EY Global Blockchain Summit

San Francisco, CA

April 26, 2017

EY
Building a better
working world

How blockchain is changing finance

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What is blockchain and what does it allow us to do?

> "Blockchain is a **distributed infrastructure technology** held collaboratively that enables a decentralized exchange of trusted data. It uses cryptography to allow each participant on the network to manipulate the ledger in a secure way **without the need for a central authority.**"

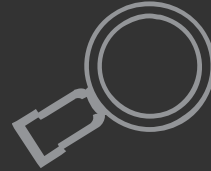Rajat Kapur, Senior Manager, Ernst & Young LLP

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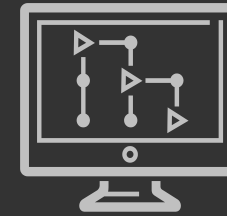# Finance-specific challenges addressed by blockchain
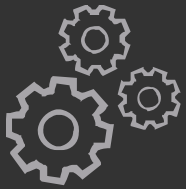
Manual processes

A great number of processes are still in paper form, opening the door to unnecessary operational risks.

Lack of transparency

The mixture of manual, siloed systems and disorganized data creates databases with few actionable insights and creates analysis paralysis.

Disorganized compliance data

Data is not transferred between departments and organizations efficiently, resulting in unreliable customer due diligence.

Siloed systems

Trading, order management and settlement processes are housed in separate systems, in addition to multiple copies of shared ledgers, leading to time-consuming and expensive reconciliation processes.

Cybersecurity risk

Legacy systems give rise to cybersecurity risk as a result of segmented IT infrastructure. A hack into just one back door can compromise the whole organization.

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What is the value of distributed ledger technology in finance?

Distributed ledger and blockchain technologies can be the solutions to many problems faced by our clients.

▶ Blockchain technologies enable storage of data at the record level (transaction) in an immutable shared database, while allowing users to access and validate data with minimal effort.

▶ Distributed infrastructure is technology that allows the distribution of trusted value transfer and execution — the disintermediation of intermediaries — when the network becomes the intermediary.

Characteristics of distributed infrastructure

Characteristics specific to blockchain technology

Provable transactions

Digital identity

Autonomous executions

Immutable golden source

Transparent

Rapidly scalable

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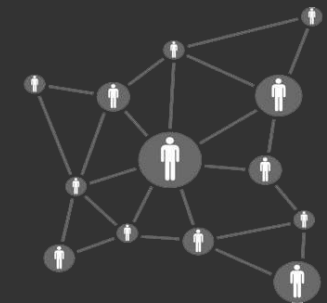
Use case
Current state process: billing (accounts receivable)

