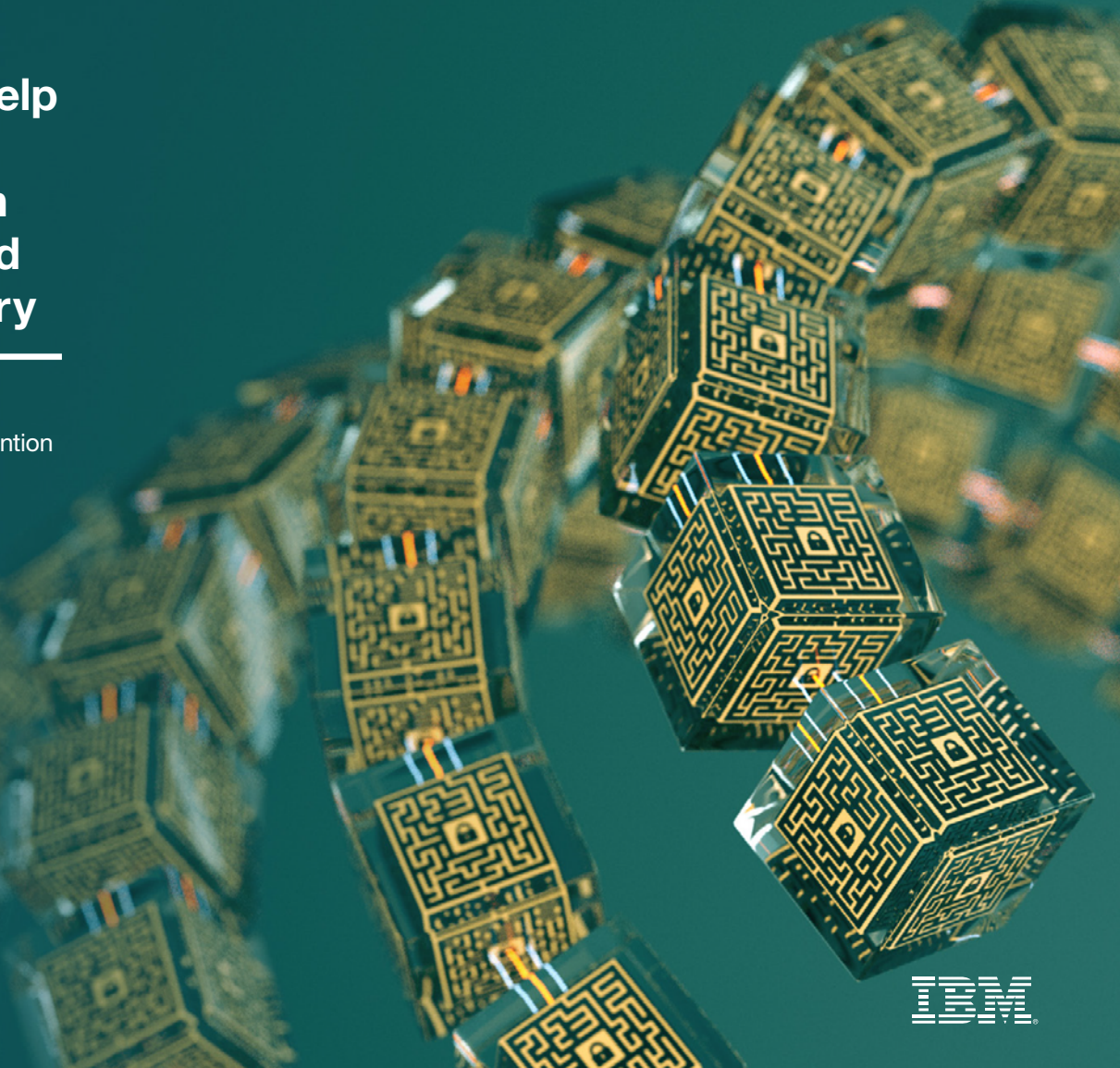


Blockchain can help transform supply chain networks in the chemicals and petroleum industry

