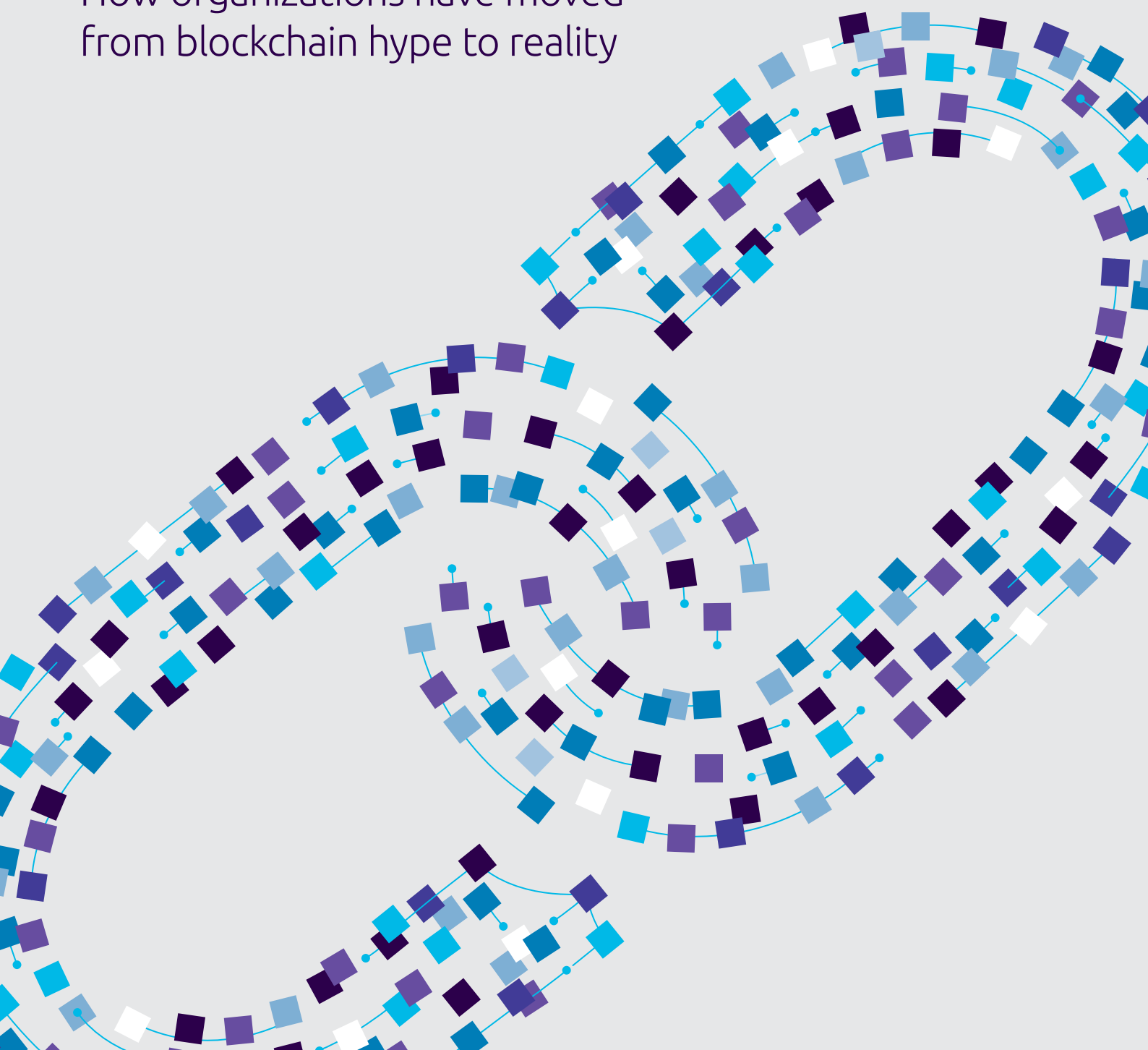


Does blockchain hold the key to a new age of supply chain transparency and trust?

How organizations have moved from blockchain hype to reality



Introduction

The management of today's complex, global supply chains is a daunting task. It is this complexity, and the need for much greater transparency, that is creating such interest in the application of blockchain to supply chains. It offers an opportunity to tackle some of the perennial issues that compromise supply chain effectiveness, such as the lack of traceability.

To gain a deeper understanding of blockchain maturity in the supply chain domain, and to identify use cases for different sectors, we surveyed nearly 450 organizations. These organizations from across the manufacturing, consumer products, and retail industries have blockchain implementations underway at the proof-of-concept, pilot, or at-scale stage. We assessed their approach to blockchain, the applications they are implementing, and the challenges they face in scaling their initiatives, with this report looking at three main areas:

1. How blockchain can help organizations tackle key supply chain issues, and the state of blockchain maturity in terms of the deployment of this technology today
2. The applications that are gaining traction and some real-world examples of deployment
3. The key best practices for a resilient blockchain program

Using blockchain to tackle supply chain pain points

Between September 2013 and early 2016, several people in the United States were infected with strains of listeria bacteria. It took significant time for the strain to be identified and linked to the supplier. As time passed, more people were affected.¹ It was only in April 2016 that the supplier announced a voluntary recall of certain frozen food products in cooperation with the Food and Drug Administration (FDA) and the Centers for Disease Control and Prevention (CDC).

This recall was later expanded to include 358 products sold under 42 brands.²

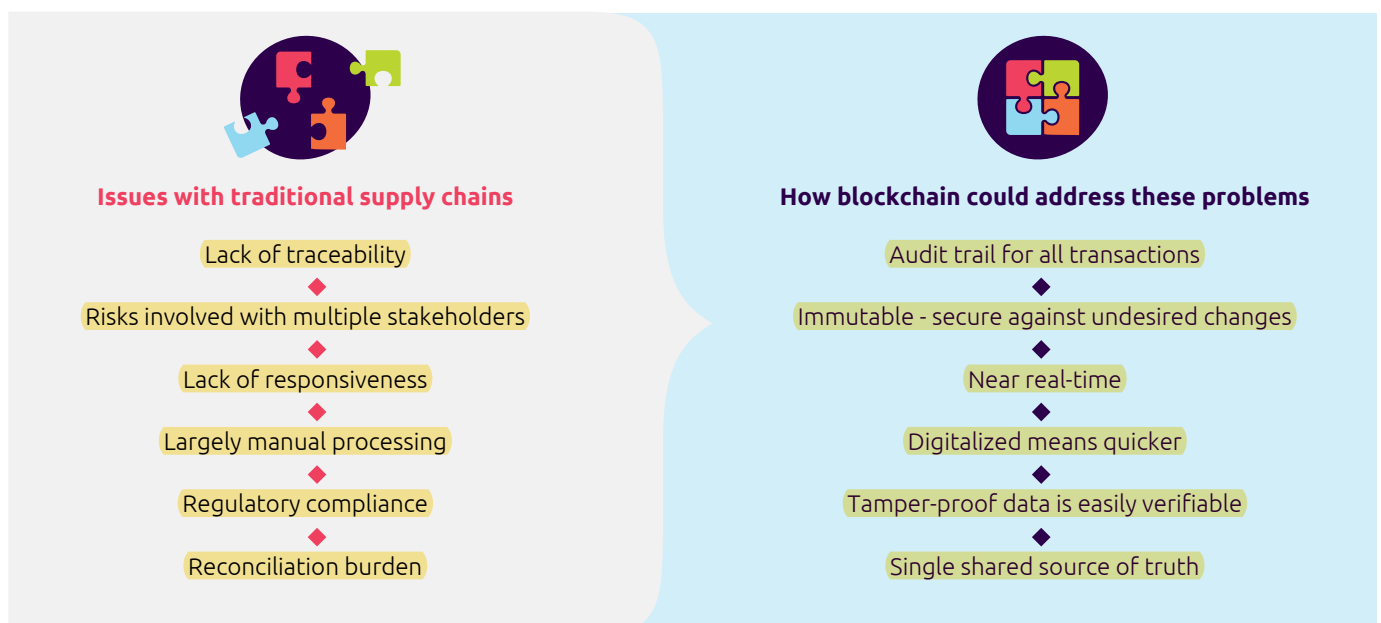
This incident highlights how important it can be to be able to trace a finished product to its origin and the various points of intervention as quickly as possible.

Blockchain: a unique solution for traditional supply chain challenges

As Figure 1 shows, blockchain can address a range of supply chain issues, such as traceability. As the listeria example illustrates, companies can struggle to identify contaminated products. It is estimated that a typical beverage recall can cost

the manufacturer close to \$8 million.^{3,4} In 2017 alone, a total of 456 food recalls were recorded in the United States, which would put the total cost at more than \$3.5 billion.

Figure 1. How blockchain can address issues hampering the supply chain



Source: Capgemini Research Institute.

Blockchain's ability to track products can improve crisis-handling. If a group of consumers fall ill in the same area, the common products they bought and the retailers they bought them from can be analyzed. Once the product responsible is identified, blockchain can be used to check the audit trail, including the origins of its ingredients and the ingredient that is causing the issue. With the source of contamination identified, the authorities can track all other products that use the same ingredients, focusing the recall on what matters.

Illustrating the speed that is possible, Walmart's blockchain pilot in China enabled them to trace a package of mangoes from store to farm in a few seconds. Previously, this would have taken days or weeks.⁵ Frank Yiannas, vice president, Food Safety at Walmart explains: "Blockchain technology enables a new era of end-to-end transparency in the global food system. It allows all participants to share information rapidly and with confidence across a strong trusted network. This is critical to ensuring that the global food system remains safe for all."⁶

Europe's largest retailer, Carrefour, is also using blockchain technology to trace the production of free-range chicken in the Auvergne region of central France: "Consumers can use a smartphone to scan a code on the package to obtain information for each stage of production, including where and how the chickens were raised and what they were fed as well as where the meat was processed."⁷

As well as assuring the provenance of goods, which the Walmart and Carrefour examples illustrate, blockchain has further applications across various stages of the supply chain that help eliminate points of failure and enhance trust, transparency, and security. In addition to these benefits, the decentralized and autonomous blockchain model makes it an ideal foundation for other technological disruptors such as Internet of Things (IoT) and Artificial Intelligence (AI).

“Blockchain technology enables a new era of end-to-end transparency in the global food system.”

Frank Yiannas

vice president, Food Safety at Walmart





Blockchain technology for enterprise supply chain

Blockchains are one form of distributed ledger technology (DLT). A distributed ledger is a decentralized, shared, immutable distributed database of transactions. While there are many applications of blockchain and

other distributed ledger technologies in supply chain, organizations need to pay attention to the following key areas before going ahead with an enterprise implementation:

i. Public or permissionless versus private or permissioned

In a public or permissionless DLT, anyone can join, write data to, and transact in the network. A private or permissioned DLT restricts who can access the network. Whilst both public and private DLT/blockchains have similar characteristics, because they are both decentralized, peer-to-peer networks where each participant maintains a replica of a shared ledger (thereby guaranteeing the immutability of the ledger), when it comes to supply chain, the nature of B2B business models demands a private or permissioned blockchain. For enterprise use, private or permissioned blockchains also offer greater scalability because they use consensus mechanisms that are computationally inexpensive compared to the computational power required by public blockchain to achieve consensus.

