Forbes insights

THE ART OF BLOCKCHAIN:

Creating Masterpieces in a New Medium

IN ASSOCIATION WITH: wipro

TABLE OF CONTENTS

4 FOREWORD

5 THE ERA OF BLOCKCHAIN: FINDING THE RIGHT MEDIUM
- 6 BLOCKCHAIN'S "DESIGN ELEMENTS"
- 6 BLOCKCHAIN'S PROMISE

9 THE BLOCKCHAIN PALETTE: ADDING COLORS TO THE CANVAS
- 10 PAINTING WITH BLOCKCHAIN
- 11 INTERMEDIARIES: DEALERS IN THE ART OF BLOCKCHAIN
- 12 CASE STUDY: NORTHERN TRUST STREAMLINES PRIVATE EQUITY DEALS
- 13 CASE STUDY: AETNA ADVANCES THE ART OF IDENTITY AUTHENTICATION
- 14 CASE STUDY: INNOGY INITIATES THE AGE OF "THE MACHINE ECONOMY"
- 15 INNOGY: BLOCKCHAIN'S VALUE PROPOSITION

15 WHAT IT MEANS: PAINTING A PORTRAIT OF THE FUTURE
- 16 THE ROLE OF CONSORTIA
- 17 CASE STUDY: FORTUM: BLOCKCHAIN ENERGIZES THE ENERGY SECTOR

18 BLOCKCHAIN IN PRACTICE: EARLY WORKS OF ART
- 18 BARCLAYS: PILOTING SWAPS AND SMART CONTRACTS
- 19 IATA: MINTING A NEW AIR TRAVEL CURRENCY
- 20 HSBC: BLOCKCHAIN/DISTRIBUTED LEDGER TECHNOLOGY CAN GROW NEW BUSINESSES

22 OVERCOMING ROADBLOCKS CREATIVELY: NEW BRUSHES AND BRUSHSTROKES
- 23 A BOON FOR REGULATORS
- 24 CASE STUDY: DEUTSCHE BANK USES BLOCKCHAIN TO IMPROVE CUSTOMER EXPERIENCES

25 WHAT PORTRAIT WILL YOU PAINT?

26 ACKNOWLEDGMENTS

26 ABOUT WIPRO

FOREWORD

ABIDALI NEEMUCHWALA
CEO, Wipro

Driven primarily by digital trends, businesses today are under tremendous pressure to adapt to new competitive threats and opportunities. Today's emerging models are collapsing existing value chains in favor of more effective ways to store, exchange and track assets in a secure, efficient and trusted manner in multi-party digital ecosystems. It is for this reason that the blockchain buzz is gaining momentum in boardrooms across the globe.

Blockchain enables **"value exchange"**—be it of currency, rooftop solar panel energy, letter of credit documentation, voting rights or any type of proof of ownership representing digital assets—without the need of central intermediaries. Its rise not only carries the potential to become a new standard for the exchange of value, but it also introduces a range of opportunities for improving strategic and operational performance.

Peel through the layers of the technology palette: decentralization, distributed ledgers, smart contracts and various consensus protocols. What you really see at the core of blockchain is a new paradigm of thinking in which peer-to-peer exchange is possible between two entities in a multi-party digital ecosystem using a new trust protocol. For businesses, this is a truly disruptive technological force to reckon with—meaning blockchain will be a key enabler in building future digital ecosystems by enabling trusted transactions between unknown entities. All told, blockchain has the power to bring disruptive and transformational change for individuals, industries, governments and society.

Thanks to blockchain, the hottest kid on the technology block, the time to make a change is now; the place to do it is here, and it begins with you. I am already witnessing, first-hand, how blockchain, leveraging the simple concept of a distributed ledger, is a force multiplier in the sharing economy. As a thought-to-finish partner for global customers in their blockchain journey, we at Wipro are enabling great works of blockchain art.

Wipro believes blockchain is one of the technology themes that can transform the customer business and technology landscapes by 2020. We are investing significantly in building skills, competencies and innovative solutions alongside a robust IP/patent portfolio.

Blockchain has the power to drive transformation across a range of industries like banking and financial services, insurance, communications, manufacturing and technology, energy and utilities, retail and consumer goods, healthcare and life sciences, and government. Market impact will be visible when scale is augmented to power a consortia model to drive network effects in a business ecosystem.

Now, for a moment, imagine the billions of connected devices that are on their way in the form of the Internet of Things (IoT). These devices will chalk up billions of transactions daily, each costing only a few or perhaps only fractions of a cent. Are existing systems ready to handle this avalanche of micro-transactions? In contrast to the current hub-and-spoke model of transaction processing, a peer-to-peer model of trusted value exchange is in vogue, and can soon be the new norm.

Let's put it this way: You can create amazing business experiences, solutions, models and operating paradigms with blockchain. This report helps us take a step in that direction. Blockchain is here to stay. Are you ready to take it and create your masterpiece?