Example

ABC Telecommunications sells a smartphone to a customer for US$300.
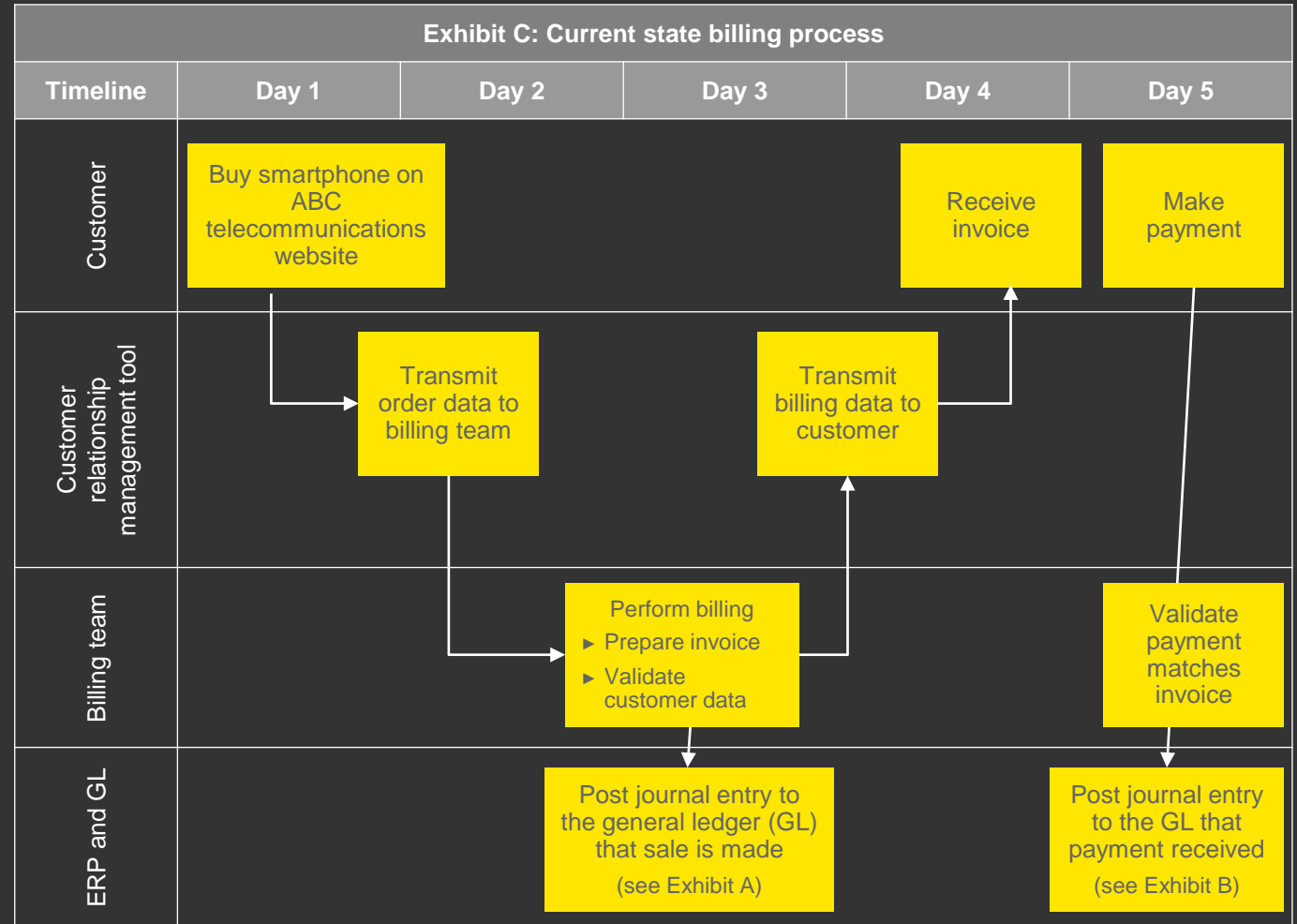The cost to sell this smartphone is US$50.

Exhibit A: Sales journal entry

Date	Account	Debit	Credit
3 April 2017	Accounts receivable	US$300	
	Cost of goods sold	US$50	
	Revenue		US$300
	Inventory		US$50

Exhibit B: Receive payment journal entry

Date	Account	Debit	Credit
8 April 2017	Cash	US$300	
	Accounts receivable		US$300

Exhibit C: Current state billing process

Timeline	Day 1	Day 2	Day 3	Day 4	Day 5
Customer	Buy smartphone on ABC telecommunications website			Receive invoice	Make payment
Customer relationship management tool	Transmit order data to billing team		Transmit billing data to customer		
Billing team		Perform billing ▸ Prepare invoice ▸ Validate customer data			Validate payment matches invoice
ERP and GL		Post journal entry to the general ledger (GL) that sale is made (see Exhibit A)			Post journal entry to the GL that payment received (see Exhibit B)

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Use case
Future state process: billing (accounts receivable)

Journal entries do not change but the process and timing to "complete" transactions change significantly.

Approach	Exhibit D: Future state billing process		
Leverage blockchain (distributed ledger) technology, particularly immutable record-keeping, enhanced data security, and smart contracts functionality to generate invoice and confirm payment	**Timeline**	**Day 1**	
	Customer	**1** Buy smartphone on ABC telecommunications website — ***Seller initiates a new smartphone invoicing contract with customer:*** *all parties transparently edit and update*	**4** Receive confirmation of sale and payment
	Blockchain invoice software	***Copies of smartphone invoice are held by both parties:*** *all parties have a copy of distributed ledger, with smart and secure permissioning, only invoice information relevant to each party visible* — **2** Validate identities / Raise disputes — **3** Validate consensus / Publish confirmation	**4** Receive confirmation of sale and payment
	Billing team ERP and GL	***When payment is made, everyone aware:*** *with smart contract technology, invoice terms set and connected to bank payment network* — **ERP interface exists:** transactions translated into journal entries that automatically can be posted	**5** Post journal entry to GL that sale made and payment received (see Exhibits A and B)

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Billing use case
Benefits of utilizing blockchain technology for billing