Shared-ledger technology drives substantial efficiency, fraud prevention and cost take out



Introduction

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Supply chain relationships in the chemicals and petroleum industry are as vast and intricate as the geographies in which they operate. In the current “lower-for-longer” crude oil market, capitalizing on meaningful insight, cost take out, and the associated transformation opportunities for efficiency and longevity are keys to profitability. This applies across all internal and external supply chain functions for different subsidiary companies and divisions, and across established joint venture partners and supplier/subcontractor relationships.

Each participant in a supply chain must maintain their records, updated with their transactions and systems, which must then be reconciled among other participants in the network. This time-consuming, manual reconciliation process is susceptible to errors or manipulation of transactions.

As a result, all participants in the supply chain incur costs and delays associated with this reconciliation. These issues are further complicated when third-party validation or intermediaries have to be brought in to resolve disputes.

Enterprises, ecosystems and economies

Transaction terminology



Ledger

The system of record for a business. It can have multiple ledgers for multiple business networks in which they participate.



Transaction

An asset transfer onto or off the ledger.



Contract

Conditions under which a transfer can occur.

Given geographic, political and operational realities, along with the scale of investment required within the industry, companies in chemicals and petroleum cannot exist in isolation. Most are connected beyond the industry consolidation we've witnessed recently through engineering, procurement, construction management, joint ventures, or other key service supplier relationships. These companies rely on extensive supply chain networks to bring their products and services to market. Their industry network connects suppliers, partners, distributors and customers, and operates across geographies and regulatory boundaries.

Industry networks become more complex as the number of participants in them increases. They also reorganize constantly through restructuring initiatives, mergers, acquisitions or regulatory actions.

Assets, goods and services are exchanged within these supply chain networks, and value is created through transactions governed by contracts. For a network to function properly, transactions must be recorded accurately in a system of record and be accessible to all participants. This system of record is often referred to as a ledger even though it is usually a digital record.

Transactional challenges in the supply chain



USD 1.1B

in investments in past three years



80%

of the world's largest banks will have initiated Blockchain projects by YE 2016



2,679

Patents filed in the last three years in tech innovation, a surge of 83% from the prior three years

Figure 1: Why is blockchain relevant? Investment activity in blockchain is showing a trend comparable to the early-stage investment in the internet¹

Given the specialty nature of the chemicals and petroleum industry, there will always be multiple suppliers throughout the supply chain. Today each supplier maintains their ledger in compliance with their policies and procedures. For that reason, most business transactions are inefficient, expensive and vulnerable.

Inefficient

Inefficiencies result from the duplication of a single contract by each participant in the supply chain. The time it takes for each participant to record and reconcile transactions can slow down the flow of capital and revenue recognition throughout the entire supply chain.

Expensive

This duplication of effort, and the need for third-party validation of transactions, adds to the interaction and administrative cost of doing business. Additionally, the expense of an intermediary to resolve disputed transactions further increases interaction costs and also delays the reconciliation process of the other participants in the network.

Vulnerable

In such a tightly woven network, the risk of any compromise in one participant's system can affect every participant in the supply chain network. Incidents can include fraud, cyberattack or a simple mistake. This depletes trust, prevents automatic verification or authentication of assets, and increases costs even more.

“Some 5 billion persons and 20 trillion dollars have been shut out of the economy due to disputed assets.”

— **Hernando De Soto**, First Annual Block Chain Summit, May 2015

The IBM point of view

“Over the past two decades, the internet has revolutionized many aspects of business and society – making individuals and organizations more productive. Yet the basic mechanics of how people and organizations execute transactions with one another have not been updated for the 21st century. Blockchain could bring to those processes the openness and efficiency we have come to expect in the Internet Era.”