THE ERA OF BLOCKCHAIN: FINDING THE RIGHT MEDIUM

If technology is art, there's a new medium taking hold: **blockchain.**

In its 2015 report, *Deep Shift: Technology Tipping Points and Societal Impact,*[1] the World Economic Forum (WEF) proclaimed that within a decade, a full 10% of global GDP would be stored/documented/executed by some form of blockchain process. The group is so intrigued by the potential of blockchain, and discusses its arrival and implications so often, that its June 2017 meeting was dubbed the "blockchain forum" by many of its participants.

Further testimony comes from renowned futurist writers Don and Alex Tapscott. In *Realizing the Potential of Blockchain,*[2] developed on behalf of the WEF and presented at the organization's June 2017 meeting, the authors quote email correspondence from Tim Draper of Draper Fisher Jurvetson: "If anything, financiers are underestimating the potential of blockchain."

In its 2016 report, *Blockchain Technology Market – Global Forecast to 2021,*[3] Markets and Markets forecasts that blockchain investments can be expected "to grow from USD 210 million in 2016 to USD 2.3 billion by 2021, a compound annual growth rate of 61.5%." Similarly, Transparency Market Research[4] predicts rapid adoption, gauging global blockchain and related technology sales in 2015 at $316 million, but expecting this to grow to $20 billion by the end of 2024.

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A growing number of universities are also taking interest in blockchain. Again, according to the Tapscotts' report for the WEF, "Academic institutions are funding labs and centers to study this technology and collaborate with colleagues outside their silo."[5] In particular, the report cites Joichi Ito, director of the MIT Media Lab, who states that schools provide a forum where key issues in blockchain can be addressed "without any bias or special interests."[6] The report continues by saying that leading "universities such as Stanford, Princeton, Duke and New York [are also now teaching] courses on blockchain, Bitcoin and cryptocurrencies."[7]

More recently, in its August 2017 *Blockchain Enterprise Survey,*[8] Juniper Research reported that 39% of companies with over 20,000 employees are considering or deploying blockchain. Of those considering or deploying blockchain, 35% believe the technology will cause "'significant' internal disruption"; 51% say it will cause "'significant' disruption for their partners/customers."

Given the findings, statements and insights such as these, it is clear that blockchain and enabling/accompanying distributed ledger technologies (DLT) can expect exponential growth, impacting not only nearly every industry but also government agencies and regulators.

1 Deep Shift Technology Tipping Points and Societal Impact, Global Agenda Council on the Future of Software & Society, World Economic Forum, September 2015.
2 Realizing the Potential of Blockchain A Multistakeholder Approach to the Stewardship of Blockchain and Cryptocurrencies, p. 26, Don Tapscott and Alex Tapscott, World Economic Forum, June 2017.
3 Blockchain Market by Provider, Application (Payments, Exchanges, Smart Contracts, Documentation, Digital Identity, Clearing and Settlement), Organization Size, Vertical, and Region - Global Forecast to 2021; MarketsandMarkets, 2016.
4 http://www.prnewswire.com/news-releases/worldwide-blockchain-technology-market-is-anticipated-to-exhibit-a-cagr-of-587-between-2016-and-2024-elimination-of-third-parties-improves-demand-and-security-of-online-transactions--tmr-611067345.html
5 Realizing the Potential of Blockchain, p. 27, World Economic Forum, June 2017.
6 Ibid.
7 Ibid.
8 Juniper Research: Blockchain Enterprise Survey August 2017, Juniper Research, August, 2017, https://www.juniperresearch.com/resources/infographics/blockchain-enterprise-survey-august-2017

BLOCKCHAIN'S "DESIGN ELEMENTS"

By now, most executives are familiar with blockchain-enabled cryptocurrencies like Bitcoin. But, what exactly are the key design elements of blockchain, and how are they being harnessed to paint widespread business process and industry revolution and disruption?

"At its core, blockchain is nothing more than a special kind of distributed database," says Brian Behlendorf, executive director of the Hyperledger Project, a blockchain-focused arm of the Linux Foundation. Brian's core goal is to work with technology providers, open-source communities, businesses and governments in order to promote, as well as optimize, the value and development of blockchain and associated technologies, including Linux.

As Behlendorf goes on to explain: **"This special kind of distributed database features an ecosystem of select participants, which could include anything from upstream suppliers to downstream consumers, regulators or other appropriate stakeholders."** Members of the ecosystem occupy a series of distributed electronic ledgers—nodes—able to make identical copies of the same entries over and over. Adding a unique identifying code as it goes, as a means of timestamping the entry, further enhances each entry's provenance. Together, this creates a network of records that is—among other compelling capabilities and attributes—nearly impervious to alteration or fraud.

Moreover, since each participant is working from an identical record, there is no need for reconciliation, reducing costs and accelerating fulfillment, settlement or whatever processes are being governed within the blockchain. Often today, says Behlendorf, counterparties have already agreed to execute a transaction, but three or more days are needed for reconciliation prior to settlement. "Call it T+3 [trade plus three days]," says Behlendorf, "but introduce blockchain, and we move from T+3 days to T+3 minutes."

Key blockchain benefits include speed of transaction execution, accuracy and security , to name just a few, and all told, interviewees for this report estimate operational cost savings ranging from 25% to 40%.

