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Blockchain for Manufacturing – The Future of Distributed Manufacturing

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A Distributed Manufacturing Vision

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Trust is the foundation of our business relationships. Today we pay a high cost to achieve trust in terms of time and money. Our 20th centralized century model does not fit the decentralized, distributed reality of the 21st century.

What would happen if we could encode trust into a digital infrastructure that eliminated the high financial costs and inefficiencies we live with today?

In a manufacturing context that would mean the following...

- **Boost innovation and economic development** by enabling entrepreneurs in even remote areas to monetize their ideas.
- **Slash inventory costs and service times** by enabling companies to print parts on a just-in-time basis.
- **Automate trade finance processes** via smart contracts from inside the supply chain.
- **Speed the flow** (and reduce the cost) of new products.
- **Create new market opportunities** and increase market efficiencies by facilitating mass customization of products and smaller production runs.
- **Monetize local overcapacities globally** by trading manufacturing flexibilities.

For a moment let's assume this has already happened. What might this future look like?

Distributed Manufacturing in 2020

The leaders who took the first steps to change their business models and adopt new distributed ledger technology have begun to reap rewards.

At the heat of this bold leap is a change in business models & relationship. The leaders understand the greatest source of value comes from the ability to manage secure digital assets related to the manufacturing process.

Distributed Manufacturing in 2020

Competitive advantage comes from new “pure digital” capabilities powered by a distributed ledger technology that enable:

- Secure Digital Intellectual Property
- Automated business negotiations encoded into the digital assets themselves
- Frictionless payments negotiated by “smart contract”
- Immutable provenance and authenticity documentation