When building such a network, consideration should be given to:

- **Onboarding and access control mechanisms** – to join the private permissioned DLT network. Licensing mechanisms can be set up for this and a few areas can even have regulatory interventions. The Linux Foundation's Hyperledger is an example of a permissioned blockchain framework of this kind.
- **Privacy, security, and performance features** – Private or permissioned ledgers need much more intense security, privacy and data consideration than public blockchain setups. For this, enterprises need to assess architecture and platform related factors as highlighted in Figure 2.

Figure 2. Finalizing a DLT requires thorough consideration of various factors

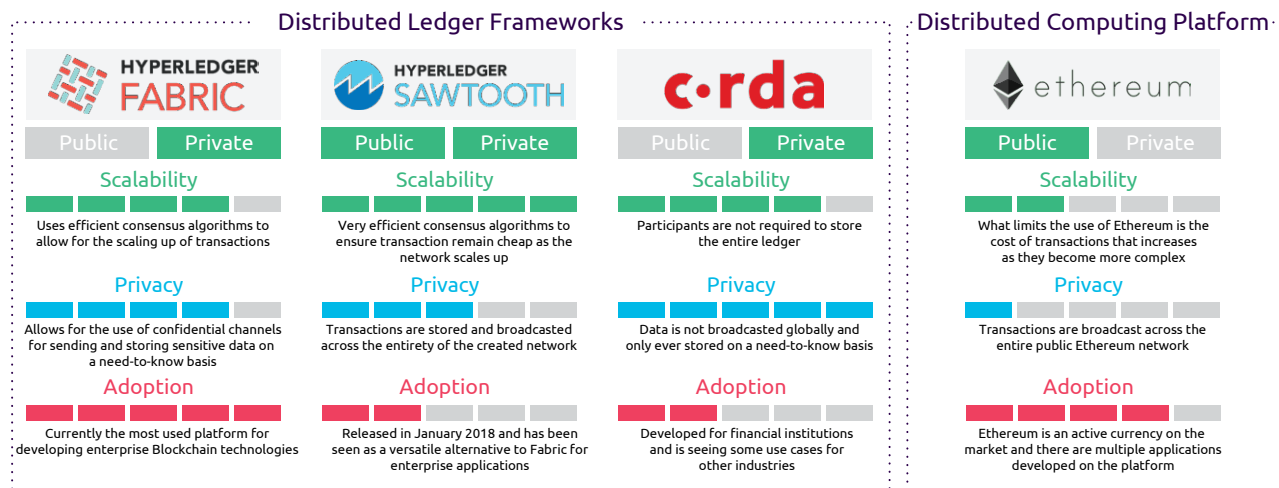
Key factor	Key consideration
Security at all levels	Security for all layers – infrastructure (on which the DLT is deployed), the ledger, the software, identity and access management
Privacy	Fine grained access controls for managing data across all layers of the platform
Scalability and performance	Managing for speed and throughput once the transaction volumes pick up
Environment	Choosing the suitable option amongst – on-premise, single or multi-cloud environments
Enterprise integration	Required APIs (Application Programming Interface) to plug into data sources within and across the enterprise at speed as part of the use case lifecycle
Architecture	If microservices can be developed over time as the DLTs mature
Customer experience and visualization	Ability to create user interfaces and maintain user experience that masks technology complexities of DLTs (similar to web browsers)

Source: Capgemini Applied Innovation Exchange.

There are quite a few DLT solutions available on the market. Organizations will have to decide on the most suitable platform for implementation based on the relevance of features they offer as well as the blockchain

application they would like to implement. Figure 3 illustrates a few of the platforms and shows how they compare across key parameters such as scalability and privacy.

Figure 3. Prominent DLT platforms and their performance against key parameters



Source: Capgemini Applied Innovation Exchange.

ii. Data distribution

Often overlooked, the data distribution protocol is another key criterion to be determined. There are three main ways to share the ledger between the nodes of a blockchain network:

- **Broadcast** – This is the traditional way to share a ledger. Every transaction is shared and replicated among all nodes, so everyone in the network can access the complete ledger. Bitcoin, Hyperledger Fabric, and Ethereum all broadcast data.
- **Channels** – Hyperledger Fabric introduced the concept of sub-networks. Data is only broadcast to members of this sub-network. For example, there may be corporates, insurers, and re-insurers in the same network, but it is possible to set up a channel just between corporates and insurers (excluding re-insurers), or another channel between insurers and re-insurers that excludes corporates.
- **Bilateral communication or peer-to-peer** – Instead of sharing data across a network or a sub-network, data is only shared between named entities, usually the ones engaged in the transaction (two or three entities in most cases). This is useful for B2B communications where two entities are engaged in a transaction but do not want other entities to be aware of it. R3's Corda delivers this functionality.

iii. Governance

This is probably one of the weakest areas in respect to enterprise adoption of DLTs. Attention should be paid to:

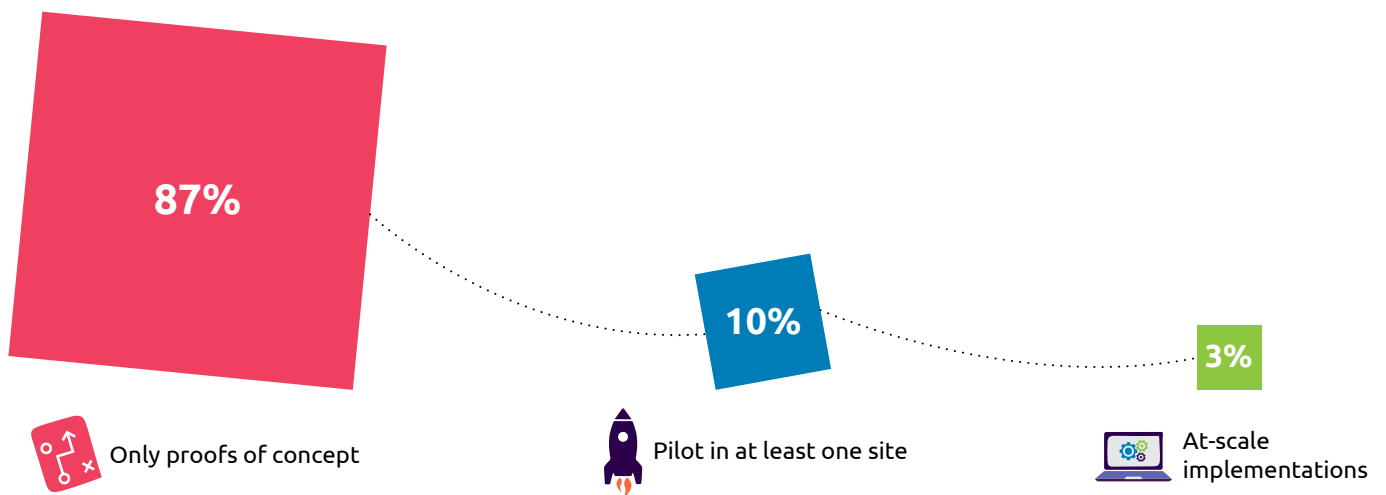
- **DLT ecosystem governance** – This needs to be developed both for the business and the technology. The operating model should detail the roles and responsibilities for all partners in the ecosystem.
- **Deployment governance** – Around regulation, compliance, and security.
- **Technology governance** – For integrating blockchain and DLT solutions with other digital disruptors like IoT and AI.
- **Program governance** – For developing and maintaining a business case for investment in DLTs.
- **Ownership** – Unlike a centralized system, it is not always obvious who owns the ledger. A new foundation in a multi-stakeholder ecosystem is one possible answer.

Most blockchain deployments are still in the experimental stage

As Figure 4 shows, we analyzed organizations' blockchain deployment maturity and found three groupings:

- The vast majority (87%) are at an early experimental or proof-of-concept stage
- 10% are at an advanced stage of experimentation, with pilots in at least one site
- Only 3% of organizations are deploying blockchain at scale

Figure 4. Only 3% are implementing blockchain use cases at scale



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

3%
Percentage of organizations that are deploying blockchain at scale”



Future of blockchain adoption

We believe that the maturity of blockchain adoption will evolve in three waves:

Wave 1: Awareness (2011–2018)

Organizations have invested in understanding the technology, its implications, and raising their awareness.

Wave 2: Experimentation (2017–2020)

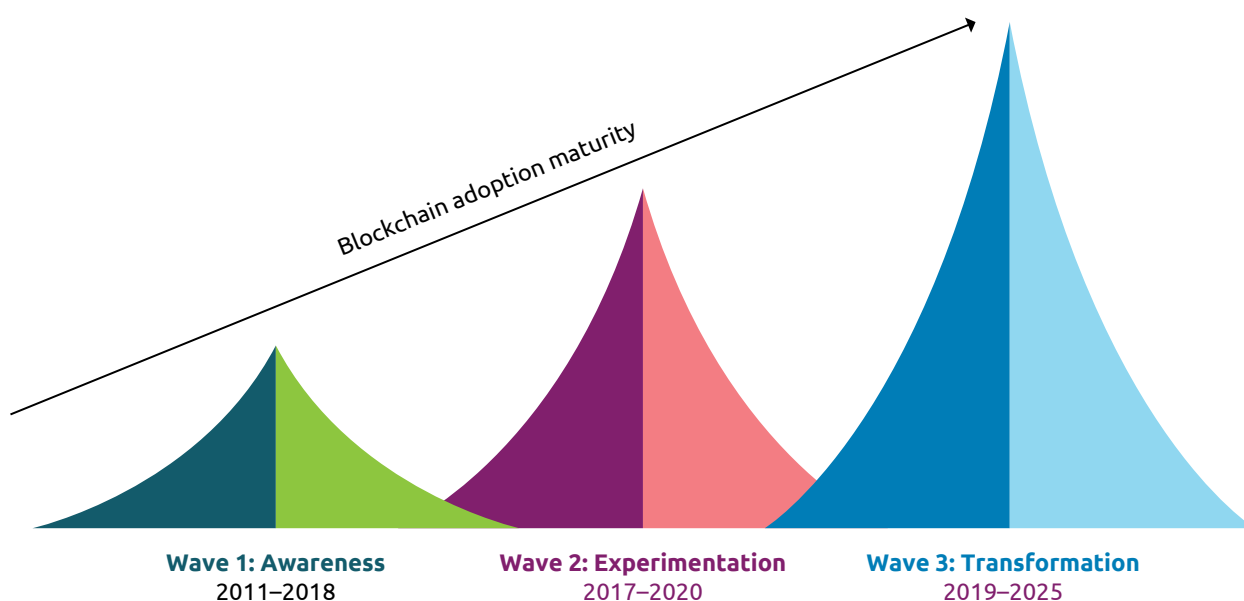
Organizations are exploring proofs of concept and working on establishing consortia. Industries other

than financial services have also started investing in blockchain.

Wave 3: Transformation (2019–2025)

Organizations will undertake enterprise transformation, driving enterprise integration and establishing policies for privacy and data management.