Automate invoicing in an easier, cheaper, faster and more transparent way

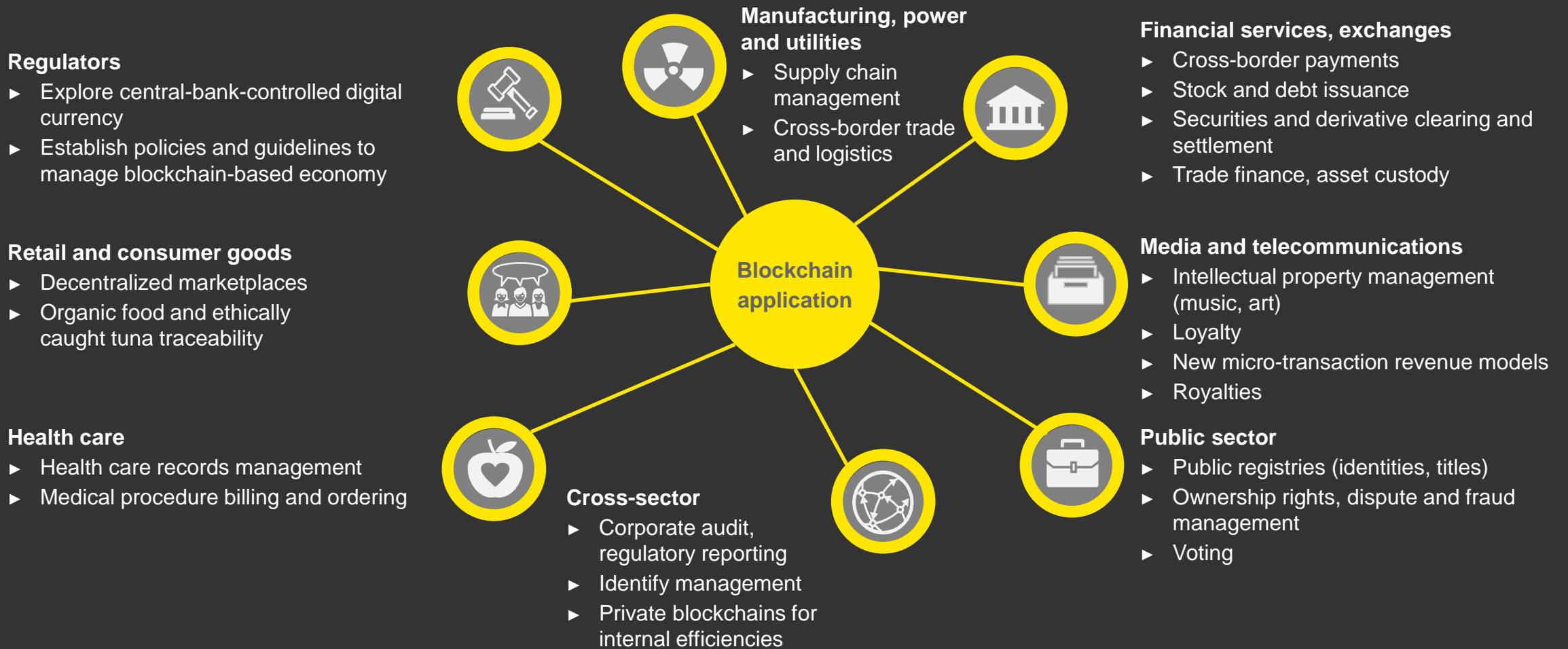| **Blockchain invoicing software is ERP or accounting system agnostic**	**Seamlessly issue and reconcile invoices in real time**	**When payment is made, everyone is aware**	**Invoices can be bought and sold in market**
Software functions as a blockchain service layer that connects to ERP. Companies can use blockchain software without changing front-end ERP systems.	The smart contract functionality of distributed ledger technology enables automatic reconciliation of payments to corresponding invoices.	With smart contract technology, invoice terms are set and connected to the bank payment network. Once the bank confirms the payments, invoices are automatically settled.	Now businesses can more easily offer their invoices for sale on the global factoring market and receive payment based on agreed-upon terms.