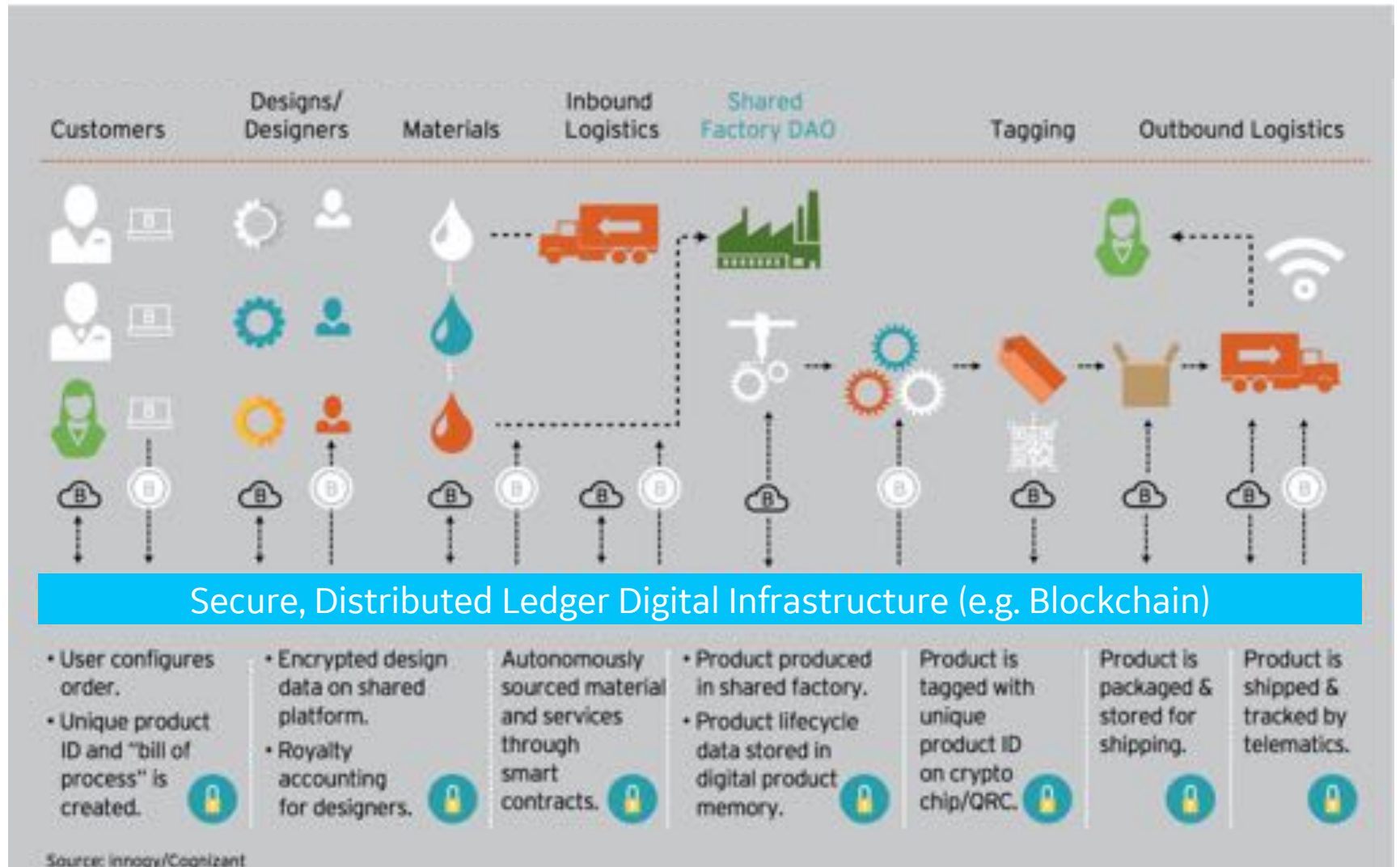
Distributed Manufacturing in 2020

Beyond just digital capabilities, the head of the pack learned that their new “trust” enabled digital infrastructure allows them to create relationships with smaller more nimble entities.

The design of physical products moves outside the factory and became scattered across the globe. The ability to transact in digital files that contain all the information necessary to create a product means factories can sell “manufacturing cycles” similar to cloud computing providers sell “compute cycles.”

Distributed Manufacturing in 2020

The elimination of the “trust tax” opens up a new way of doing business enabled by a new digital infrastructure that provides intelligence, security, and efficiencies across the entire supply chain.