— Arvind Krishna, Senior VP, IBM Research

When the price of crude oil is low, the high cost of upstream oil exploration and development coupled with downstream efficiency challenges forces most companies to reduce costs, almost to the point of sacrificing their future. We believe that a step change is needed in how chemicals and petroleum companies conduct business transactions. IBM sees blockchain as a key component in this step change for the industry.

Blockchain is more than just a disruptive technology. It represents an opportunity for chemicals and petroleum companies to increase their profitability in today's economic environment and well into the future. IBM has a deep understanding of the regulatory issues for chemicals and petroleum companies and what is required to move this next generation digital transformation forward.

In the future, as blockchain-enabled business transactions become more sophisticated, business and industry networks could evolve into self-governing cognitive business networks and reduce the cost of payment transactions by an estimated 30 percent.² Much more than a technology to automate business transactions, blockchains create a new model for trust by establishing transactional relationships between businesses via smart contracts, certifications and digital compliance.

IBM is committed to developing blockchain solutions that are open, scalable and contain security features that are critically important to building business networks, such as the ability to register participants with proof of identity. IBM demonstrates this commitment by being a leading contributor to the Hyperledger Project – the Linux Foundation's open source project that is developing the permissioned blockchain fabric that meets these needs and more.

For details, visit: hyperledger.org

How blockchain works

Transaction vulnerabilities addressed by IBM Blockchain

Time – Many business transactions:

- Are time sensitive
- Require more time to settle and reconcile
- Are prone to processing delays

Cost – Many business transactions:

- Include multiple companies/operating units that add overhead
- Are costly to manage and execute
- Require extensive documentation

Risk – Many business transactions:

- Are ambiguous and not verifiable
- Are prone to errors and tampering
- Have no single source of truth

Blockchain allows the contract for asset transfer to be embedded in the transaction database. Once a contract is validated and deployed, its execution is guaranteed. All transactions against the ledger require consensus across the network, where the provenance of information is not subject to misinterpretation and accessible to all participants. Transactions cannot be changed and are final.

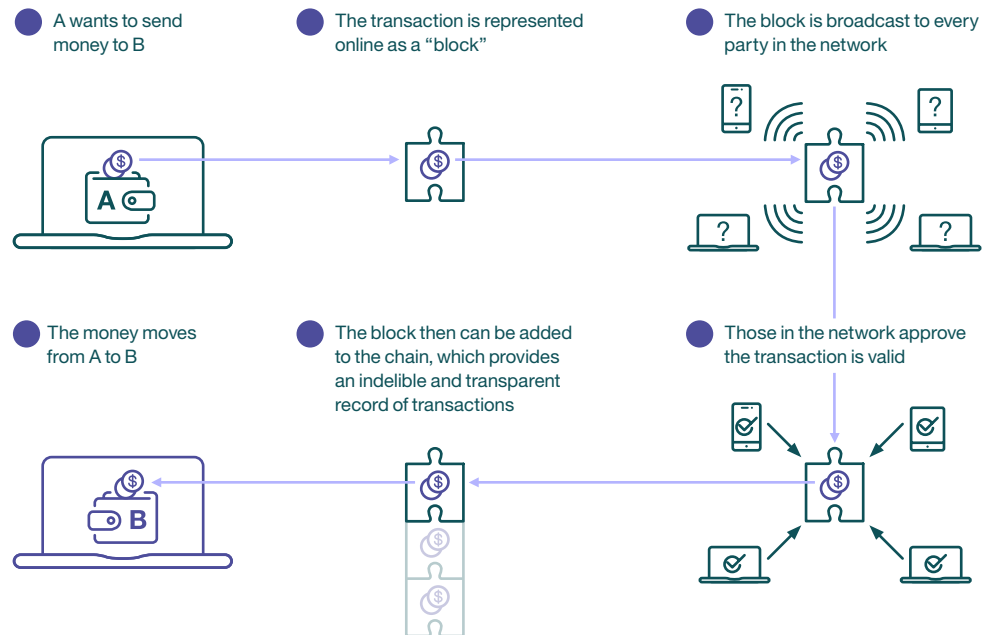


Figure 2: How blockchain works: To see these concepts in action, watch the blockchain demonstration video: youtu.be/F0P7NM7d-ps. Source: *Financial Times*

