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A REALITY CHECK FOR BLOCKCHAIN IN COMMODITY TRADING

By Antti Belt and Steven Kok

To the commodity traders that support it, blockchain technology is a panacea. Blockchain-based platforms promise to improve the way the commodity-trading industry operates by addressing its struggles: with inefficiencies and issues of trust and with the complexity of transactions, which typically involve multiple counterparties. It's no surprise, then, that senior executives are lining up to invest in blockchain.

The technology's ability to transparently record complicated transactions, track goods, and reduce fraud seems to make it a natural fit for the commodity business.

But not so fast: Companies have already invested in different mechanisms to foster trust and address other obstacles. And blockchain could be bad news for certain participants, such as merchant traders, that rely on market inefficiencies to make money. What's more, switching to a blockchain platform would involve an expensive and disruptive overhaul of existing systems that may not be justified.

Senior executives need to carefully consider blockchain's benefits and drawbacks before they proceed. They should also consider ways to take advantage of the hype around this nascent technology: all this attention could prompt industry players to find even better ways to solve commodity trading's poor standardization and transparency.

Taking a Reality Check with Blockchain

Commodity trading needs improved standardization, efficiency, and tracking of goods. But whether blockchain is the killer app that will deliver these benefits remains to be seen. Industry players have yet to fully adopt the technology. There are marked benefits to blockchain technology but also significant drawbacks on several fronts.

Pricing and Arbitrage

For a blockchain-based solution to gain acceptance, most trades would have to be recorded accurately in a shared ledger. If transactions were recorded in such a ledger, participants could compare the price of

their consignment against other consignments and thereby spot discrepancies. Greater transparency would lead to fairer prices. However, it would impact the profits of traders that rely on pricing inefficiencies to make money. Price-reporting agencies would also need to find new ways to expand their businesses.

Risk

Considerable risks currently exist in the clearing of trades (if a counterparty defaults, for example) and in the physical delivery of goods (fraud and poor quality). By enabling settlement in almost real time, blockchain would largely eliminate clearing risk and diminish the role of clearinghouses. There is a drawback: financial market players have struggled to close the gap between transaction dates and settlement dates. And real-time settlement would be bad for some counterparties because they would have to release collateral early. However, tamper-proof step-by-step verifications would reduce physical delivery risks, particularly those arising from fraud, by enabling participants to track inspections and certifications. (See Exhibit 1.)

Regulatory Oversight

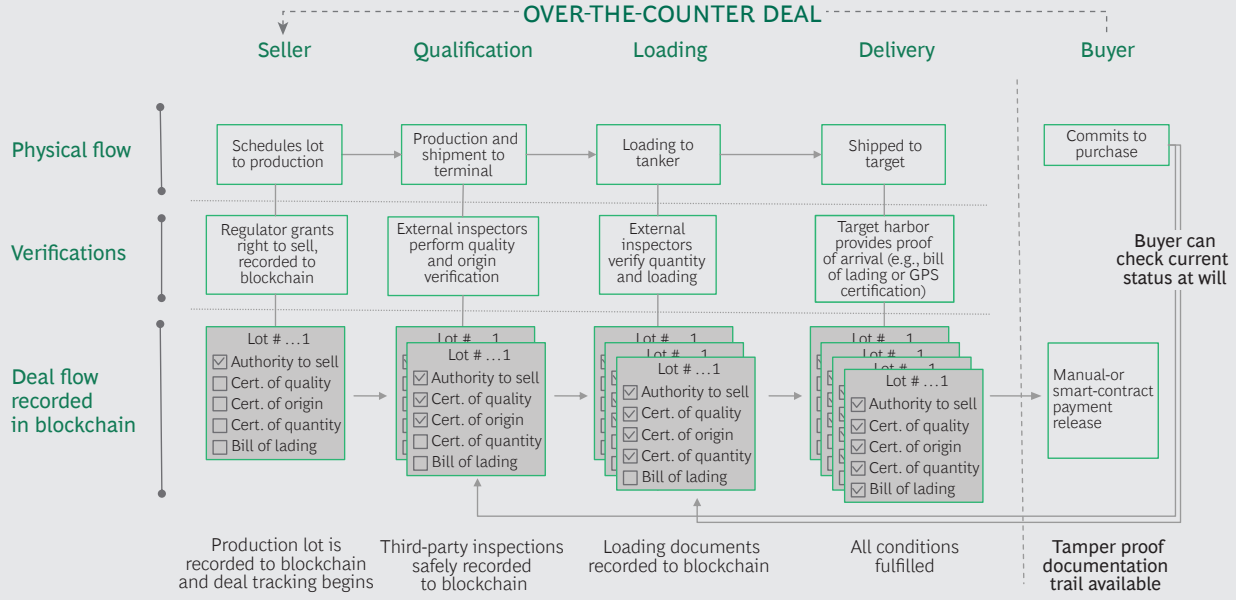
Blockchain could significantly improve regulatory reporting. Today, participants submit compliance reports. But with blockchain, regulators would have automatic access to the shared ledger. As a result, they could inspect trades in real time, rather than after the fact, and follow up on any discrepancies. Similarly, energy network companies entrusted with balancing electricity or gas supply with demand in power markets could inspect the positions of market participants in real time, rather than having to collect information from each. By using the more accurate, timely, and granular information in the ledger, they would be able to make better-informed and more effective interventions. The challenge will be to ensure consistency in regulatory guidance in different countries and commodity markets.