So how do we get there?

What are the challenges & potential pitfalls?

What steps might we take today?

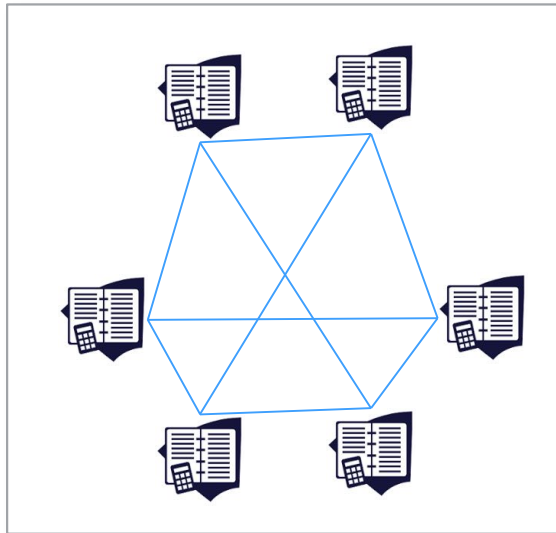
Blockchain Overview

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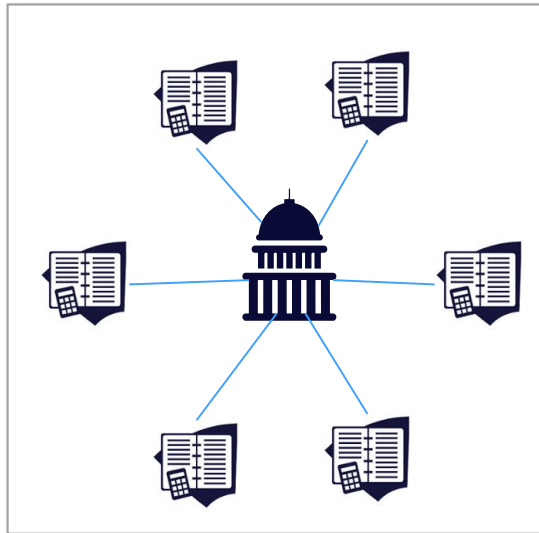
Blockchain is network database that allows disparate parties to come to an agreement

Separate Ledgers



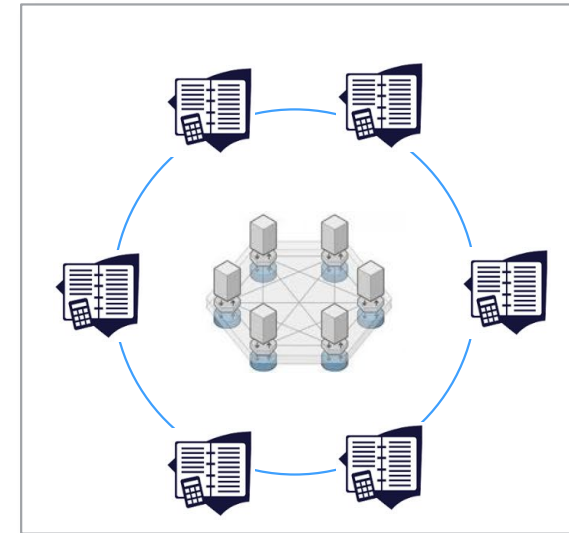
EXTENSIVE RECONCILIATION
PRONE TO ERROR

Central Ledger



INTERMEDIARY COST
SINGLE POINT OF FAILURE

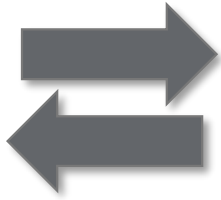
Blockchain



DISTRIBUTED
SHARED
CRYPTO SECURED
TIME SEQUENCED
IMMUTABLE

How does it work?