Figure 5. Adoption maturity of blockchain technology



Source: Capgemini and Swinburne University of Technology.

Reducing costs, improving traceability, and transparency are the key drivers of blockchain investment

The key drivers for investment range from cost efficiency to revenue growth. Four out of five of the organizations implementing blockchain say that blockchain's ability to trace products and provide better transparency is driving their investment (see Figure 6).

firm, says: "If you think about any multiparty process where shared information is necessary to the completion of transactions, and the coordination of activity and the exchange of value, that's where blockchain technology can be put to good use."⁸

Blythe Masters, former executive at JP Morgan Chase and current CEO of Digital Asset Holdings, a financial technology

Figure 6. Cost saving, traceability, and transparency are the top three drivers behind blockchain investments



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

In the following section we examine specific blockchain use cases in manufacturing, consumer products, and retail.

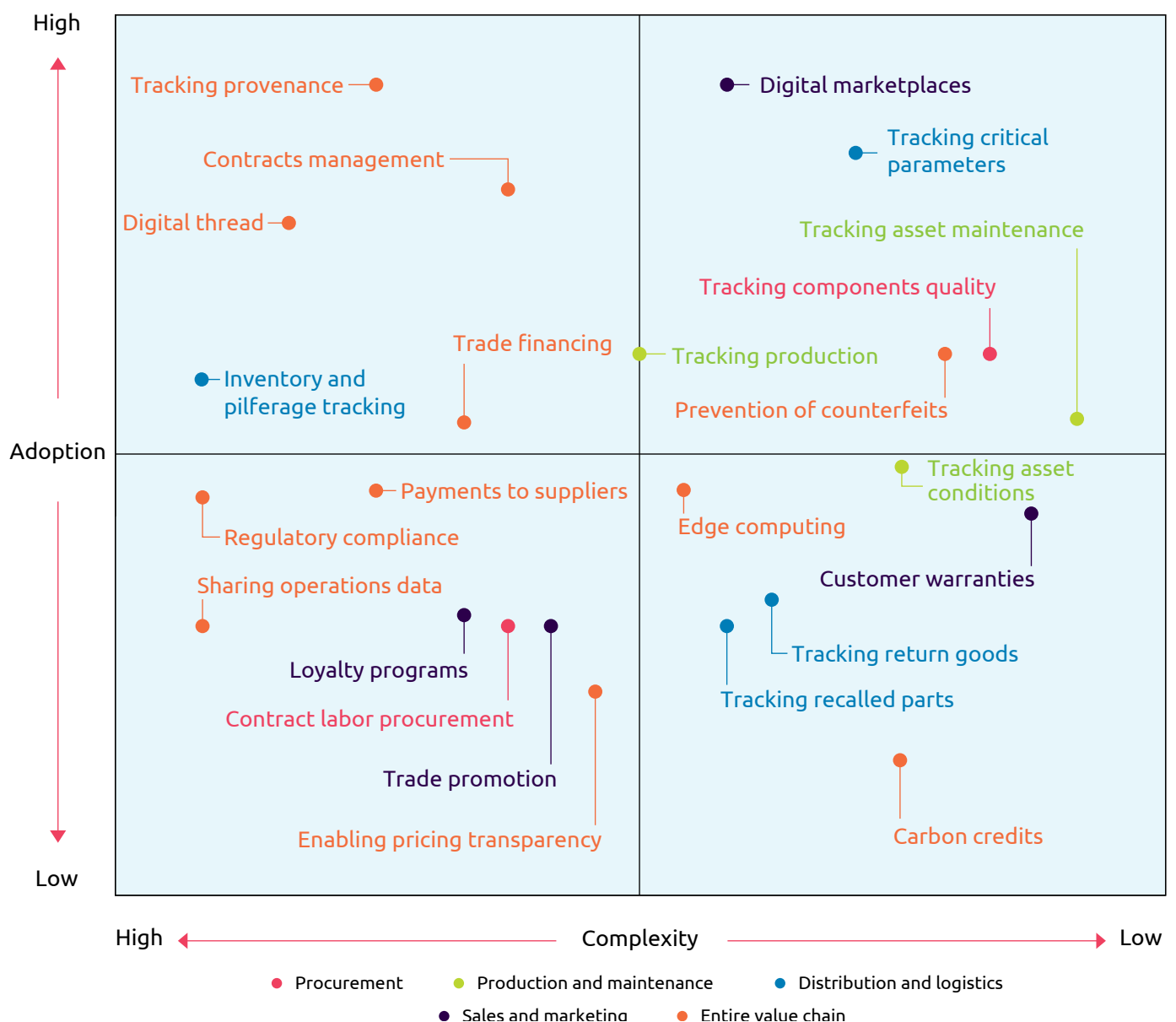
81% Percentage of organizations who cite enhancing traceability as one of the top three drivers behind blockchain investments."

Blockchain in the supply chain: where to invest?

Drawing on our cross-industry research, as well as interviews with experts and startups, we have identified 24 blockchain

use cases across the value chain, which we have segmented based on their complexity and adoption levels (see Figure 7).

Figure 7. Blockchain use cases in supply chain



Source: Capgemini Research Institute, Blockchain Survey and expert interviews; April–May 2018, N=447 organizations.

Below we analyze the opportunities blockchain presents across manufacturing, consumer products, and retail.

i. Managing supplier contracts is the most popular blockchain use case for manufacturing organizations

Our research shows that the manufacturing sector has the most organizations with at-scale deployments, compared to the other two industries in our research (see Figure 8). While most are at an early stage, manufacturing has three times the share of at-scale implementers compared to retail and consumer products.

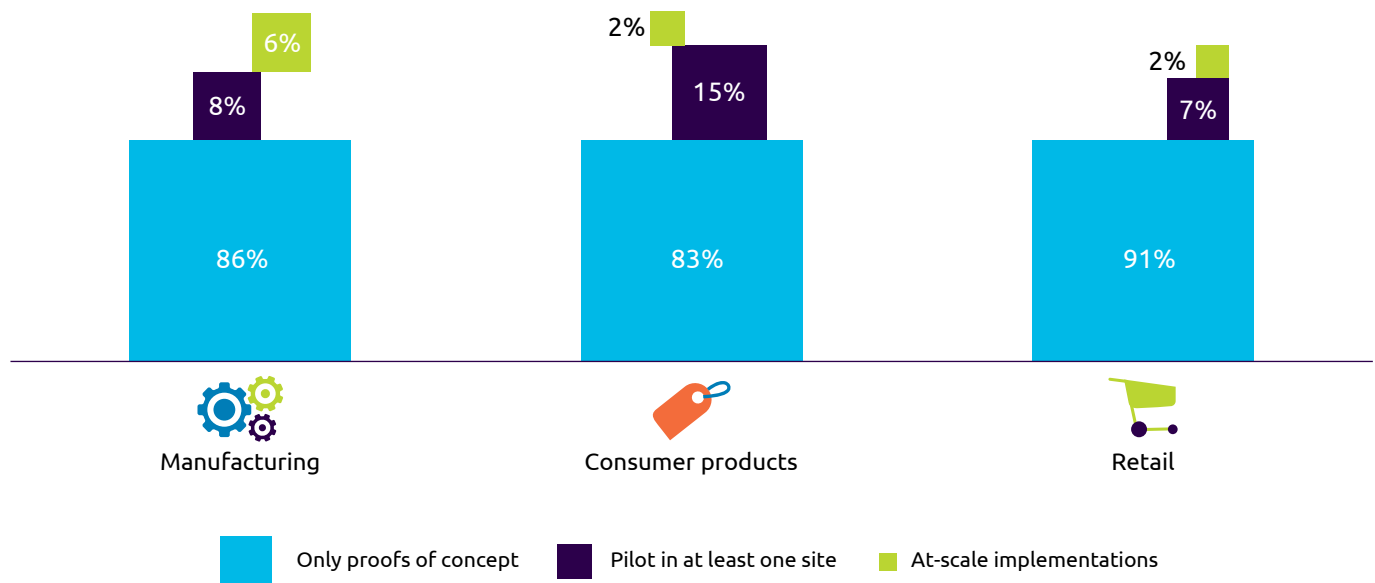
Some manufacturing organizations have already made significant inroads with blockchain:

- Foxconn (Apple Inc.'s largest electronics contract manufacturer) has launched a blockchain-based supply chain finance platform called **Chained Finance** as part of its efforts to provide working capital to its supply chain base. After a successful trial during which \$6.5 million worth of loans was disbursed to its suppliers, taking banks completely out of the equation, Foxconn launched

the platform at scale for its suppliers in China. Jack Lee, CEO of FnConn, a Foxconn subsidiary, said: “By using the **Chained Finance platform**, every payment, every supply chain transaction can be more transparent, manageable, and easily authenticated. Chained Finance will provide timely, efficient support to far more suppliers of all sizes. It will also help ensure the timely delivery of products to end customers and improve efficiencies across the entire supply chain.”⁹

- A number of automotive manufacturers, such as Robert Bosch and ZF Friedrichshafen, have formed a consortium called the **Mobility Open Blockchain Initiative (MOBI)** with automakers such as BMW, General Motors, and Renault. MOBI's aim is to establish compatibility standards across multiple brands for various blockchain-based services.¹⁰

Figure 8. Scale of blockchain adoption by industry



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

“Manufacturing has three times the share of at-scale implementers compared to retail and consumer products”

The top five blockchain opportunities that manufacturers are pursuing are:



Supplier contract management

Smart contracts can be used to transform transaction efficiency, improving speed of execution and supporting faster dispute resolution. Responsive contracts eliminate inefficiencies associated with regular contracts.



Digital thread

Digital thread is a communication framework that connects traditionally siloed elements in manufacturing processes and provides an integrated asset view. Blockchain adds trust to this ecosystem when multiple partners are involved.



Production tracking

Manufacturers need instant information on the products completed by their EMS (electronic manufacturing services) providers. A blockchain helps OEMs track and authenticate this in real time.



Tracking asset maintenance

Blockchain, along with technologies such as IoT, helps in determining whether an asset has been maintained according to schedule, especially when multiple parties are involved.



Tracking recalled products

Blockchain enables product or component tracking by recording a product's entire manufacturing journey, from the origin of its components until the product reaches the consumer.

