaction where the fraudster abuses the Value-Added Tax (VAT) - free regime between jurisdictions. The fraudsters will import VAT-free goods, and charge VAT when selling them to a shell company they set up, and then the goods and the VAT will be passed around between multiple companies even across multiple jurisdictions. At last, the fraudsters will disappear with the VAT before paying it over to the government collection authority. Hence this scheme is also called the "missing trader fraud." It is hard to detect because every single transaction in this grand scheme is viewed and recorded in silos, without putting together the whole picture, commodity oversight agencies such as CFTC will not be able to identify a fraud is taking place. A reporting requirement on the Blockchain as a prerequisite for the execution of transaction would effectively alert CFTC about irregular trading activities through a self-generated Suspicious Activities Report (SAR), and record all the information the agency may need to find out the identity of the fraudsters.

It is good news that the idea of Blockchain-based platform has germinated in the field of commodity trading. The first and most recent example is Vakt, aiming to use Blockchain to digitalise the commodity trading sector and create a trusted and secure ecosystem around trading. It is beyond doubt that more platforms like Vakt are yet to come, and transform the way we see, operate and oversee commodity sector, and leaves little room for corruption activities.

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