TRANSACTION



Unique Signature
(PKI)

BLOCK



Time sequencing

**NETWORK
CONSENSUS**



Automated reconciliation

CHAIN



Reference hash of previous
block

There isn't just one type of blockchain

Blockchain's can be transaction focused or business logic focused...

Logic Optimized

Smart Contract Enabled:

"if I delivery the shipment on time, then you pay me"

Transaction Optimized

Transfer of assets, ownership, currency, etc.

Different types of blockchains address concerns such as privacy and performance...

Public Permission Less

All unknown actors
Open to anyone

Public Permissioned

Known and unkown actors
Permission needed to post transactions

Private Permissioned

All known actors
Permission needed to view and post transactions

Decentralization



Performance



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Blockchain has the power to transform the industry, say executives...

A total of 281 respondents were surveyed, with 28% respondents from North America, and the remaining from Europe.

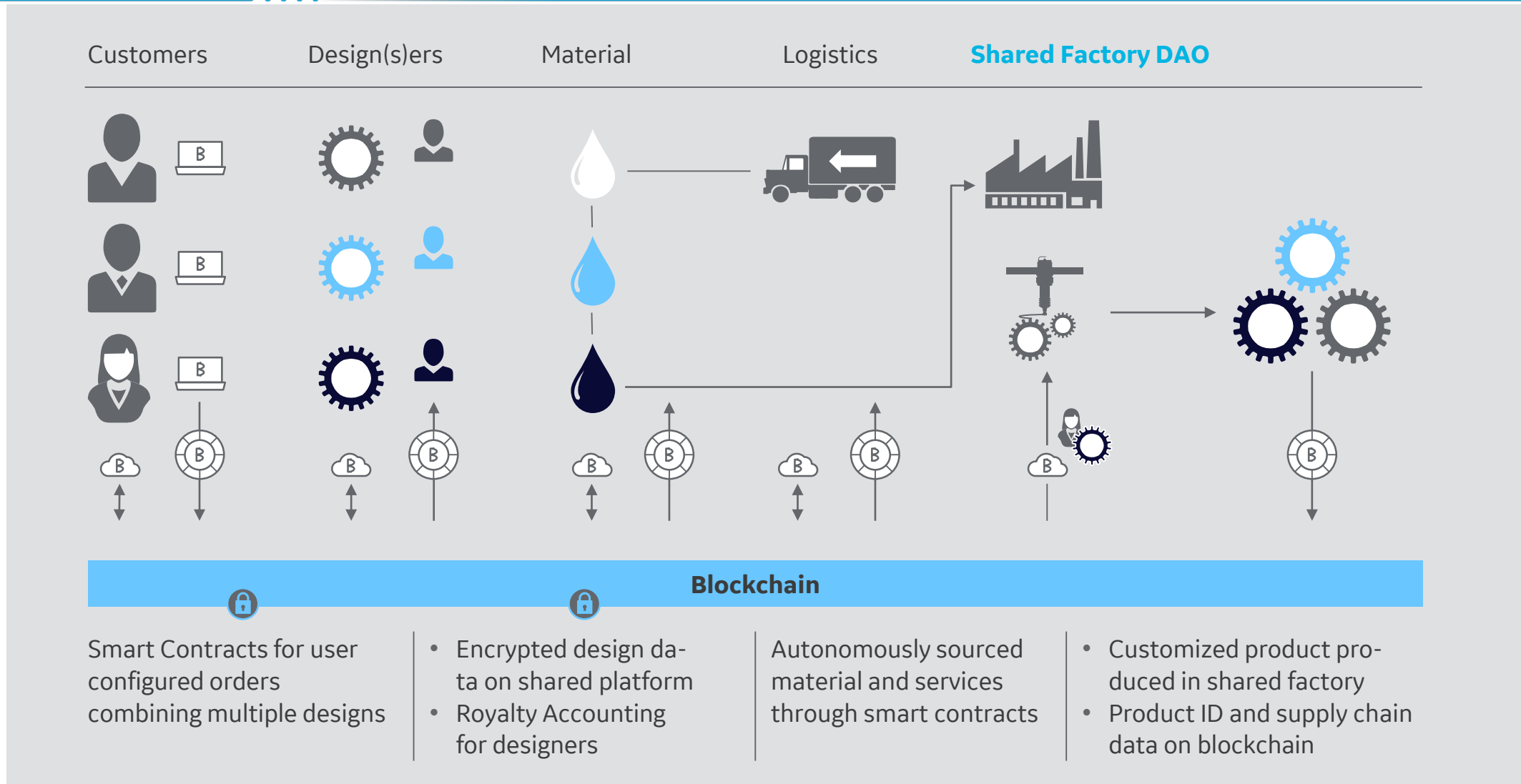
87%

BLOCKCHAIN IS CRITICAL OR IMPORTANT TO THE FUTURE OF ORGANIZATION

74%

BLOCKCHAIN IS IMPORTANT OR VERY IMPORTANT TO THE FUTURE OF THE INDUSTRY

GOT process flow/ demo



Genesis of Things

Blockchain Solution for Additive Manufacturing

Overcoming 3D Printing Market Failures



Manufacturing Closed Shop



Manufacturing 'Trust Tax'

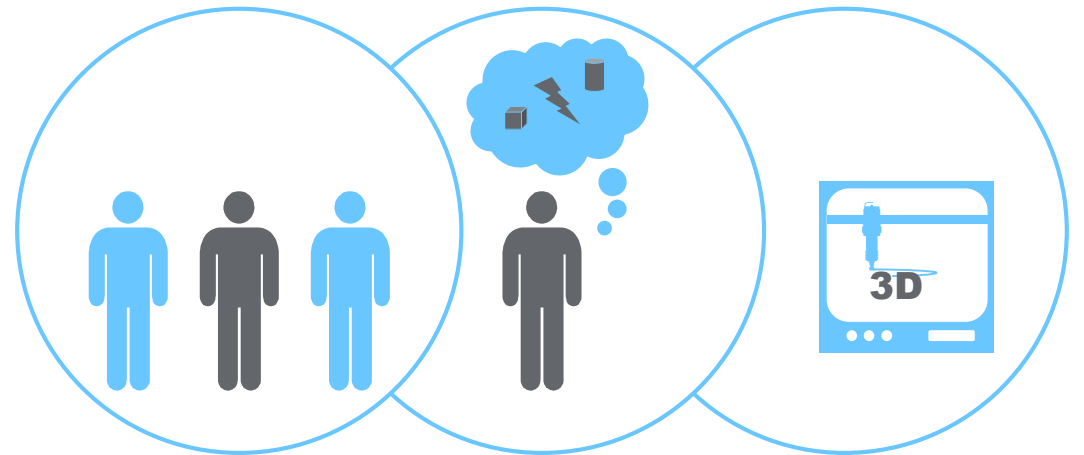


Supply Chain Transparency



IP Protection

Connecting designers, customers, and 3D printing providers for seamless manufacturing



Blockchain can bring tremendous value to the enterprise

- Cost savings
 - Process automation and disintermediation
- Operational Efficiency
 - Eliminates need for reconciliation
- Security and Authentication
 - Immutable history and visibility of transactions

Organizations are actively exploring use cases...