Below, we look at these use cases in more detail:

Manufacturers are using blockchain to manage supplier contracts and increase payment efficiency

Large organizations deal with multiple suppliers, especially in manufacturing. **Traditional contract management involves a long, drawn-out process of negotiation, authoring, execution, payment, and renewal.** These activities need to be coordinated across multiple organizations – and multiple departments within those organizations – making the entire management process cumbersome. Estimates show that inefficiencies in supplier management, procurement, and freight administration cost firms in the UK alone \$2 billion annually.¹¹

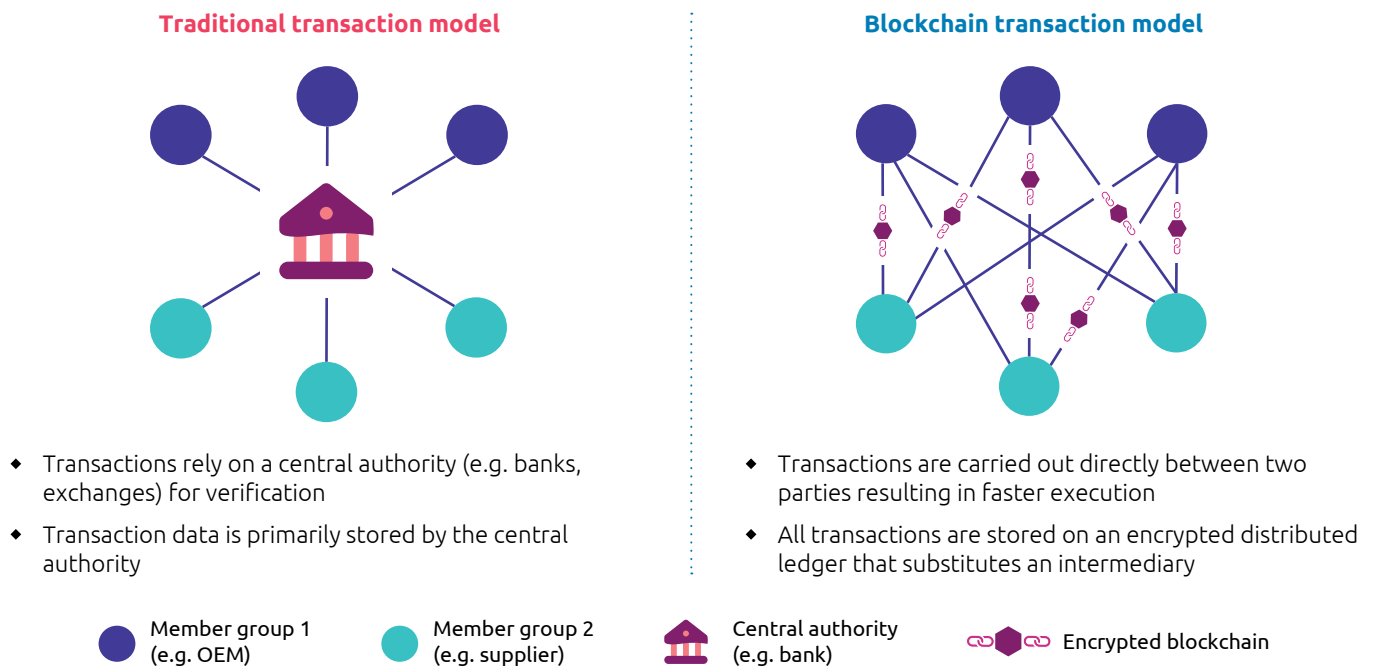
Blockchain technology can make these contracts smart by programming them to execute themselves when certain

events happen. With blockchain, organizations can set up a distributed peer-to-peer network in which parties can interact with each other without an intermediary, in a verifiable manner.¹² As there is a trusted platform, the stakeholders can agree to exchange data and authorize transactions without the need for intermediaries (see Figure 9).

This improves speed of execution and allows faster dispute resolution and a faster payment mechanism for the suppliers involved. For example, a proof of delivery from a supplier can trigger an automatic quality inspection of the materials. Then, if the inspection is satisfactory, a digital payment is triggered. This will help reduce suppliers' working capital requirements.

12 Does blockchain hold the key to a new age in supply chain transparency and trust?

Figure 9. Blockchain network allows shorter payment cycles and faster dispute resolutions



* Figure illustrates a simplified blockchain transaction model

Source: Capgemini Research Institute.

Manufacturing organizations are using blockchain-enabled secure digital threads to shorten the design process

A “digital thread” is the connected data flow that allows for an integrated view of an asset’s data throughout its product lifecycle (PLC) across traditionally siloed functions.¹³ This is not restricted to the design and build phases of a product, but also includes operations and maintenance. Increasingly, aerospace and automobile players are using IoT applications to track the condition of critical and high-value parts during operations. This has led to a proliferation of data across multiple partners, which creates greater complexity in terms of data exceptions, auditing costs, and security.

A blockchain-enabled digital thread allows organizations to share data across OEMs and suppliers with a high degree of

trust, as the data cannot be altered without the knowledge of all stakeholders. The blockchain platform acts as a single source of truth across all nodes and can be tied to all contracts across the PLC. It reduces operational costs related to exceptions and reconciliations and, because the data network is encrypted, it is more resilient to attacks.

This presents opportunities for manufacturers to effectively and securely collaborate with their partners on design, engineering, and operational data, helping them deliver improved products.

ii. Consumer product organizations are focused on provenance-tracking solutions

As we have seen, food recalls are costly and create significant reputational risk. This is driving some of the biggest names in the consumer goods industry, including Nestlé, Unilever, Tyson Foods, Golden State Foods, Dole Food Company, and McCormick & Co, to start blockchain trials.¹⁴

As we saw previously, the consumer products industry lags behind manufacturing in at-scale implementations of

blockchain. However, 15% of organizations have at least one pilot running, which is the highest figure among the three industries. This shows significant potential for at-scale implementations in the future.

The top five blockchain opportunities consumer product organizations are pursuing are:



Tracking provenance

Blockchain allows businesses and consumers to trace a product's origin, attributes, and any change of ownership.



Tracking critical parameters

For products that are sensitive to storage conditions, blockchain, coupled with IoT, can help companies track conditions, such as temperature during transit.



Monitoring asset conditions

Blockchain, coupled with technologies such as IoT, helps in monitoring the condition of assets in remote locations.



Regulatory compliance

A blockchain can maintain a product's entire history and allows regulators to determine whether that product has been manufactured and handled in a compliant manner.



Providing warranties

Blockchain helps to establish the proof of ownership of a product. This allows organizations to extend warranties to customers with genuine products and avoid losses in warranty frauds.

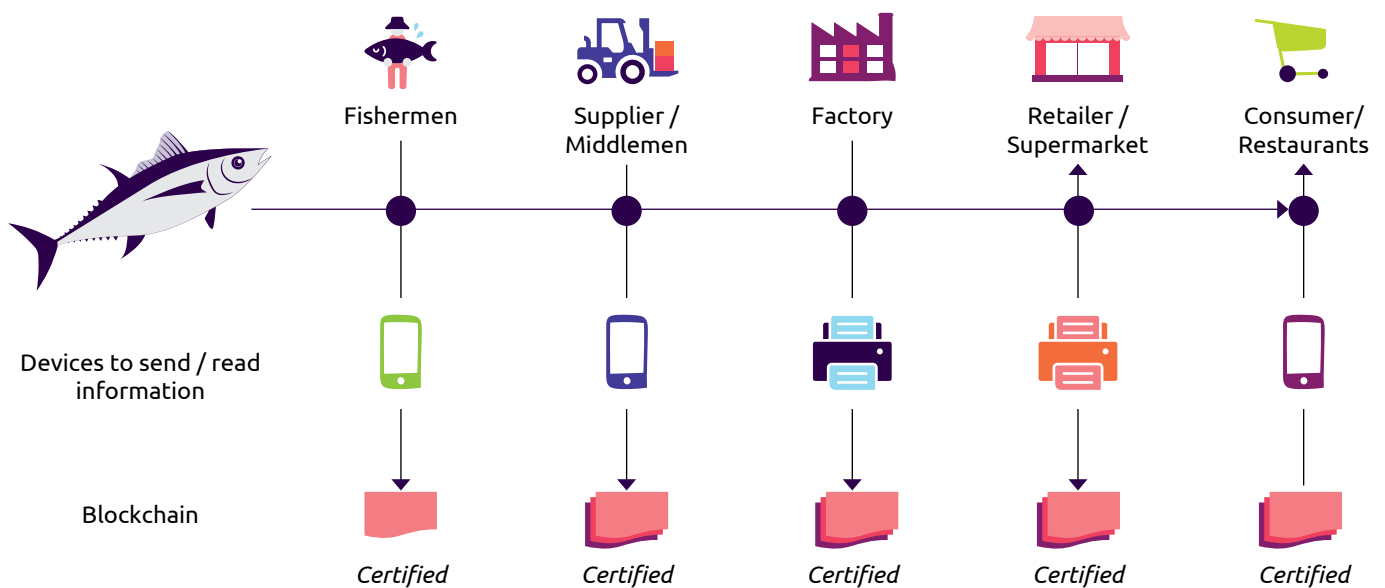
“We see blockchain technology as being able to step up the transparency in the supply chain, which previously was difficult or quite expensive to do.”

The chief executive officer, WWF Australia



Tracking provenance is turning out to be a major use case for blockchain in the consumer goods industry

Figure 10. Simplified process for ensuring the provenance of a tuna fish



Source: Provenance, "Tracking Tuna from Catch to Customer," September 2016.

Tracking provenance allows organizations to track products across the supply chain, from the source to the customer. This has applications across numerous fields, from luxury goods to pharmaceuticals, from art to agriculture.

Today, there is significant focus on the provenance of food and whether food has been procured from sustainable sources. An estimated €966 billion opportunity exists for brands that make their sustainability credentials clear. Keith Weed, Unilever's chief marketing and communications officer says: "Research confirms that sustainability isn't a nice-to-have for businesses. In fact, it has become an imperative [...] they must act quickly to prove their social and environmental credentials and show consumers they can be trusted with the future of the planet and communities, as well as their own bottom lines."¹⁵

For example, there is an increasing focus on sustainable fishing and the sustainability of fish such as tuna. A London-based NGO has developed a system to track skipjack and yellowfin tuna, creating "catch-to-consumer" transparency. The fishing crew attach an RFID tag to the fish that are caught and scan and upload the information to the cloud using

handheld devices. This data is added to the blockchain ledger, creating a tamper-proof trail (see Figure 10). This helps in tracking the product as it passes from catch, to canner, and on to the consumer.¹⁶

The World Wildlife Fund (WWF) has successfully piloted a "bait-to-plate" project that helps track tuna on a blockchain-based platform that uses a combination of RFID tags and QR codes. Speaking about the project, the chief executive officer of WWF Australia said: "We see blockchain technology as being able to step up the transparency in the supply chain, which previously was difficult or quite expensive to do."¹⁷

Cappgemini has successfully deployed a blockchain solution that enables traceability, provenance, and payments for a digital marketplace connecting farmers and fishermen with high-end restaurants. By tracking Australia's southern rock lobsters using a blockchain solution integrated with smart tagging technology, Cappgemini was able to develop a commercially viable blockchain solution that has simplified the client's supply chain. This has reduced supply chain costs by removing the middleman and helped the company to pass on these savings to both producers and restaurants.

Consumer goods companies are relying on blockchain to ensure product safety and authenticity

Ensuring the safety and authenticity of certain consumer goods, such as infant food, pharmaceuticals, dairy, and premium-cut meats, is of paramount importance. Today, there is added emphasis given high levels of counterfeiting, especially in e-commerce.