Tenets of blockchain

- **Shared ledger:** Append-only distributed system of record shared across business network
- **Smart contract:** Business terms embedded in transaction database and executed with transactions
- **Privacy:** Ensuring appropriate visibility; transactions are secure, authenticated and verifiable
- **Consensus:** All parties agree to network-verified transaction

Start planning for blockchain adoption now

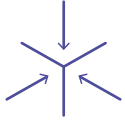
Adoption of blockchain technology will enable faster, permissioned, immutable, transparent and auditable business-to-business interactions between companies and their suppliers, distributors, financial institutions, or regulators. We recommend that businesses consider the following steps to get the most value from blockchain:

- **Position your business operation as an early adopter by:**
 - Identifying the most compelling use cases by considering the highest-value opportunities
 - Identifying discrete areas where the attributes of blockchains drive rapid impact
 - Using design thinking to simplify the user experience and create agile proofs of concept to drive rapid adoption
- **Collaborate broadly to achieve globally accepted standards by:**
 - Exploring the role of alliances and how profit pools might be redistributed. Then, decide on your role in building and piloting broader business networks
 - Consider the blockchain as the new business environment and collaboration as the optimal way of working, then consider with whom you should partner to create the optimal business network
- **Scale lines of business with clear revenue models by:**
 - Looking for new sources of revenue as business models are disrupted by blockchain, for example, consumption-based pricing, licensing and micro-charges and payments
 - Exploring how new blockchain-based services and apps can replace, complement or scale existing revenue models
 - Understanding how blockchain might extract further value from other technologies, such as big data analytics, the Internet of Things, cognitive and cloud computing

Blockchain insights



Today, three types of frictions – information, interaction and innovation – are a drag on efficiency.



Five attributes that are fundamental to blockchains have the potential to vaporize the frictions that hold us back today.



Monumental business model changes enabled by blockchains could lead to a new science of organizations, the tightening of trust and new nexus for value exchange.

- **Chemicals and petroleum industry-related starting points for blockchain:**
 - Capital projects
 - Commercial trades/deals and service execution contracts
 - Supply chain/pipeline/logistics/shipping/procurement
 - Marketing and loyalty programs (for example gas points, movie tickets, upgrades and more)
 - Trading in carbon emissions (Enabling oil commodities investment trading in carbon emissions)
 - Cryptocurrency integration to existing gas stations
 - Joint-venture data/accounting
 - Transfer pricing
 - Disputes/settlements
 - Divisional orders
 - Land royalties
 - Production sharing
 - Shareholder voting

Benefits of blockchain adoption

Just as the internet made “frictionless commerce” possible by connecting buyers and sellers in online marketplaces, blockchains could provide the frictionless fabric for value exchange within discrete digital business networks.

- Reduce the cash cycle time from days to almost instantaneous.
- Make transactions more efficient by lowering overhead and reducing the number of cost intermediaries.
- Increase transaction visibility to help make tampering, fraud and cyber crime much more difficult.
- Increase the level of trust regarding transactions by using shared processes and recordkeeping.