Product Design Equipment Maintenance *Customer Relationship*

Management Ownership tracking Inventory Management *Operations*

Improved automation of legal documents *Combating*

Counterfeiting Equipment Maintenance *Order tracking* Supply Chain Financing

Smart contract-based B2B money transfers Trade finance *Quality Control* IoT

and Blockchain *trusted telematics* Sourcing

And expect significant benefits from Blockchain adoption

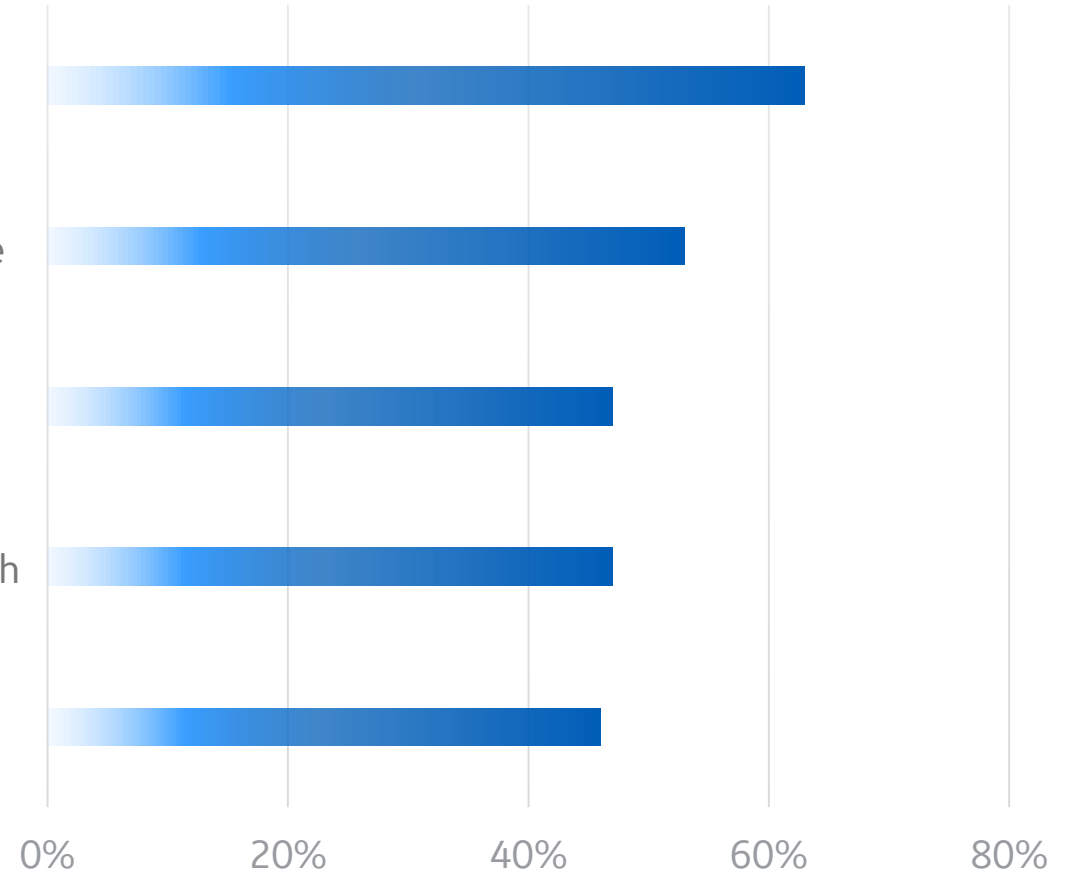
Trusted data on raw materials, production and product to reduce cost of certification, quality control, vendor selection

Elimination of non-value adding intermediaries in the global supply chain

More efficient logistics (e.g. through trusted telematics data/ track and trace)

Improved Product Lifecycle Management (PLM) through trusted data

More efficient sourcing of raw materials (e.g. through elimination of various product checks / quality controls)



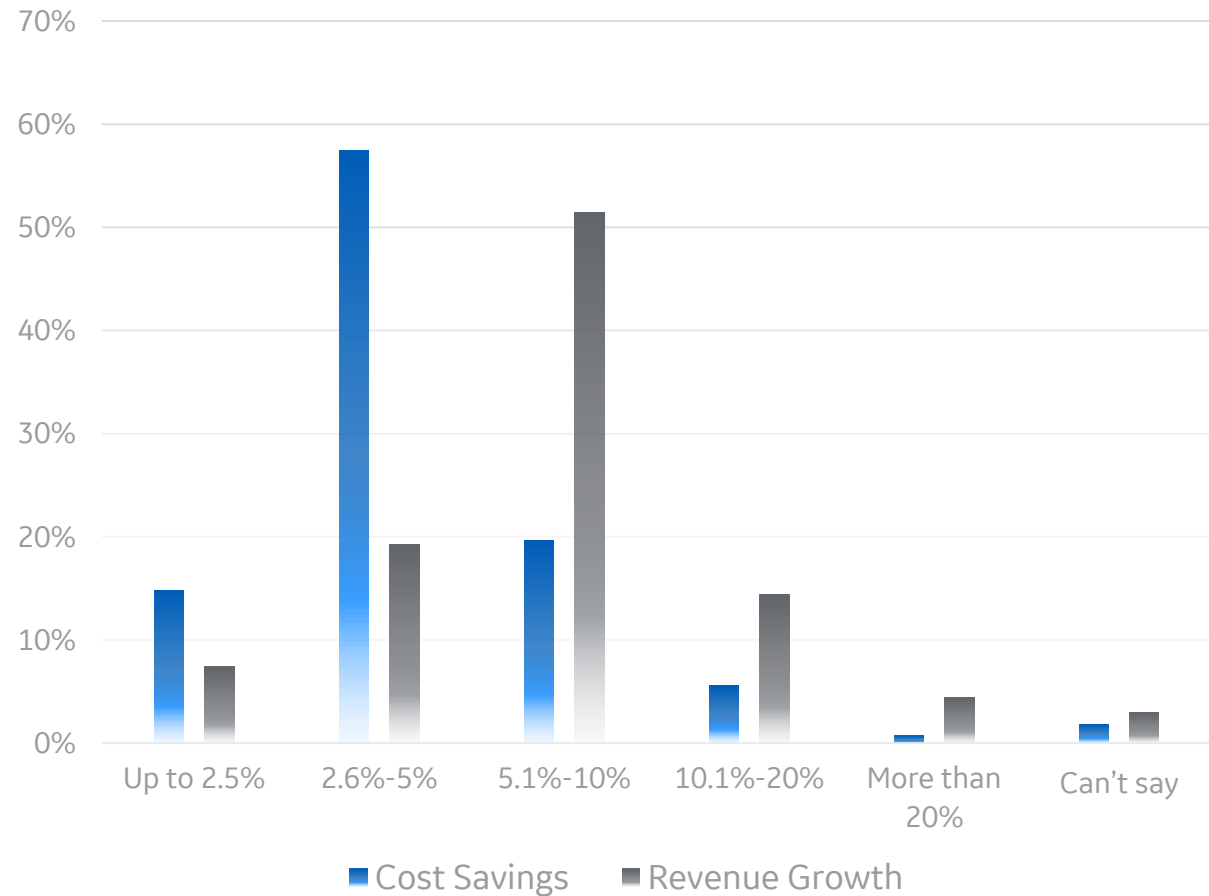
That will impact both top and bottom line