New Funding Mechanisms

Initial coin offerings (ICOs) allow companies to transform the ownership of assets or other rights into blockchain-enabled virtual, tradable tokens. These can be sold upfront to finance investments. For example, WePower, a Lithuania-based platform, allows developers to raise funds for renewable energy projects by selling tokens that entitle holders to a share of future output.

However, ICOs have several drawbacks.

Exhibit 1 | A Tamperproof Documentation Trail Would Reduce Fraud Risks



Source: BCG analysis.

They have attracted the ire of regulators because companies located in countries subject to international sanctions can use ICOs to circumvent those restrictions and tap international funding. Creating and operating systems that recognize both tokens and conventional currencies in order to settle trades could be both expensive and complex. In addition, ICOs still need to prove they are a cheaper and better choice than other funding options for large industrial-scale commodity projects.

IT Investment and New Processes

Commodity-trading practices have been developed over many years. But they are undergoing significant changes, and many companies have invested massively in IT systems to meet new regulatory demands. Shifting to more transparent, synchronized markets using blockchain solutions would radically change the ways in which commodity companies operate, particularly in trading physical goods. But it would also require investment in additional IT infrastructure. What's more, the industry would likely have to act in concert given that blockchain's full benefits would be realized only if all players participated.

Blockchain Versus Bitcoin

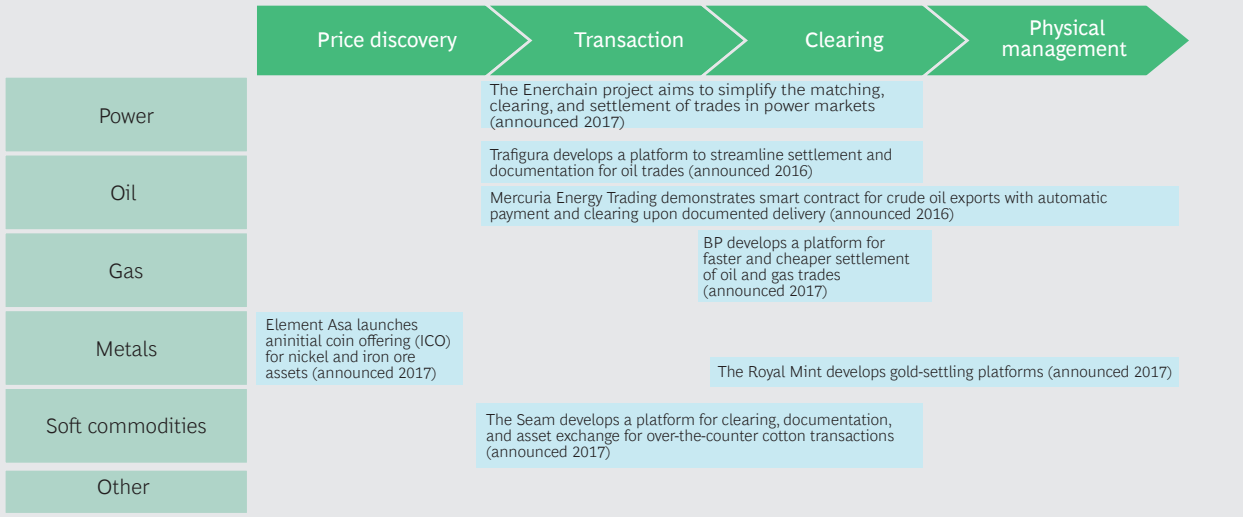
Traders of commodities, energy products, and electricity are following the lead of the banking industry, which is exploring how blockchain's function as a distributed public ledger can track and clear transactions in cross-border payments, foreign-exchange trading, and supply chain finance. Several pilots are underway in commodity trading. (See Exhibit 2.)