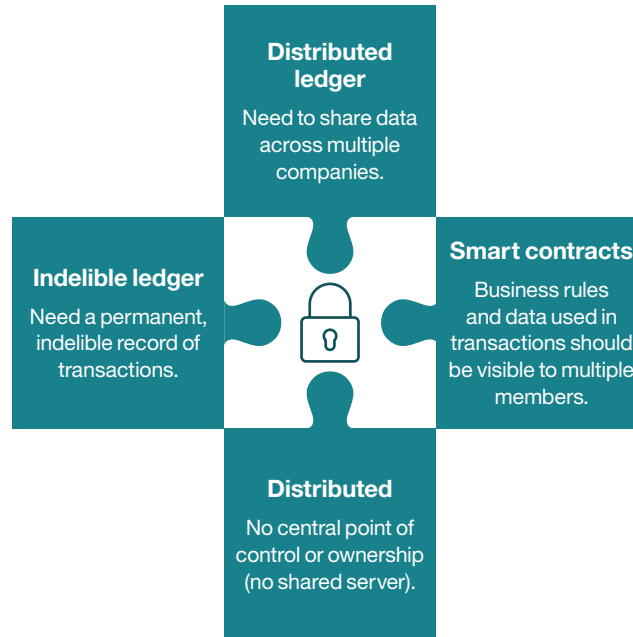


Figure 3: Attributes of a strong blockchain use case. If the data is only used by one organization, it is probably not a strong use case for blockchain

Conclusion

Blockchain has the potential to generate substantial benefits for companies in the chemicals and petroleum industry. IBM understands the complexities of supply chain relationships in the chemicals and petroleum industry. Blockchain solutions create an opportunity to become more productive now and derive even greater benefits with the imminent increase in adoption.

Blockchain technologies enable faster, permissioned, immutable, transparent and auditable business-to-business transactions among participants in the network and their suppliers, distributors and partners.

Chemicals and petroleum industry executives need to understand how best to extract value from blockchain technologies and develop an adoption strategy. Blockchain adoption across the chemicals and petroleum industry and strategic ecosystem suppliers has the potential to transform how companies work across operations on a global industry scale, delivering meaningful value for every participant in the supply chain network.

Why IBM?

As one of the world's leading innovation companies, IBM was one of the first to build a blockchain specifically for business and the first to launch highly secure blockchain services that address regulatory compliance across financial services, government and healthcare industries. We strongly believe in the value generation potential of blockchain and use it in our own IBM Global Financing business. The results speak for themselves; IBM Global Financing freed up 40% more capital and decreased dispute resolution time from 75% with our solution. Now we are combining our blockchain capabilities with our deep industry expertise to help you achieve similar results. We are already working with multiple clients around the world in the Chemicals and Petroleum Industry on the development of their projects and production deployment strategies. Clients choose IBM because we are the only company who can bring together deep industry and process expertise with our cloud-based tools and secure blockchain services to establish trusted blockchain networks and solutions.

For more information

To learn more about blockchain in the chemicals and petroleum industry, please contact your IBM representative or IBM Business Partner, or visit: ibm.com/blockchain

About the authors

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Luq is the Global Managing Director for Chemicals & Petroleum Industries responsible for industry strategy, solutions, offerings, alliances, centre of excellence, eminence and senior talent for the global Chemicals & Petroleum team serving major clients and key geographies across all IBM lines of business. Luq is also a member of the IBM Global Management Board for Industries.

Luq has over 23 years of experience in Communications, Industrial and Public Sector clients with a track record of large scale business and technology transformations for both multinational and national clients with a primary focus on network, asset and customer service transformation particularly with Energy & Utilities, Oil & Gas and Telco & Media companies. His experience includes industry and company transformation, business process and organisation change, programme and project management and the full range of IT advisory, consulting and systems delivery work including outsourcing.

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Sources

1. [coindesk.com](https://coindesk.com/state-of-blockchain-q1-2016-blockchain-funding-overtakes-bitcoin/): State of Blockchain Q1 2016: Blockchain Funding Overtakes Bitcoin, May 11, 2016
2. [the-Blockchain.com/2016/10/19/oil-industry-exec-bullish-Blockchain-says-save-30-percent-supply-chain-savings](https://the-blockchain.com/2016/10/19/oil-industry-exec-bullish-blockchain-says-save-30-percent-supply-chain-savings)



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