83%

EXPECT COST SAVINGS OF AT
LEAST 2.6%

70%

EXPECT REVENUE GROWTH OF AT
LEAST 5.0%



Use Case: Supply Chain Traceability



Digital Product Memory

The digital product memory would serve as the digital representation of the physical world and would contain a full “story” describing every physical product manufactured and traded. This representation could be used to significantly increase manufacturing productivity and product quality. It would also dramatically reduce the cost of tracking for warranty, maintenance and recycling purposes.

Secure Digital Product Memory on the Blockchain

Digital Product Memory (i.e. Digital Twin)

- Provenance
- Suppliers & Components
- Validation & Certification
- Manufacturing Lifecycle
- Royalty Terms Logic
- Sale Negotiation Logic
- Unique Identify
- Shipping Lifecycle
- Ownership & Chain of Custody
- Operational Data & Usage
- Repair & Maintenance
- Telematics
- Decommissioning

The creation of secure digital product memories—immutable records of everything from the source of the raw materials used, to where and how they were manufactured, to their maintenance and recall histories.

This data on a Blockchain accessible to all members of a business network (i.e. supply chain) creates the ability to transact in the data and value added services related to that data.

Smart Contracts for Manufacturing

Smart contracts—software enabled business rules— provide a host of new capabilities that open up new business opportunities and efficiencies

- **“Software-defined” manufacturing means customers don’t need to know where products are made.** Software (in the form of smart contracts) would find and finalize agreements with whichever partner offers the best combination of cost, terms and conditions, delivery dates and quality.

Considerations for Scale & Realization

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How Real is Blockchain?

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Blockchain is ramping up across industries

- Financial services (banking) are moving from POC to pilot/production stage
- Consortiums are forming around supply chain, insurance, etc.
- Manufacturing is taking first steps

Who is Best Positioned for Success

In a business network where improved access to information exists, then customers and business partners will be able to easily identify and choose the real champions.

Companies with demonstrably better products or processes for business and manufacturing are best positioned to win.

Potential Winners

- **Product and service providers in geographies with weak rule of law and intellectual property laws;** blockchain enabled governance
- **Smaller product designers, raw material suppliers and service providers;** eliminated “trust tax” and costs lower the bar to entry.
- **Aggregators and sellers of blockchain protected data on manufacturing or operations;** sell services that maximize value of products
- **Service providers for decentralized autonomous manufacturing organizations;** such as shipping, financing and 3-D printing



Who is Poised to Lose?

Any supply chain member that depends on traditional, cumbersome, opaque trust mechanisms, to hide higher hidden costs, inefficiencies, or lower quality products.

Potential Losers

- **All intermediary business services, including e-commerce aggregators that match buyers and sellers;** smart contracts replace this role
- **Lower-skilled workers on assembly line and in supporting clerical jobs;** jobs get automated
- **Higher-skilled workers, such as buyers, accountants, vendor managers, auditors and lawyers;** smart contracts take over complex negotiation, tracking, and verification processes
- **The authority of financial, auditing and related institutions as payment assurance;** payment processes move to the blockchain

Evaluate your Readiness for Distributed Manufacturing

Where in the value chain – both internally and externally – is my organization paying the highest “trust tax” in terms of excess cost, effort or lack of agility?