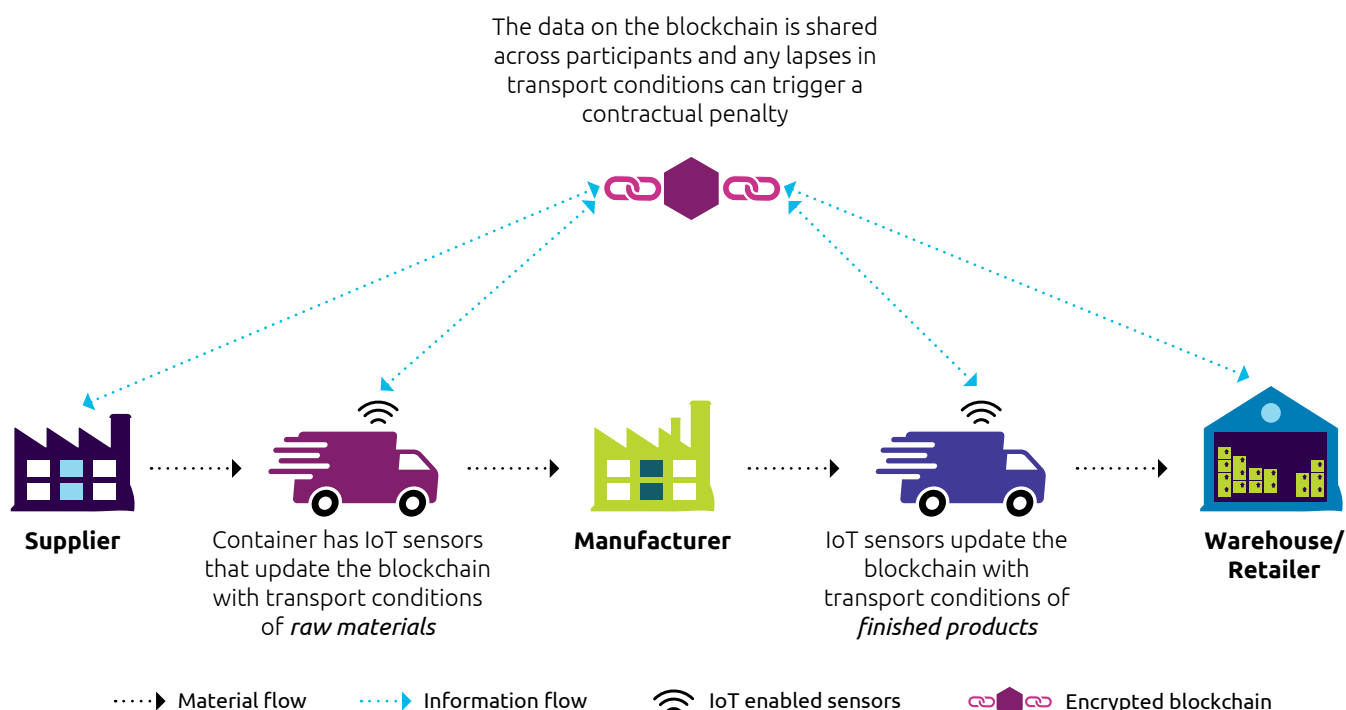
Blockchain helps consumers confirm that the product they buy is indeed manufactured by the brand. For instance, a European infant food brand has implemented a “smart cap” solution, which is IoT-enabled and available on blockchain. Consumers can check if the cap has been opened since it was manufactured, whether it is a genuine product, and the temperature conditions it has been kept in. All these parameters are recorded on a distributed ledger by IoT sensors, and the ledger is available to consumers.¹⁸

Companies can also track these parameters to ensure authenticity at the procurement stage, not just for end

products (see Figure 11). Capgemini is delivering a proof of concept for a pharmaceutical company, deploying a “smart container” management system based on blockchain technology. Smart containers are transportation containers equipped with sensors and transmission technologies. This basic IoT solution transmits data from the sensors to a blockchain. The combination of real-time data about container conditions and tamper-proof storage of that data on a blockchain is delivering unprecedented levels of transparency within the supply chain processes involved.

At every point in time, the product’s history and place of origin is identifiable. A change in temperature that represents a breach of contract can trigger automated processes, such as a contractual penalty for the forwarder and a reorder from the supplier.

Figure 11. Smart container application in supply chain



Source: Capgemini.

iii. Retailers are focused on digital marketplaces and preventing counterfeits

Walmart, Starbucks, Carrefour, JD.com, and Amazon are among the big retail players to have started blockchain trials.¹⁹

The top five blockchain opportunities that retail organizations are pursuing are:



Blockchain-enabled marketplaces

Trust in the intermediary (marketplace) is replaced with trust in the underlying code and consensus rules. Blockchain technology allows this verification to be undertaken at minimal cost, even at scale.



Preventing counterfeit products

With the ability of blockchain to track the origin of each part of a final product, it is possible to have an audit trail that is visible to all relevant parties. This ensures the authenticity of goods and reduces counterfeiting.



Inventory and pilferage tracking

End-to-end visibility from suppliers to retailers ensures transparency and authenticity where multiple suppliers are involved.



Tracking returned goods

Blockchain systems help retailers ensure returned goods are tracked back to their suppliers, along with contracts to better manage returns.



Loyalty program management

A blockchain-enabled loyalty program can be used to create a single wallet for loyalty rewards, providing convenience to customers and improving trust when multiple businesses are involved in the same program.

Retailers are using blockchain-enabled digital marketplaces to improve trust

Online marketplaces such as Amazon and Alibaba are disrupting product and service distribution channels across the globe. However, as these centralized marketplace players grow, trust issues emerge. These trust issues can increase costs and act as roadblocks to further growth.

Marketplace participants should be able to efficiently verify and audit transactions, including the credentials and reputation of the parties involved and the characteristics of the goods and services exchanged. Blockchain technology fundamentally transforms the traditional flow of information and third-party verification. Any transaction, or information about the agents and goods involved, can be verified at little cost and in real time. Trust in the intermediary is replaced with trust in the underlying code and consensus rules. With blockchain technology, the incremental cost of verification is minimal even as these marketplace models scale.

Coupit is an example of a blockchain-driven e-commerce marketplace that is designed to help verify the reputation of buyers and sellers.²⁰ Every time a transaction is established, a claim is registered, a problem is resolved or left unresolved, a review is written, or any other transaction event occurs, the associated information is hashed and updated on the blockchain and made available to authorized users engaged in future transactions.

Blockchain has the potential to enable a new wave of innovation in digital marketplaces. This is highly relevant to marketplace model incumbents, but also to consumer product businesses that want to put in place the infrastructure to partner with blockchain-enabled freight platforms or retail marketplaces.

Retailers are using blockchain to stop counterfeiting

Digital businesses, including e-commerce, social commerce, and consumer-to-consumer platforms, have been plagued with counterfeits. Counterfeit goods account for 2.5% of global trade, amounting to \$461 billion.²¹

In March 2018, police in China seized some 50,000 counterfeit bottles of wine. The chief executive at the Winemaker's Federation of Australia, Tony Battaglione, said: "It is potentially an enormous problem, and that is why we need to do everything we can at our end to keep the integrity of the product."²²

Using blockchain, retailers can provide customers with indisputable proof of the provenance and authenticity of their products. A tech startup in Australia is using blockchain technology to combat the counterfeiting of wine bottles exported from Australia.²³

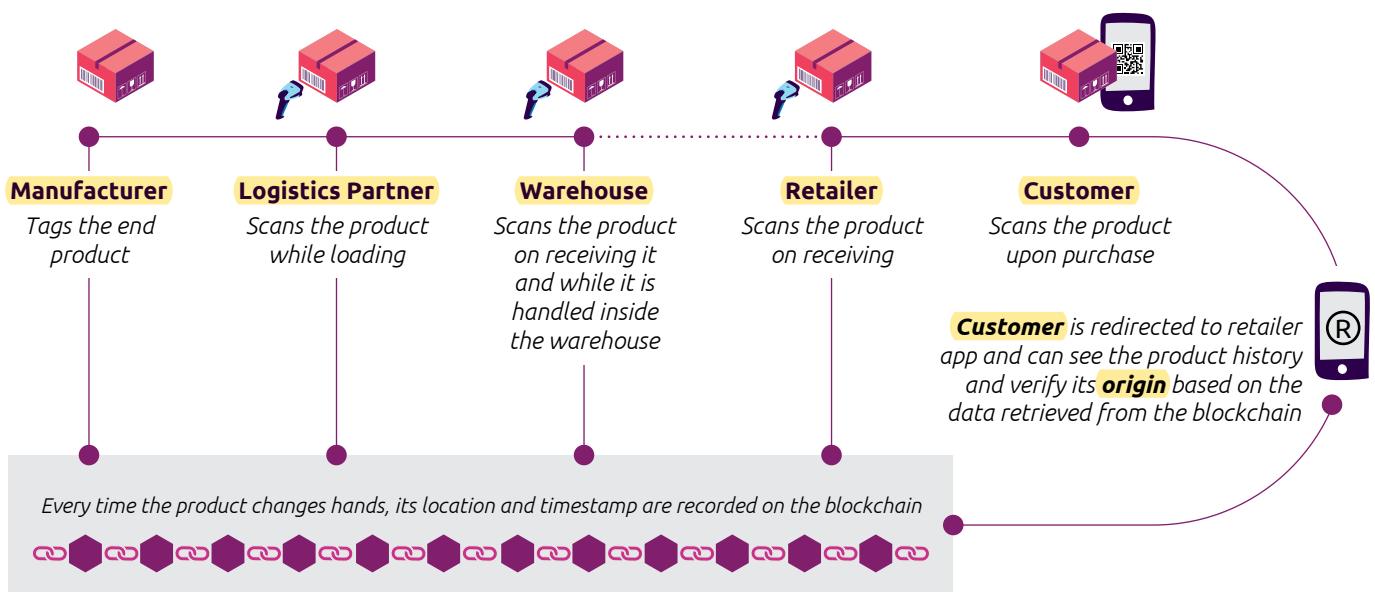
Permissioned distributed ledgers offer a solution to the counterfeiting problem. In this model, parties require permission to read the information on the blockchain and the parties who can transact on the blockchain are restricted. Every authorized partner on the ledger can access and operate the blockchain through a node. The function of a node or a validator is to validate the data before it is appended

to the blockchain. The validation is based on a unique tag for a product and a scalable protocol that is embedded in the blockchain platform to enable a visible supply chain that includes all stakeholders such as suppliers, vendors, distributors, and partners.

The blockchain maintains a timestamped archive of each token transaction, i.e., movement, in the supply chain (see Figure 12). Such a solution reassures the brand's owners, its logistics partners, and consumers that the captured data stored on the ledger cannot be edited. This creates trust and allows consumers to track the authenticity of the product through a mobile app.²⁴

Chinese e-commerce giant JD.com has used Hyperledger Fabric, an open-source blockchain platform, to build a similar solution for combatting counterfeit products. Within the first few months of going live with the solution, JD.com had more than ten brands participating on its blockchain, including companies in the alcohol, food, tea, and pharmaceutical industries. "Whether to guarantee the safety of food or authenticity of luxury products, consumers want transparency and traceability to be sure they are not being duped with counterfeits," says Haibo Sun, head of blockchain research and development at JD.com.²⁵

Figure 12. Simplified process for tracking products using blockchain



Source: Capgemini Research Institute.