But for many business leaders, blockchain is shrouded in misperceptions. They typically associate blockchain with cryptocurrencies such as bitcoin. But, in fact, its potential uses are far broader.

In essence, a blockchain platform works as an encrypted and immutable database that does not need to be controlled by a central party and can be made accessible to all participants. Blockchain platforms can track commodities, record contractual agreements, and serve as a trusted register for trade documentation. Since blockchain has the advantages of being distributed and secure and can digitize information, automatically execute contracts, and be used to standardize procedures, participants can manage and settle transactions reliably. And with permissioned platforms (where participants need permission to join or carry out certain functions and their identity is generally known), settlement can be achieved in close to real time.

According to naysayers, blockchain requires

EXHIBIT 2 | Commodity Traders' Blockchain Pilots



Sources: Reuters; company websites; BCG research.

huge amounts of power, and ledgers become unwieldy as transactions are added. They argue that the technology has yet to show that it is suited to complex applications. Finally, they say that commodity trading's traditional price-setting mechanisms may be threatened if blockchain is widely adopted.

But these four areas of criticism confuse issues relating to bitcoin, an application of blockchain, with blockchain itself.

Excessive Power Consumption

In the world of bitcoin, energy consumption is skyrocketing. According to some estimates, the cryptocurrency uses more electricity each year than Ireland. But this reflects how bitcoin, not blockchain, works. With bitcoin, "miners" are rewarded with new coins for solving a computational problem allowing them to create chains, or "blocks," of transactions (There's no such thing as *the* blockchain.) The process enables transactions to be verified and added to bitcoin's public ledger, and it creates new cryptocurrency units.

For now, bitcoin's economic model supports the energy consumption required by miners to create blocks. But in most other commercial blockchain applications, users need some degree of permission to join a blockchain platform so that the participants are known. Because there is greater trust between participants, reaching a consensus—necessary for changes to the ledger to be made—is faster and less expensive and consumes less energy. Blockchain platforms still need to become more efficient, however, because even the most advanced systems use far more processing power per transaction than a traditional credit card payment.

Unwieldy Ledgers

Because blockchain platforms record all user transactions in a given network, critics argue that blockchain ledgers could become too large to operate easily. In fact, since bitcoin's creation, in 2009, the size of the bitcoin database has grown to only 150 gigabytes or so. In commodities trading, particularly where physical goods rather than financial instruments are traded, the number of transactions is less than with bitcoin. Whether a single trade involves one thousand barrels of crude oil or less, it can be recorded, verified, and cleared just as easily. Even in a hyperliquid market where commodity trade flows increased massively, blockchain ledgers would still be manageable.

Complexity Shortcomings

Blockchain performs a relatively straightforward role with cryptocurrency applications such as bitcoin, enabling them to be both a store of value and a means of payment. (Recently, volatility and a surge in the price of bitcoins have eroded its usefulness as a payment method; it now functions as a value store similar to gold.) The main technical challenge is how to exchange bitcoins into a conventional currency. However, blockchain can also be used with the more complex applications that are common in commodity trading. The technology allows multiple ledgers—for assets, cash positions, and securities—to interface with one another. This can result in a degree of data transparency and enrichment across value chains that would be impossible to achieve otherwise. It can also give different access rights to different users, enabling regulators and government agencies to view but not to alter blockchain ledgers.

Price-Setting Threats

Because blockchain technology is effectively a ledger, it does not automatically set market prices. This requires a marketplace generating sufficient trading volume to determine a price. Blockchain-enabled P2P trading could be used to set prices in commodity trading. But given blockchain's distributed nature—users independently update the ledger and then seek approval from other users—speed would be sacrificed. It takes several seconds for a transaction to be verified and recorded today, even with the fastest systems. Such a time lag would be an important drawback for commodity trading, where speed is increasingly a key differentiator.

How Blockchain Could Affect Different Commodity Markets

Given that adopting blockchain will require

significant investment, market participants need to be clear about the value it creates and the key drivers of success.