Which types of partners, in what geographies and expertise areas, could my company benefit from working with, if only the transactional costs and efforts were lower?

How would the availability of a digital product memory drive value for us, our customers and our business partners?

Which information assets (e.g. manufacturing, maintenance, operational data, usage information) about my organization’s products could we monetize if there were a secure way to do so?

What does this mean for your organization?

1. Prepare for the **cultural shift**
2. Educate yourself and develop **skills and capabilities**
3. Experiment with the **business need first approach** – do not get locked into any particular platform

***Future of manufacturing is shared and distributed...
Don't get left behind!***

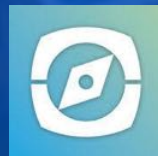
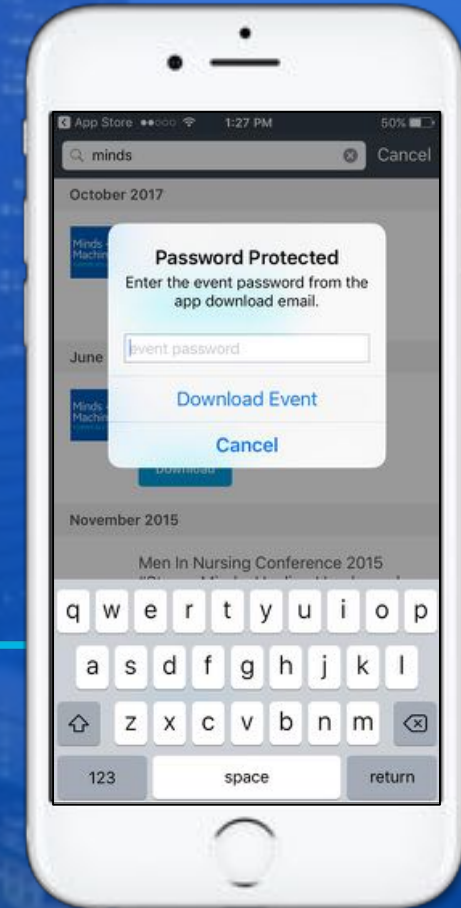
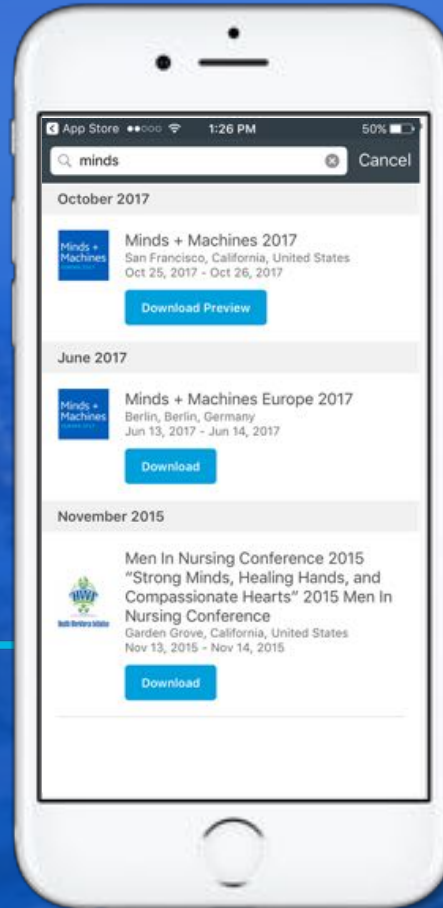
An aerial night view of a city skyline, likely San Francisco, with a blue overlay. The image shows various skyscrapers and buildings, with some lights visible. The text "Thank You" is prominently displayed in the center-left.