Who is leading in the blockchain race?

We have identified a group of leading organizations we call “Pacesetters.” This cohort is made up of the 13% of respondents who are either implementing blockchain at scale (3% of the sample) or have pilots in at least one site (10% of the sample). We compare pacesetters

against the rest of the sample, those we call “Early-stage experimenters,” who make up the clear majority of respondents – the 87% who have only engaged in blockchain use cases at a proof-of-concept stage.

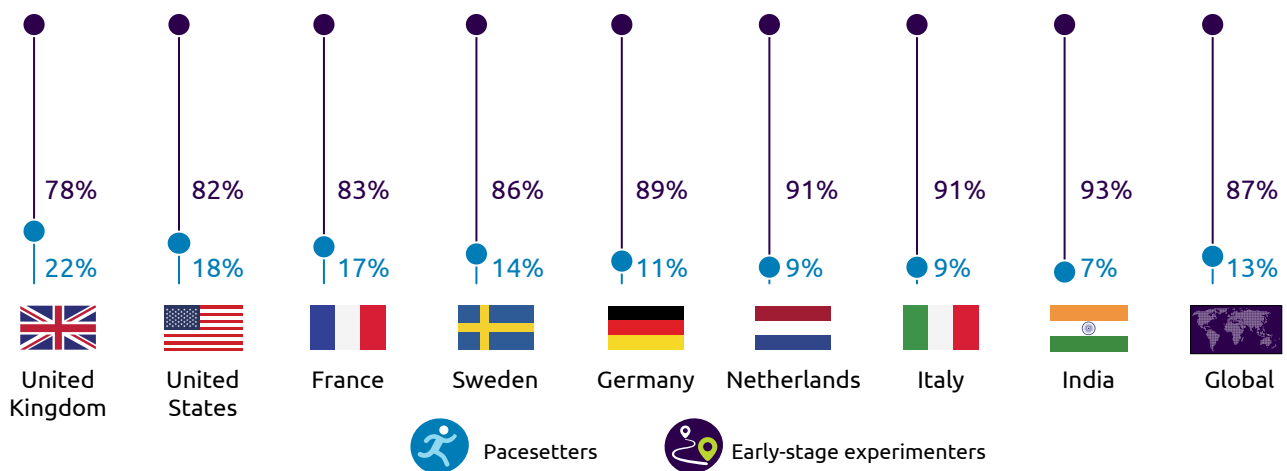
The UK, US, and France lead the way

When we looked at the fallout of pacesetters by geography, the UK, US, and France lead the way. The presence of a large blockchain ecosystem in these countries probably explains their lead:

- Since 2012, the US has seen investment of over \$1 billion in blockchain startups

- The UK follows, with over \$500 million of investment
- Other markets, such as Sweden and Germany, have only seen investment of about \$50 million in the same period.²⁶

Figure 13. Pacesetters by geography

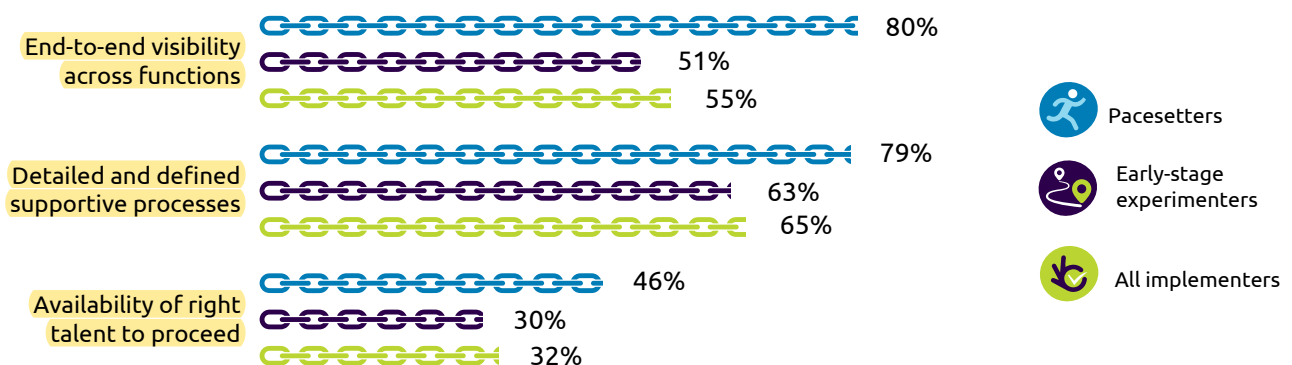


Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations, N=61 pacesetters; N=386 early-stage experimenters.

Cross-functional visibility and process maturity differentiate pacesetters

As Figure 14 shows, pacesetters show a greater level of organizational readiness, with end-to-end visibility and clearly defined processes across the supply chain.

Figure 14. Pacesetters show a higher level of organizational readiness



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations, N=61 pacesetters; N=386 early-stage experimenters.

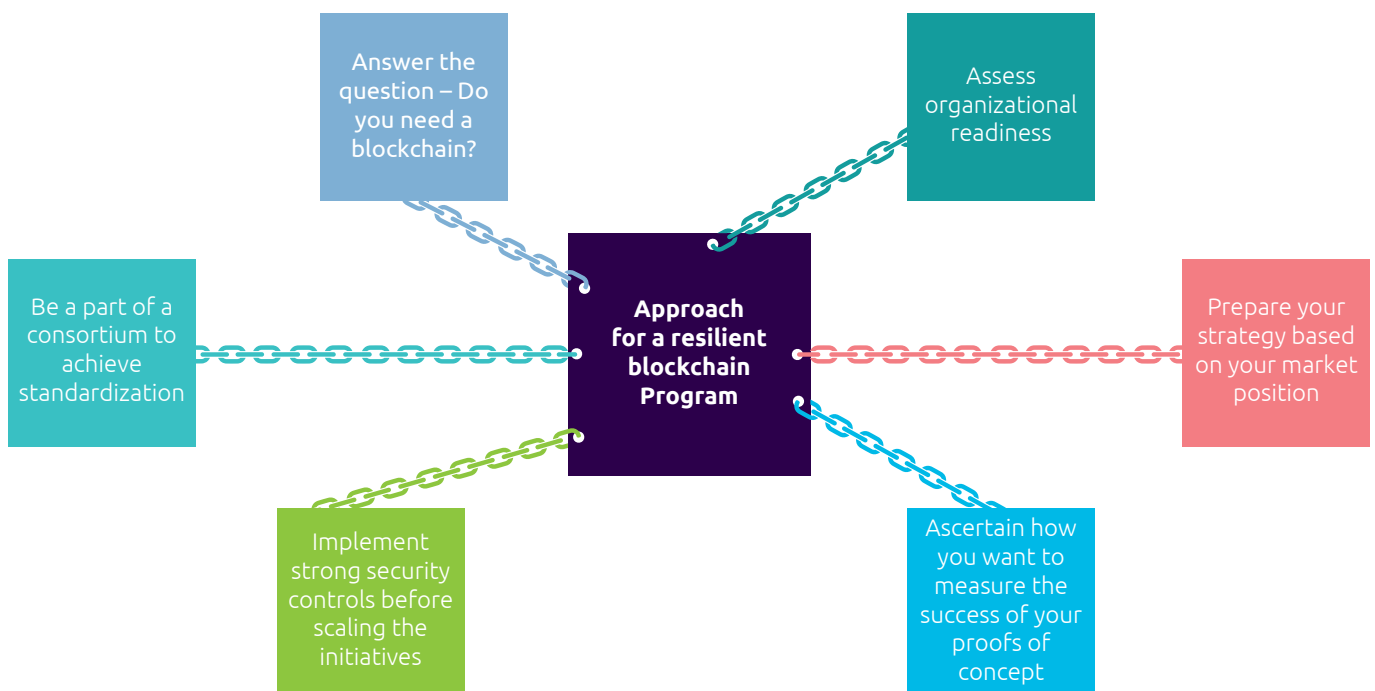
With these enablers already in place, over 60% of the pacesetters in our survey believe that blockchain is already transforming the way they collaborate with their partners. Encouraged by these results, pacesetters are set to increase their blockchain investment by 30% in the next three years.

How can organizations deliver a resilient blockchain program?

While many believe in the promise of blockchain, only three percent of organizations that have implemented blockchain have done so at scale (see Figure 4). From our analysis of

blockchain implementers, as well as interviews with industry experts and startups in this area, we have identified a number of key recommendations.

Figure 15. Key recommendations for a blockchain supply chain strategy



Source: Capgemini Research Institute analysis.

Answer the question – Do you need a blockchain?

While blockchain has many potential use cases, organizations should be sure they are not using it to address a perceived problem that could be solved by an alternate solution.

Organizations should ask themselves whether their current supply chain solutions, with additional customization, can offer the same benefits as a blockchain implementation.

Blockchain may be the right answer if the following are true:

- Traceability and its authenticity are a critical aspect of the supply chain and are difficult to achieve with the current set up
- The organization is seeking to eliminate or minimize costs associated with certain intermediaries, such as cost for proof of delivery or an audit process to improve efficiency across the entire value chain
- The organization wants to look at new trust-based business models that are made possible by blockchain.