To determine blockchain's ability to transform commodity trading, we examined each of the main markets using four variables: pricing complexity, particularly how much diversity currently exists in pricing mechanisms; transaction volumes, including variations in consignment size; the requirement for a foolproof certification of origin; and the seriousness of efforts to reach a more efficient market infrastructure, including how developed the current infrastructure is and how beneficial improved efficiencies and more systematic processes would be. (See Exhibit 3.)

Blockchain solutions can improve how business functions in all commodity markets, but it will impact each one in different ways.

Power and Gas

These markets already benefit from high levels of standardization and transparency, and they deal in homogeneous products. Consequently, there is limited scope for blockchain technologies to disrupt existing systems. The main reason for adopting blockchain platforms will be to enhance the efficient settlement of transactions, which would be a boon for markets, such as power and gas, that have high transaction volumes. Even with this application, blockchain is likely to be a mere bolt-on for current clearing and reconciliation processes or for the nomination systems that govern industry contracts. Its use may result in reduced trading costs, but it will have little direct impact on how traders operate. Most leading players in wholesale power and gas markets have invested significantly in IT systems to manage their back-office processes. As a result, the adoption of blockchain will be gradual.

Blockchain solutions could have a far more dramatic impact at the retail end of power markets. Distributed power generation and localized microgrids, which can function independently of the traditional centralized electricity grid, are growing in popularity. Blockchain is being used to develop peer-to-peer (P2P) online platforms, enabling localized producers and buyers to trade energy. However, even with this application, we see three fundamental reasons why the adoption of blockchain-enabled P2P trading at scale will be limited in this industry:

- Startups are developing P2P solutions that facilitate load balancing in microgrids (matching demand with supply). Most are focusing on managing demand peaks better by bringing additional sources of generating capacity onstream. However, few developers are exploring solutions that will enable microgrids to cope with surplus supply by providing producers with incentives to shut down capacity. These solutions are essential if P2P energy systems are to gain broad acceptance.

Exhibit 3 | Multiple Factors Determine Blockchain's Suitability for Particular Markets

BLOCKCHAIN DRIVER	LOW		MEDIUM			HIGH
Pricing complexity	Power	Gas	Iron ore	Diamonds	Agricultural	Physical oil
# of transactions	Diamonds	Iron ore	Agricultural	Physical oil	Gas	Power
Requirements for origin certification	Power	Gas	Iron ore	Agricultural	Physical oil	Diamonds
Effort to reach efficient infrastructure	Power	Gas	Iron ore	Physical oil	Agricultural	Diamonds

Source: BCG analysis.

- For P2P trading to work at scale and operate over long distances using grid infrastructure, individual customers will need the ability to select a preferred energy source (such as a wind farm or solar park in another part of the country) and compensate that source for the power they consume. There are well-established settlement mechanisms for this to happen at a wholesale level. But for consumers to do at a retail level what energy companies currently do in wholesale markets would require huge investment in grid-level digital technologies over decades.

- P2P trading would add significant and unwanted complexity to the customer experience. Rather than receiving a regular monthly bill from their energy supply company, customers would have to actively participate in P2P trading to secure energy from their preferred source in the network. "Prosumers"—participants that both consume power and generate electricity—would have to control how much energy they were generating and track how much was being consumed.

Oil, Iron Ore, and Diamonds

These less-developed markets are characterized by a small number of daily transactions but the pricing of individual commodities varies considerably, depending on factors such as the quality and origin of shipments. Effective quality control and the tracking of goods in real time from their point of origin to final delivery, increased transparency, and fraud prevention are important concerns. In addition, participants have yet to develop ways to standardize transactions and improve efficiencies.

The use of blockchain solutions would significantly improve transparency in the supply chain, verifying the ownership and origin of goods and enabling secure, reliable tracking. It would also create a more efficient and liquid market, moving commodity trading away from bilateral deals struck directly between two parties to transactions based on electronic platforms that match buyers and sellers. (See "Hyperliquidity: A Gathering Storm for Commodity Traders," BCG article, November 2016.) This would expedite the shift to a state of market hyperliquidity characterized by speed, highly standardized and accessible information, trading platforms, and narrow spreads. (See Exhibit 4.) However, successful and widespread adoption would require the industry's leading players to embrace new and highly disruptive blockchain solutions. It would also need a critical mass of participants to switch to these solutions.

What's Next for Blockchain?