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Multiple use cases across industry sectors

Regulators

- ▶ Explore central-bank-controlled digital currency
- ▶ Establish policies and guidelines to manage blockchain-based economy

Retail and consumer goods

- ▶ Decentralized marketplaces
- ▶ Organic food and ethically caught tuna traceability

Health care

- ▶ Health care records management
- ▶ Medical procedure billing and ordering

Manufacturing, power and utilities

- ▶ Supply chain management
- ▶ Cross-border trade and logistics

Cross-sector

- ▶ Corporate audit, regulatory reporting
- ▶ Identify management
- ▶ Private blockchains for internal efficiencies

Financial services, exchanges

- ▶ Cross-border payments
- ▶ Stock and debt issuance
- ▶ Securities and derivative clearing and settlement
- ▶ Trade finance, asset custody

Media and telecommunications

- ▶ Intellectual property management (music, art)
- ▶ Loyalty
- ▶ New micro-transaction revenue models
- ▶ Royalties

Public sector

- ▶ Public registries (identities, titles)
- ▶ Ownership rights, dispute and fraud management
- ▶ Voting

Blockchain application

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Summary: what it is and what it allows us to do

Blockchain is a **decentralized** ledger that keeps a record of each transaction that occurs across a **peer-to-peer network.**

It allows us to:

1

Store digital records

Blockchain allows control of information through secure, auditable and immutable records of transactions and assets.

2

Exchange digital assets

Users can issue new assets and transfer ownership in real time without banks, stock exchanges or payment processors.

3

Execute smart contracts

Self-governing contracts simplify and automate lengthy and inefficient business processes.

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Use
Blockchain use cases in finance should be explored

Treasury	The corporate treasury function can be transformed by implementing a blockchain-based clearing and settlement function within the company's financial network. The immutable nature of such a network lends **huge credibility to financial risk management, while effectively managing cash flow based on up-to-date financial numbers.**

Contracting	Using a digitized contracting system, two anonymous parties can **trade and transact without the involvement of a middleman** or a trusted party. This, in turn, this helps reduce or eliminate costs associated with monitoring and enforcement.

Cost allocation	Blockchains with inbuilt smart contracts capabilities enable **financial applications to allocate costs on a real-time basis,** eliminating the long, manual and error-ridden process, thus improving efficiency and significantly reducing the cost of the overall function.

Property and asset management	By using a distributed ledger, tracking the **provenance of a property can be simplified and strengthened** by transacting a digital token through the blockchain system, eliminating the chances of corruption in this transaction trail. This establishes the authenticity of the certificates, enabling buyer trust and eliminating provenance checks.

Intercompany	A key application of blockchain for intercompany transactions would allow **instant transactions with immutable documentation.** This would simplify the intercompany transaction process, **automating dispute resolution and eliminating manual the invoicing process.**

Identity management	Blockchain provides an attractive platform to manage vulnerable peer-to-peer assets, such as identities. The **inherent fraud management capabilities** of blockchain, through hardened cryptography and distributed ledgers, allow for an easy and secure way to share digital identities.

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Use case
Smart contracts: cost management example

Step 1: Smart contracts
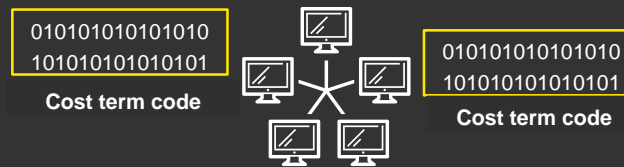
Public ledger

Finance and IT — Manufacturing

Transcribe a cost allocation agreement into a smart contract between parties at the beginning of the year (**set rules, i.e., smart contracts**).

► The contract that includes cost allocation terms and logic is communicated to all parties.

► The smart contract is agreed and validated via a consensus vote in a blockchain network and stored in each node as a hash.

The smart contracts enable:

► Consensus-based validation

► Standardization and storage in all nodes

Step 2: Allocate costs

010101010101010
101010101010101
Cost term code

010101010101010
101010101010101
Cost term code

The IT department incurs the cost and allocates the cost at the end of the period to all departments, e.g., allocates $5m in costs based on the smart rule to the manufacturing, sales, finance and treasury departments.

► Sends the allocation transaction via blockchain network for validation with set rules

► **Validation can be manual or automated,** based on how it is set up

Step 3: Amend contract

Expiration date February 6, 2017

Transcribe a cost allocation amendment into a modified smart contract between parties (**modify set rules, i.e., smart contracts**).