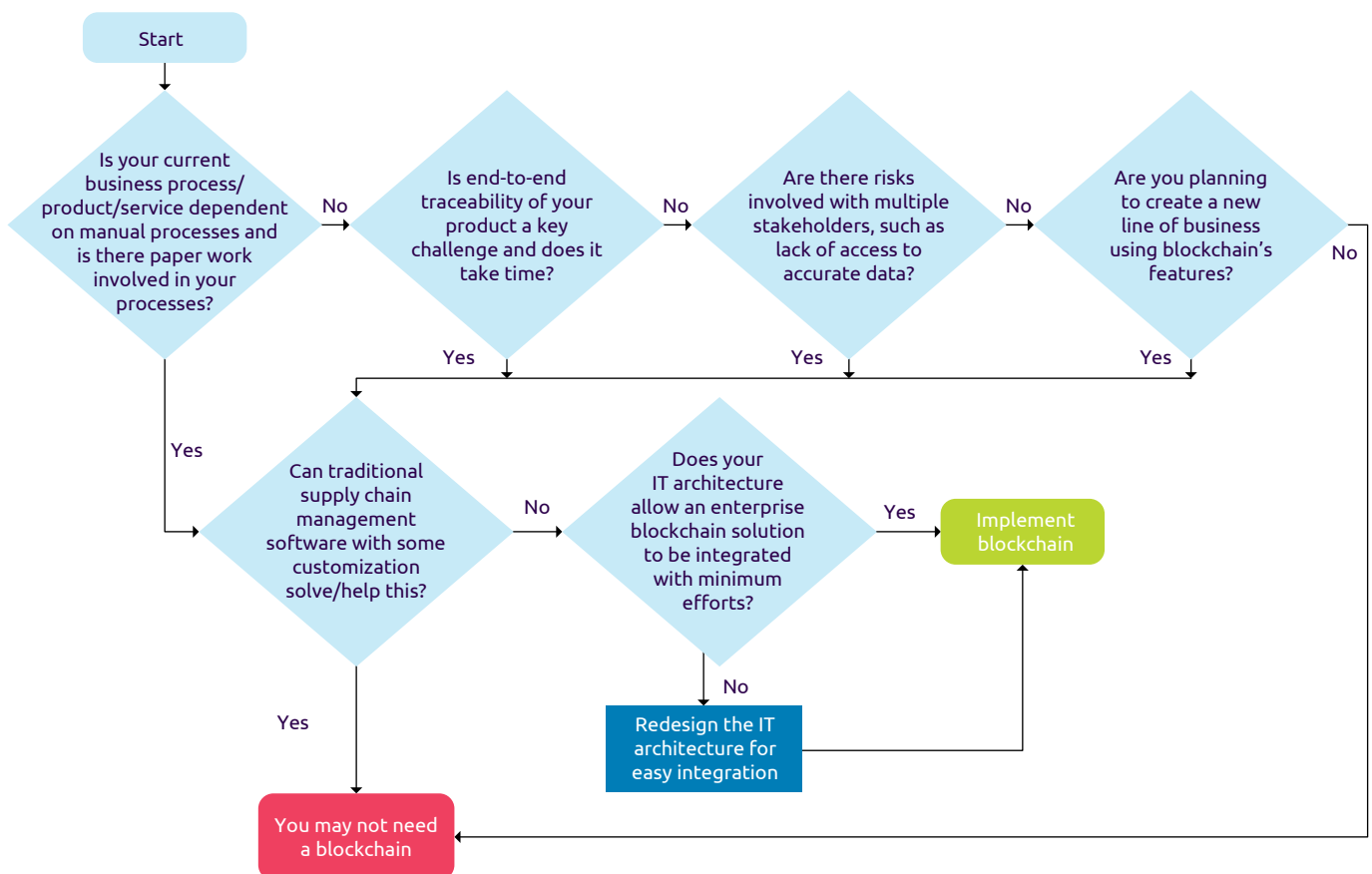
The benefits of blockchain lie in its transparency, traceability, and immutability. Organizations should determine which pain points in their supply chain they want to address, clearly assess whether blockchain is the best solution, and identify the use case they want to initially run as a proof of concept before scaling up.

Assess organizational readiness

Blockchain is not a silver bullet for all supply chain challenges. Organizations should consider whether blockchain is the right solution to their problems before adopting it (see Figure 16). After assessing the need for blockchain, organizations also

need to ensure they have the required talent for a blockchain implementation. Technical blockchain expertise – such as experience in Solidity, a programming language for writing smart contracts – is a skill in high demand but short supply.²⁷

Figure 16. Critically evaluate whether blockchain implementation is the right choice and assess your readiness



Source: Capgemini Research Institute analysis.

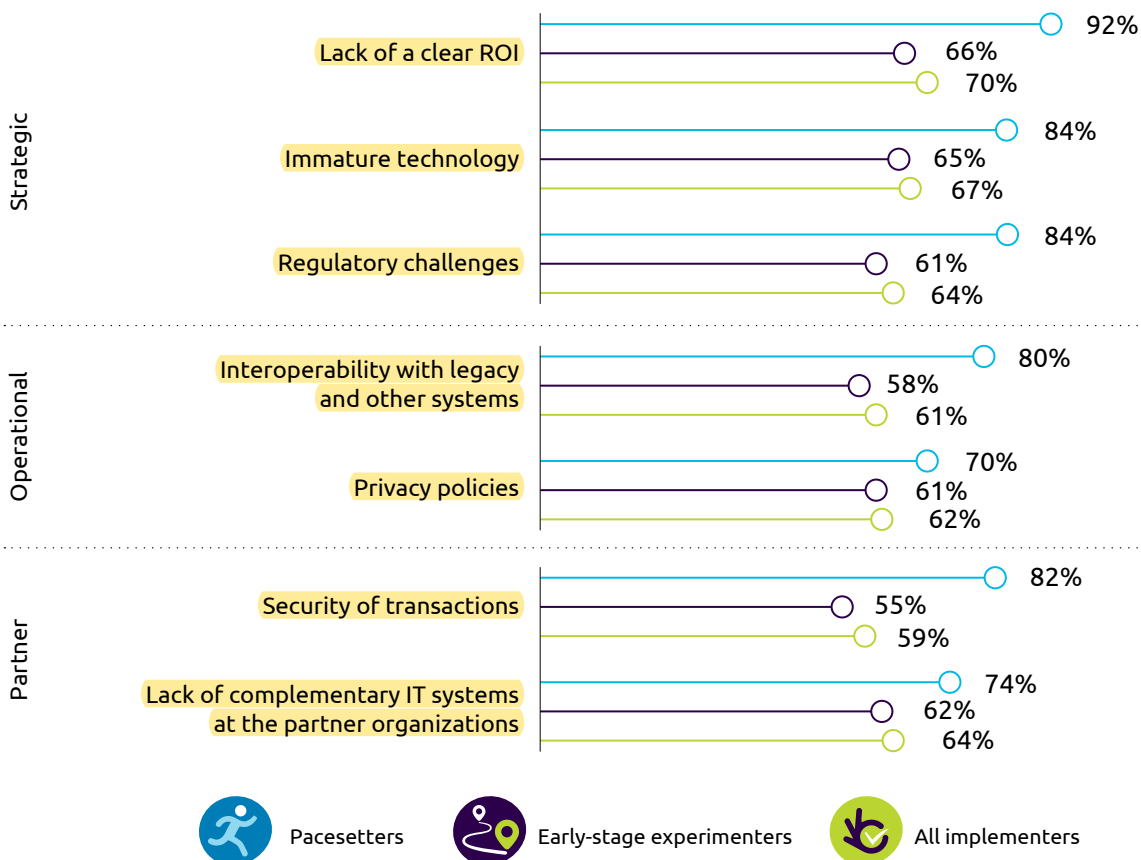


What are the key hurdles to blockchain implementation?

While many organizations are investing in blockchain, most say that establishing Return on Investment (ROI) is a significant challenge. As Figure 17 shows, pacesetters and the rest consider this the top challenge for adoption.

Nearly half of the organizations (49%) polled also noted that supply chain processes require significant transformation before implementing a blockchain solution.

Figure 17. The majority of pacesetters and experimenters cite “lack of a clear ROI” as the top reason hampering adoption



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations, N=61 pacesetters; N=386 early-stage experimenters.

Prepare your strategy based on your market position

Many of the benefits of blockchain will only materialize once all parties are on the platform, including suppliers, carriers, wholesalers, distributors, retailers, and others. Three out of five organizations say that the lack of compatibility between their IT systems and IT systems at partner organizations inhibits blockchain implementation (see Figure 17). Suppliers and other partners will need to co-invest to integrate with the blockchain platform and adoption will be smoother when the

organization driving implementation has significant bargaining power. If an organization is a market leader and has a strong negotiating hand with upstream suppliers, focusing on getting these partners onto the blockchain would seem a logical first step. If an organization is not a market leader, it should focus on organizational readiness and prepare to adapt as standards are established by the dominant players and its partners.

Ascertain how you want to measure the success of your proofs of concept

We found that a significant majority of pacesetters (92%) point to “establishing ROI” as the greatest challenge to adoption. When implementing proofs of concept, organizations should reconsider the use of ROI as the sole criterion for success. ROI does not capture the wider impact of emerging technologies. This is especially true of blockchain, given its network effects. Instead, organizations should start thinking about investing in these technologies by looking at other industries – such as financial services – to understand the benefits and costs

of implementation. They should assess the success of these initiatives in the same way that venture capitalists assess the success or failure of their investments. The idea would be to make small investments, allow them to rapidly iterate, identify those with potential, and shut down the rest.²⁸ One executive summarized their thinking about investing in an emerging technology: “This investment was primarily based on what I would call an ‘art business case,’ rather than a ‘science business case,’ and this was the right thing to do.”²⁹

Implement strong security controls before scaling initiatives

The adage “a chain is only as strong as its weakest link” could not be more true than it is for blockchain. Blockchain’s promise lies in the security and authenticity of the data on the platform. While the blockchain platform itself can be made immutable, organizations need to focus on the last-mile connection between a physical event and the digitized record of this event. If these points of entry of data onto the platform can be tampered with, the blockchain is rendered worthless. Organizations should look at securing all the points of entry and assess the risks before they think of deploying their proofs of concept at a larger scale. Aside from

the security angle, Thibaut Sahaghian, director at Stratumn, a blockchain startup, also emphasizes the importance of effective change management: “The challenge with many digital transformations is capturing the right data – the quality of output is determined by the quality of input,” he says. “Organizations need to train their employees so that everyone understands the concept of data and inputting the right data onto blockchain. Blockchain implementations do not differ from other software implementations when it comes to capturing the right data, the training required for employees or the interfaces with the current solutions.”³⁰

Be a part of a consortium to achieve standardization

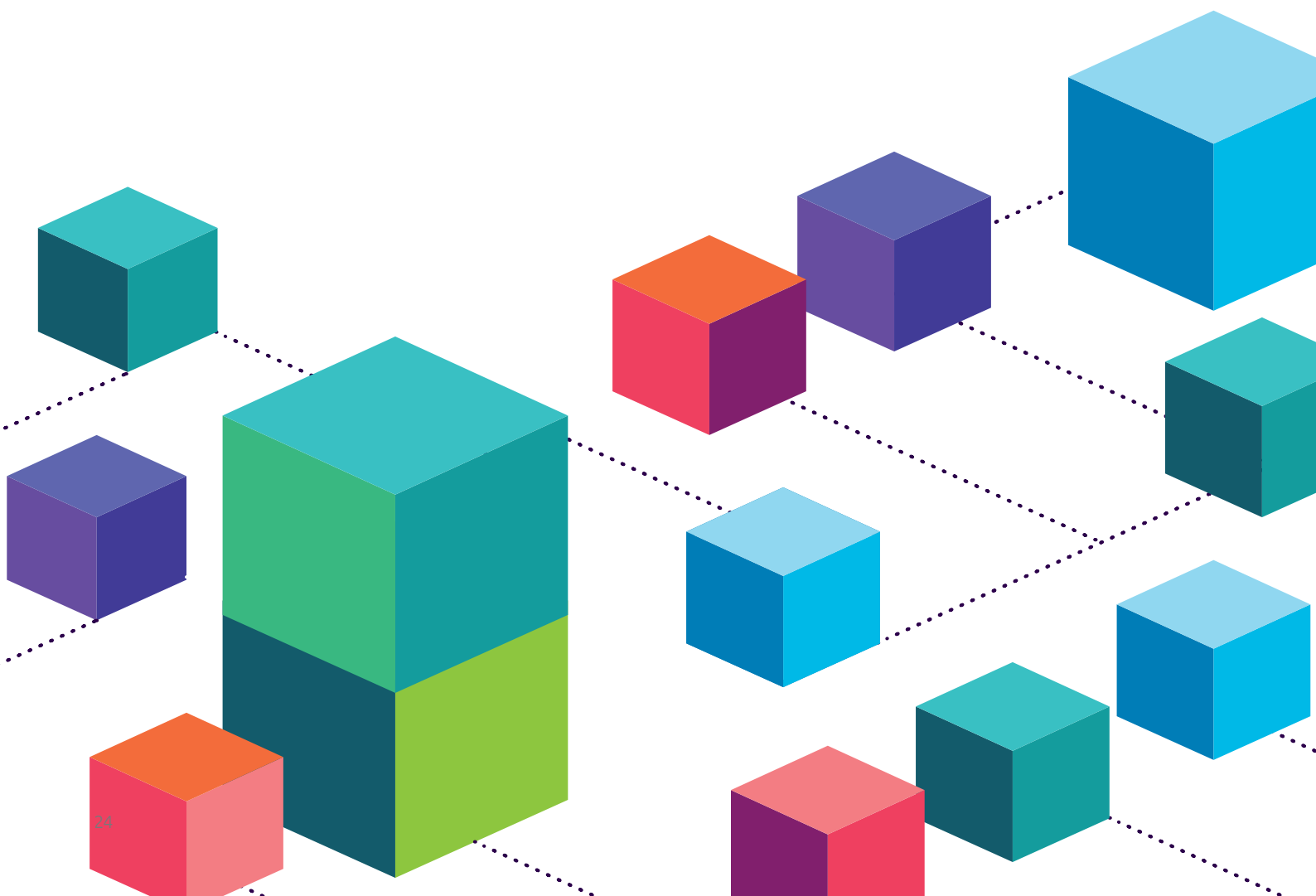
A blockchain use case will be more successful when there is a network effect. In other words, the value grows as more players become part of the network. The blockchain network will talk to a lot of systems across multiple parties and implementation costs will come down if there are established business and technology standards.