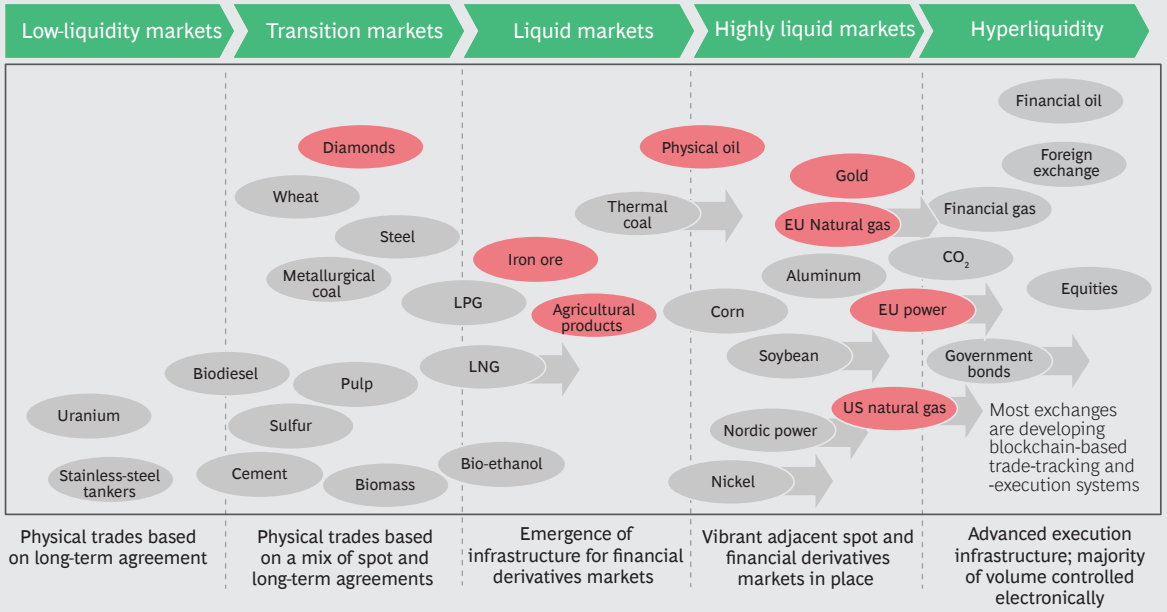
Several conditions need to be met for blockchain-based solutions to be adopted at scale. Transaction speeds and power requirements must improve, and incentives must be better aligned. Industry players will likely also have to adopt the technology en masse.

Given the disruptive potential of blockchain, companies should participate in industry debates about how blockchain-based solutions can improve commodity trading so that they can help shape the future direction of the technology. The industry will also need to consider other technologies that can offer similar benefits but are simpler or better suited to its needs. Discussions about new technologies could force players to find alternative ways to address underlying issues of weak transparency and poor standardization. Regulators have an important role in driving these debates.

Would-be blockchain adopters need to be aware of its drawbacks. Many companies have invested huge sums in IT systems to manage the complexities of commodity trading, gaining a competitive advantage over rivals. Blockchain would require further investment but, by removing complexity, it would also remove that advantage.

Companies that are persuaded of blockchain's benefits will need to ensure that they have sufficient skilled technicians in case the technology takes off. They should also carefully consider which potential solutions will best support their business,

EXHIBIT 4 | Hyperliquid Markets Are at the Vanguard in Using Blockchain



Sources: Expert interviews; BCG analysis.
Note: The markets shown in red are developing ongoing blockchain proof-of-concept projects. Arrows indicate strong movement toward higher liquidity. LNG = liquefied natural gas. LPG = liquefied petroleum gas.

which are most likely to succeed, and which can be scaled up, in order to target investment.

Developers will need to ensure that the relevant regulators are on board early in the development process; otherwise, they risk wasting resources. Some companies have been forced back to the drawing board after their proposals were blocked by regulators. Participants can avoid this by briefing or involving their regulator in pilots at an early stage.

BECAUSE OF THE complexities and cost of creating new platforms, many are being developed collaboratively. Newcomers need to select their partners with care and ensure that participants have a clear understanding of the value blockchain can add as well as potential use cases. They should consider regulatory and other obstacles and adopt a regional approach, rather than assuming they can create global solutions.

Simply put, blockchain may not be the right answer for all players. But the technology could perform another, equally important function. It could act as a Trojan horse by enabling industry-wide discussions and aligning market participants around agreed language and standardized trading terms and mechanisms. In this way, it could foster commodity trading's transition to more transparent and efficient markets and prepare the industry for hyperliquidity.

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