► Contract amendment that includes new or modified cost allocation terms and logic communicated to all parties

► **Modified smart contract** agreed and **validated** via consensus vote in blockchain network and **stored in each node as a hash**
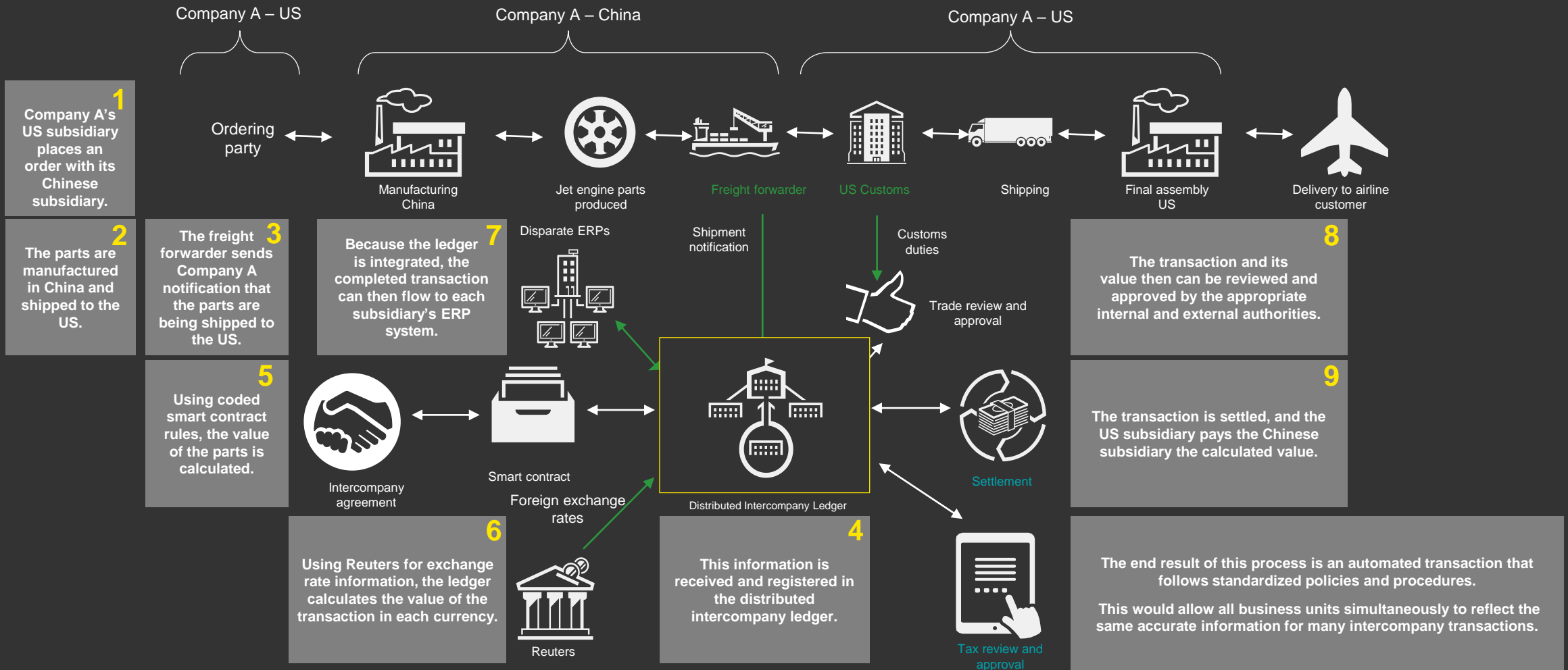

Benefits of smart contracts

1. **Low contracting**, **enforcement and compliance costs** make contracting viable for even low-value transactions
2. **Maximized transparency** of cost and profitability
3. **Limited complexity**, enabling informed decision-making
4. **Improved accuracy** of cost assignments

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Intercompany transactions require consistent documentation and instant settlement that could be enabled through blockchain.

| Typical intercompany issues	Blockchain-enabled functionality	Description of use case
Manual intercompany invoicing and payment procedures Lack of materiality thresholds for intercompany allocations and journal entries Inconsistent global intercompany processes due to fragmented ownership Manual Excel modeling and calculations Foreign currency exchange considerations	**Smart contracts**	Using smart contract functionality, an organization could establish automated intercompany transaction processes. These contracts could have pre-developed processes, transaction thresholds and use "oracles" (e.g., Reuters to inform exchange rates) to reduce manual calculations.
High volume of intercompany transactions Use of disparate ERP systems Inaccurate business unit reporting due to intercompany transfer allocations and timing Poor intercompany compliance High volume of imbalanced transactions at period-end due to differences in timing at end of transaction	**Distributed ledger with immutable record**	Taking advantage of a single immutable record distributed across all nodes of the network, an organization could eliminate imbalanced transactions and discrepancies between different ERP systems. This would enable more accurate and timely reporting and improve compliance.

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This walk-through provides an example of blockchain use through operational intercompany transactions.