Thank You

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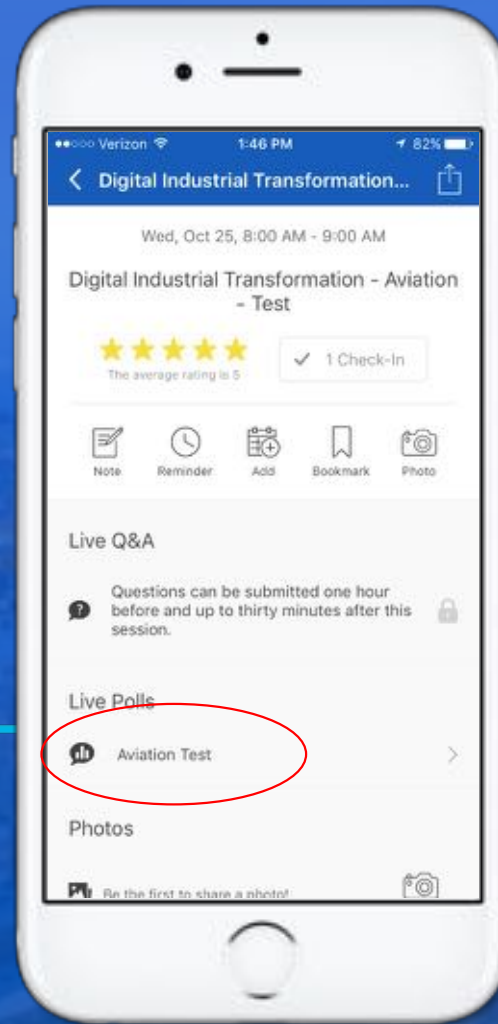


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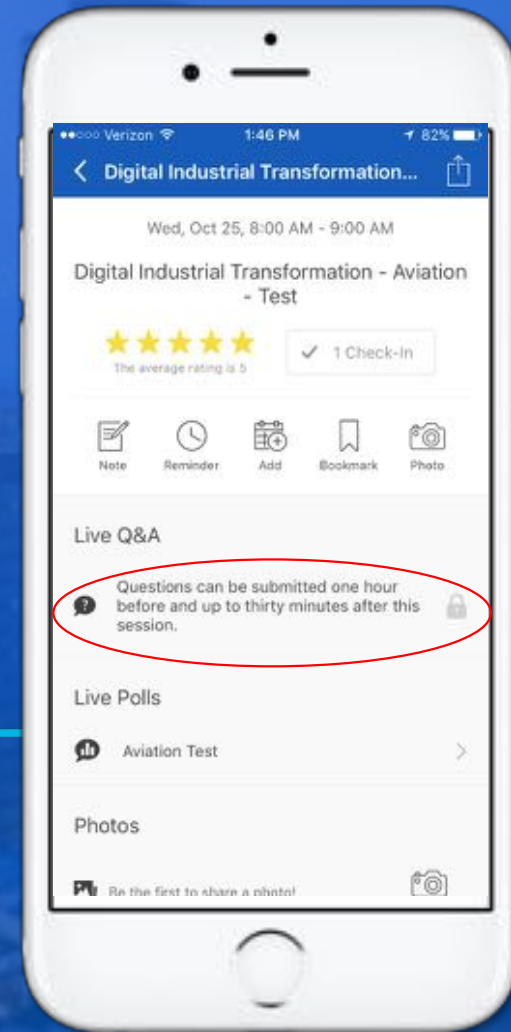


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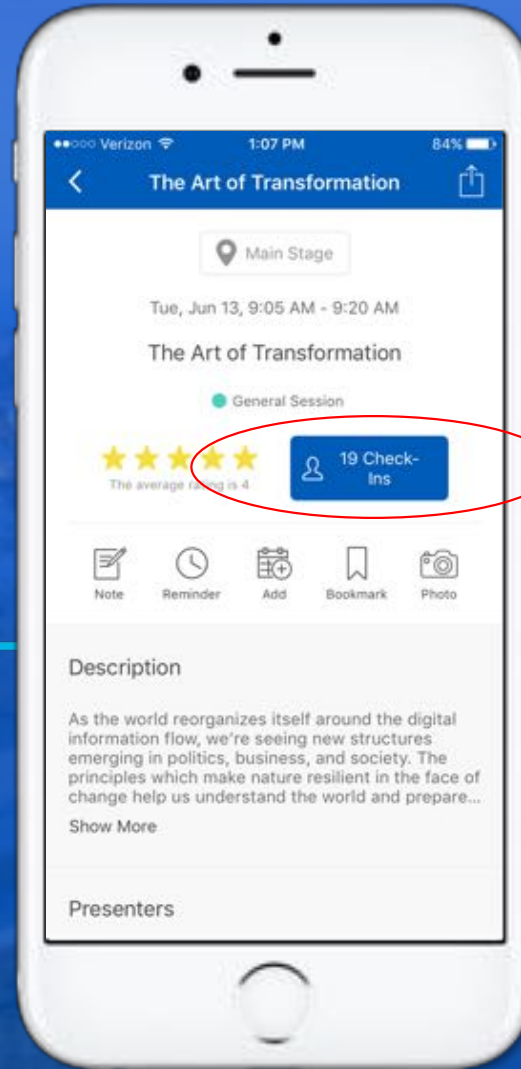


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