Chris Ballinger, CEO and founder of the automotive industry’s Mobility Open Blockchain Initiative (MOBI), believes that it is important to become involved at the right time. “[Blockchain is] a technology where the network effects will be very strong. If you’re not in at the very start, it may be too late,” he says. The consortium includes numerous parties, from automotive manufacturers to technology partners, and is focusing on getting carmakers to assign digital identities to vehicles so that cars and systems can transact with each other.³¹ Organizations should either mobilize a new consortium or be

a part of one. Rebecca Liao, VP of Business Development and Strategy at Skuchain – a startup focusing on blockchain for supply chain – believes consortiums play a key role in building collaboration and relationships. “People recognize that this is a new technology and, therefore, you need standards,” she says. “Since it’s a distributed ledger, your partners should ultimately agree to participate in some sort of organized way. I think consortia are really useful for organizing the discussion and getting people to convene. What these consortia need to guard against, however, is two things: becoming companies in and of themselves who seek to build their own proprietary technology and discussing indefinitely without concrete steps toward adoption.”³² This is most important for highly regulated industries where compliance is critical. Being part of a consortium that sets standards and onboards regulators, will help in achieving the required standardization sooner.

Conclusion

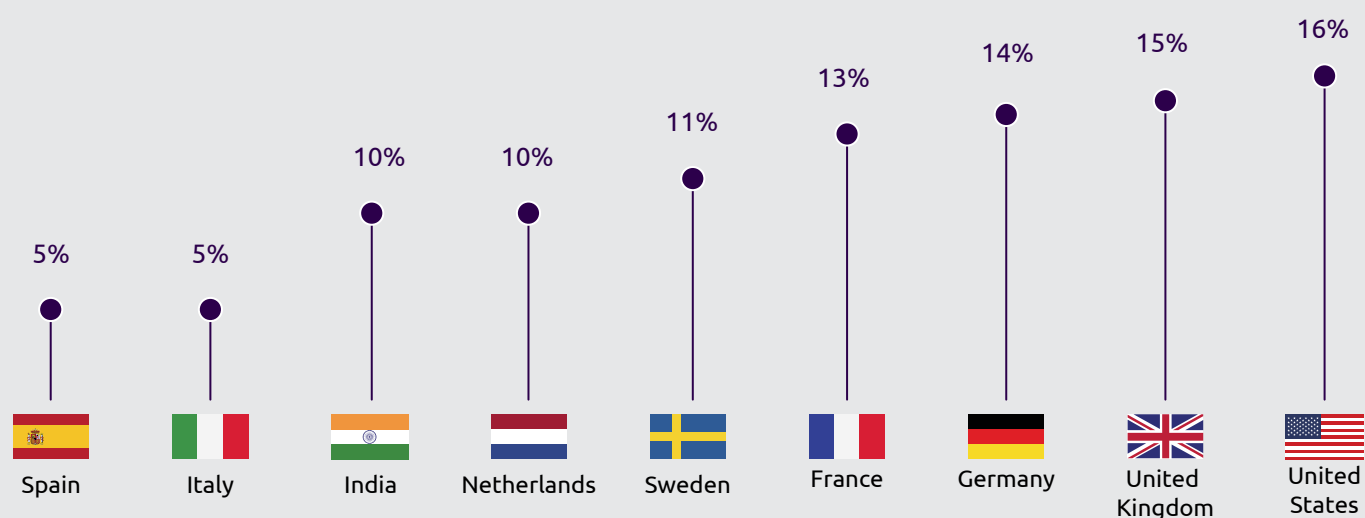
Supply chains have become increasingly complex over the years. Traceability, responsiveness, and trust issues remain barriers to more efficient supply chain networks. Blockchain's ability to remove these constraints can unlock value both by reducing inefficiencies and creating new opportunities. However, despite the compelling opportunities, there have been only a few large-scale implementations of this technology. Organizations can use the analysis in this report of applications being implemented and the characteristics of pace-setting organizations to understand how feasible this technology is for them and how to go about implementing their own blockchain programs. With that clear picture, they will be ready to strike as the blockchain hype increasingly turns to a reality.



Research methodology

We surveyed a total of 731 organizations about their existing and planned blockchain initiatives. The research focused on 447 organizations that are experimenting with or implementing blockchain. Eighty one percent of these organizations reported revenue of more than US\$1 billion in FY 2017. This survey was conducted from April to May 2018.

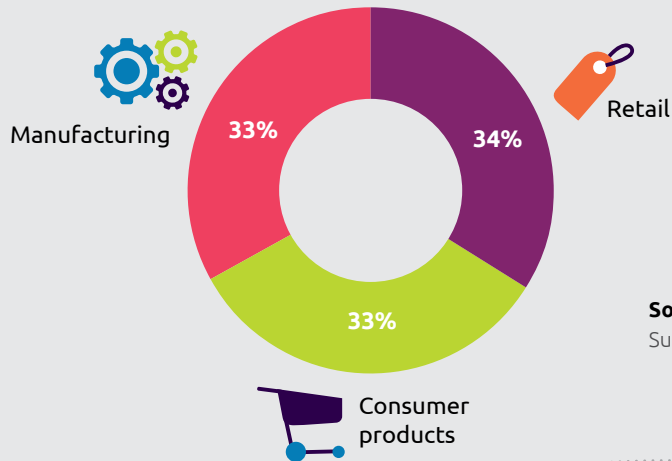
Organizations by location



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

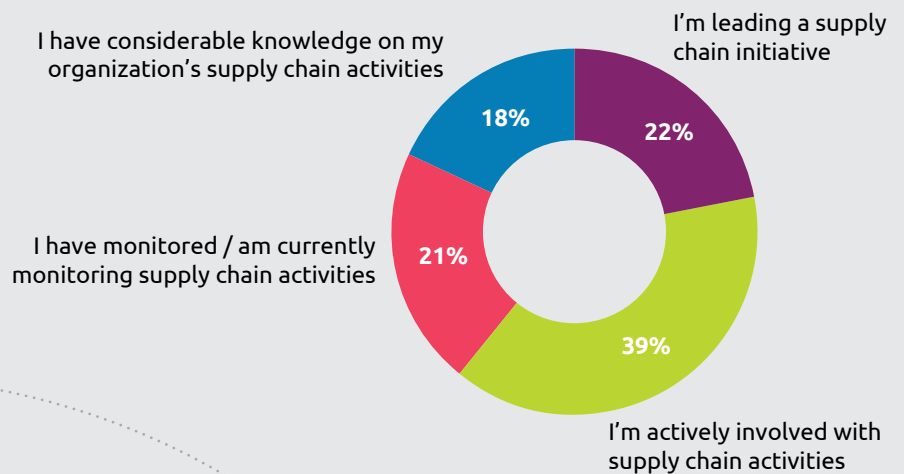
Research methodology

Organizations by industry



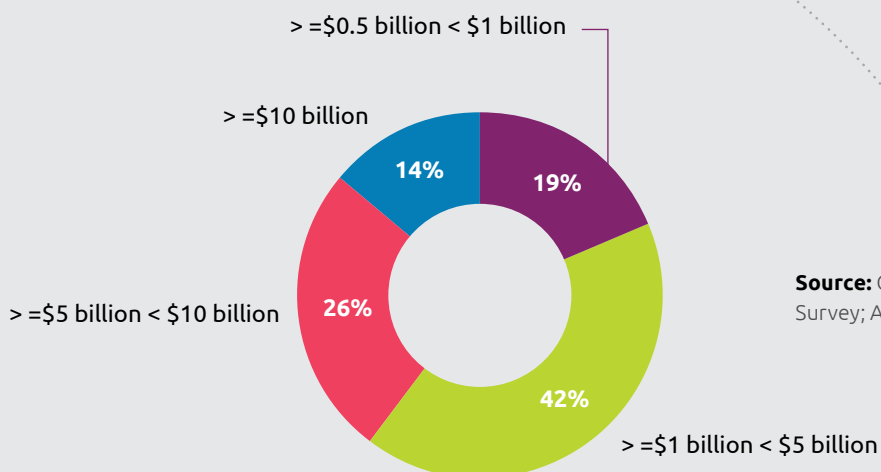
Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

Respondents by involvement in supply chain initiatives



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

Organizations by revenue



Source: Capgemini Research Institute, Blockchain Survey; April–May 2018, N=447 organizations.

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- ◆ Coopetition
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- ◆ Network economy

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- ◆ Provenance in supply chain
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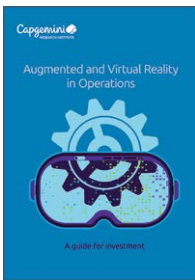
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- ◆ Agile methodology
- ◆ Distributed delivery
- ◆ Co-creation
- ◆ Client journeys
- ◆ Stakeholder management

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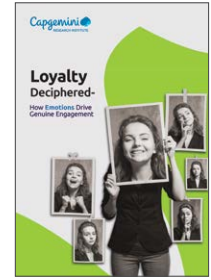
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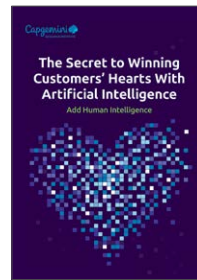
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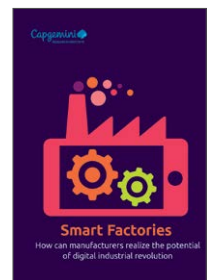
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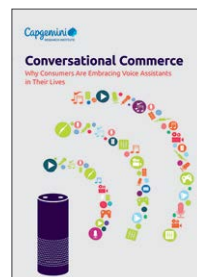
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