Company A – US

Company A – China

Company A – US

Ordering party

Manufacturing China

Jet engine parts produced

Freight forwarder

US Customs

Shipping

Final assembly US

Delivery to airline customer

1 Company A's US subsidiary places an order with its Chinese subsidiary.

2 The parts are manufactured in China and shipped to the US.

3 The freight forwarder sends Company A notification that the parts are being shipped to the US.

7 Because the ledger is integrated, the completed transaction can then flow to each subsidiary's ERP system.

Disparate ERPs

Shipment notification

Customs duties

Trade review and approval

8 The transaction and its value then can be reviewed and approved by the appropriate internal and external authorities.

5 Using coded smart contract rules, the value of the parts is calculated.

Intercompany agreement

Smart contract

Foreign exchange rates

Distributed Intercompany Ledger

Settlement

9 The transaction is settled, and the US subsidiary pays the Chinese subsidiary the calculated value.

6 Using Reuters for exchange rate information, the ledger calculates the value of the transaction in each currency.

Reuters

4 This information is received and registered in the distributed intercompany ledger.

Tax review and approval

The end result of this process is an automated transaction that follows standardized policies and procedures.

This would allow all business units simultaneously to reflect the same accurate information for many intercompany transactions.

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This complete system would require a high degree of integration and investment in blockchain architecture.
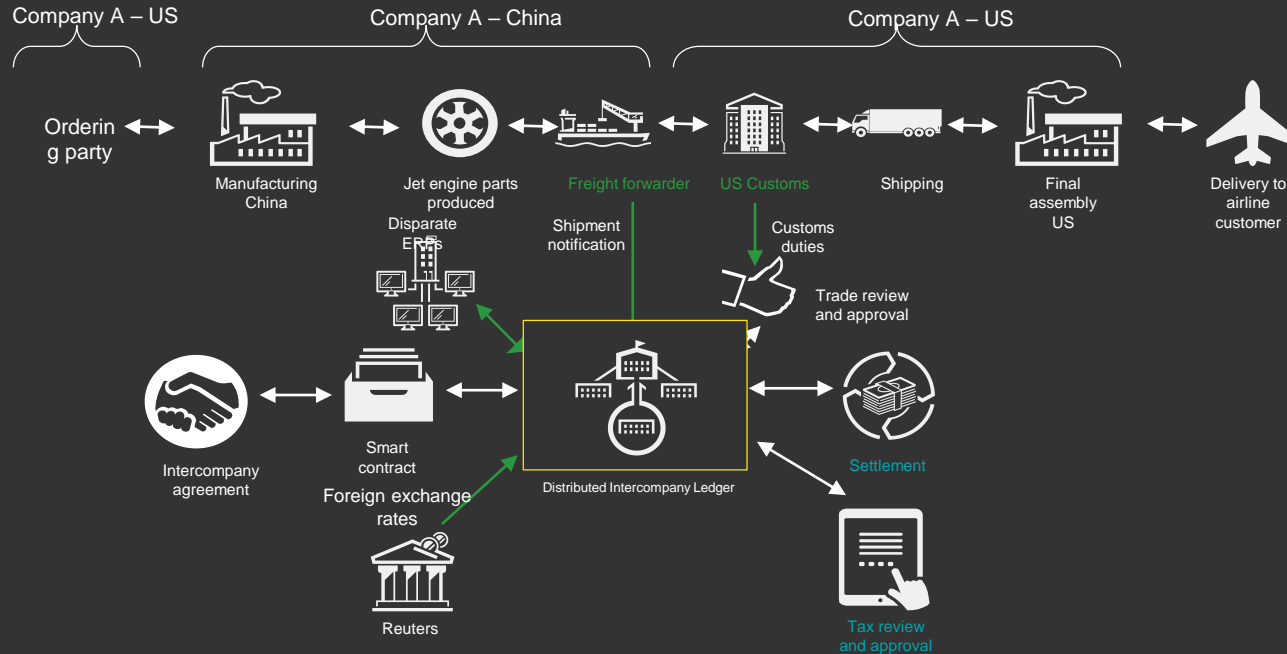
Technical architecture
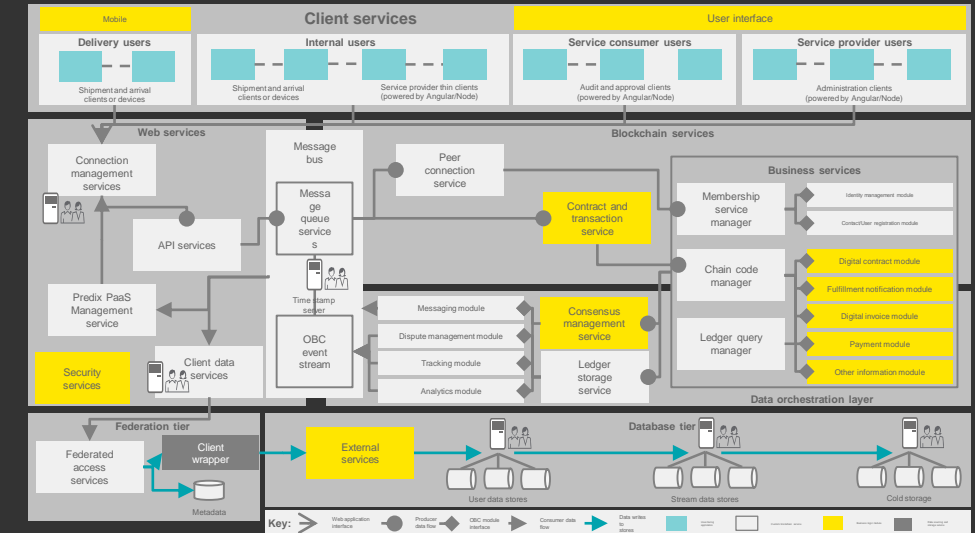
Requirements:

► A foundational private blockchain network with nodes across the company and trade partners

► Smart contract design for intercompany pricing (with possible robotic process automation support)

► Integration with third-party systems

► Integration with disparate ERP systems

► Integration into external reporting systems

Blockchain's impact on ERP
Is blockchain here to replace ERP?

To understand the difference between ERP and blockchain, it is essential to understand the architectural construct of enterprise applications.

Business processes	Activities that leverage multiple applications to accomplish a particular goal
Applications	End-user programs that rely on database technology to store information
Databases	Single source of truth of enterprise data used across functions and departments
Network	Communication between components at the physical level; to communicate, servers and computers must agree on similar protocol
Physical	Fiber-optics cables, servers, hardware storage modules, computers and other hardware

Architectural view of enterprise applications

An ERP application integrates the management of all major business processes in an enterprise.

It uses a database management system to provide a single source of truth. There are multiple database technologies that can be used to support any ERP application.

Traditionally, relational databases have been used to support the ERP applications.

Blockchain technology lives in the layer served by databases. ERP applications can use their inherent capabilities to maintain an immutable, single source of truth just like traditional databases.

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Do enterprises need to replace their ERP systems to reap the benefits of blockchain technology?

Blockchain resides at the edges of ERP applications, enabling enterprises fully to utilize blockchain's benefits without changing their existing ERP infrastructure. This can be accomplished easily by establishing an Application Programming Interface layer between the node and the database. Each participant or node on the network maintains its own copy of the transaction ledger, which can be used as an input on the database layer.

Blockchain network

Flat file data output

Data export

Application Programming Interface

Business processes

Applications

Databases

Network

Physical

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Questions and answers

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Appendix

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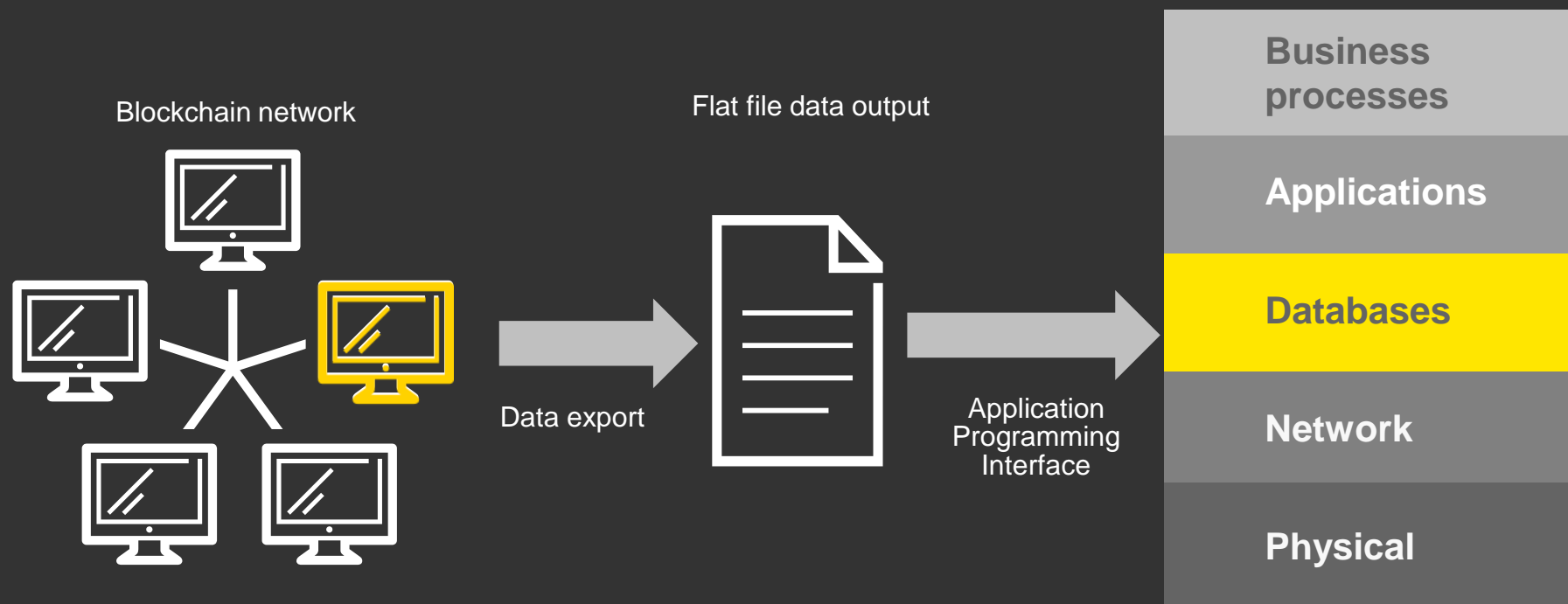
EY's point of view about how blockchain could impact the CFO

CFO execution role:

► Blockchain's distributed nature **decreases the opportunity for fraud or reporting inaccuracy.**

► The immutable transaction history provides a **single documentation trail** that will streamline the audit process and allow for greater focus on systems and controls.

► The centralized data source will allow for **greater reporting speed and validity** for both internal and external stakeholders.

CFO enablement role:

► A distributed ledger will allow for more **efficient and transparent intercompany transactions** that are settled simultaneously.

► **Less manual attention** will be needed for reconciliation and consolidation processes, allowing for a more efficient finance function.

► Blockchain's data trail will allow for more **accurate monitoring** of transactions, balances and project results.

CFO development role:

► With improved efficiency and strategic analysis, the finance function will be able to **devote more time and attention to organizational strategy.**

► With some public transactions and improved audit approaches, the CFO will be able to **communicate to the marketplace more quickly and with more clarity and transparency.**
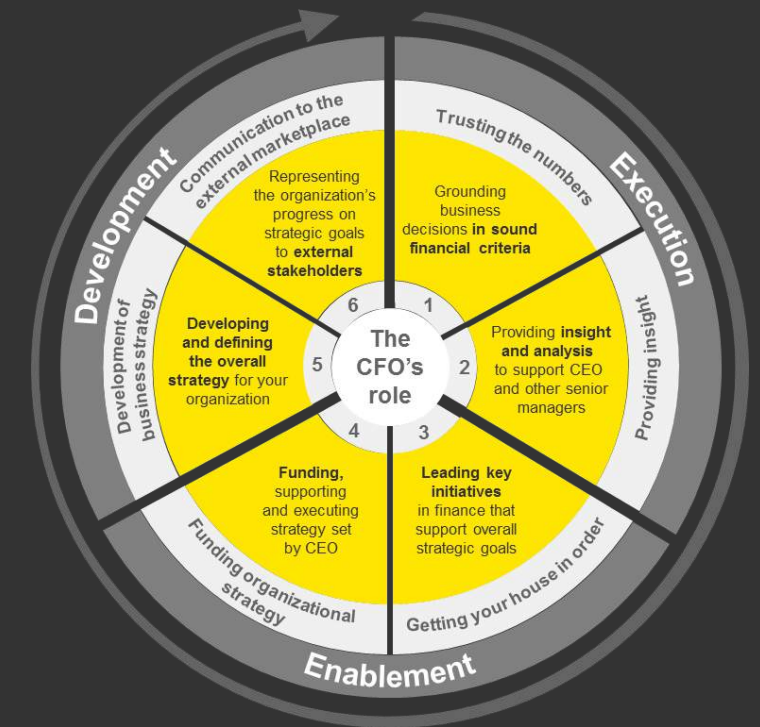
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