BLOCKCHAIN'S PROMISE

Conceptually, blockchain may seem simple, even fundamental. Yet its arrival and rapid development portends not only opportunity, but also potential disruption. Consider examples from industries such as:

BANKING AND FINANCIAL SERVICES

Leaders like Deutsche Bank (see case study, p. 24), Northern Trust (p. 12), Barclays (p. 18), and HSBC (p. 20) are engaging in a wide variety of initiatives designed to digitize assets, accelerate trading and reconciliation processes, heighten cybersecurity as well as drive new business opportunities. Examples include using "smart contracts" and blockchain to document, track and automate settlement/reconciliation of all manner of transactions, derivatives (including mark-to-market), cross-border payments and even key events throughout the process of trade finance.

Note that in *The Fintech 2.0 Paper: Rebooting Financial Services*,[9] Santander InnoVentures predicts that blockchain "could reduce banks' infrastructure costs attributable to cross-border payments, securities trading and regulatory compliance by between $15-20 billion per annum by 2022."

9 The Fintech 2.0 Paper: rebooting financial services; 2015; Santander InnoVentures, Oliver Wyman, Anthemis Group.

INSURANCE

Owing to its secure, "one-version-of-the-truth" nature, blockchain is poised to disrupt the whole of the insurance industry, enabling advances such as peer-to-peer (P2P) insurance models or even parametric insurance—where "smart contract"-enabled instant payments can be triggered by real-world events or circumstances. In addition, firms like Aetna (see case study, p. 13) are harnessing distributed ledger technology to enable quantum improvements in authentication of identity—essentially eliminating passwords while improving security—as well as expanded information sharing amid patients, doctors, payers and researchers.

HEALTHCARE

Leading drug and device makers are using blockchain to enable greater access to personal patient data in support of personalized therapies. Drug makers and distributors see blockchain as a highly effective means of tracking origin and transport, improving quality control while providing safeguards against counterfeiting. Hospitals, doctors and insurers are collaborating in healthcare-focused blockchain consortia to accelerate the development of highly secure, yet easily accessible, portable electronic health records (EHR).

Additionally, a CIO preferring anonymity told us their firm was using blockchain to address opportunities in regulatory compliance and clinical trial records. Overall, says the CIO, "blockchain puts the patient at the center of the healthcare ecosystem and can increase the security, privacy and interoperability of health data."

ENERGY AND UTILITIES

Blockchain's potential for process improvement and disruption is equally evident in this field. Key use cases include better tracking of decentralized energy generation along with improved metering and grid management. Companies like Fortum (see case study, p. 17) are using the technology to innovate in areas such as electric vehicle (EV) charging. Meanwhile, in addition to EV charging, Germany's innogy (see case study, p. 14) is pursuing peer-to-peer energy trading—"Uber for energy." Riding technology's bleeding edge, the group is pursuing autonomous, fast and efficient energy transactions initiated and executed via machine to machine (M2M).

RETAIL AND CONSUMER GOODS

In these closely related fields—one is the others' supply chain; one is another's key distribution channel—blockchain will enable a wide array of process improvements. For example, Walmart is looking to blockchain as a means of tracking goods beginning early in the supply chain all the way through sales and service. In an early trial of the sort of technology being developed, Walmart tracked pork products produced in China including "details related to farm origins, factory data, expiration dates, storage temperatures and shipping across producers, processors, distributors and grocers."[10] So enabled, the retailer would be able to quickly respond to any product issues or even detect product quality risks in advance of their becoming a problem.

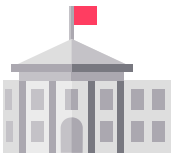
10 What will blockchain mean for retail supply chains?; January 24, 2017; Ryan, Tom; Retailwire.

MANUFACTURING AND HIGH-TECH

The same sorts of ideas being explored by the likes of Walmart, Northern Trust and innogy can be applied to manufacturing as well. Whether high-, low- or medium-tech, members of any product/service ecosystem will be able track products from the materials phase all the way to up-and-running products. Add M2M capabilities, and everything ranging from a lowly flow-gauge to a leading-edge microprocessor or server could use blockchain to report on its operating condition and, where appropriate, autonomously initiate needed actions.

"This is more than just a means of reducing costs and streamlining processes. Fundamentally, blockchain is a trust tool—a means of ensuring the highest integrity in your interactions."

BRIAN BEHLENDORF, EXECUTIVE DIRECTOR, THE HYPERLEDGER PROJECT



GOVERNMENT

In that blockchain enables secure transactions to take place beyond centralized control, the technology could be mischaracterized as the antithesis of government—which tends to centralize control. But in fact, blockchain has the potential to enhance the role of government almost across the board. With blockchain, regulators can be granted concurrent access to the transactions they need for their regulatory efforts. In fact, the Australian Securities Exchange is looking into blockchain-enabled clearing and settlement, while the UK Financial Conduct Authority (FCA) has created its own testing ground for the technology (FCA Sandbox Project).

Other core focus areas of blockchain initiatives in government include licensing of healthcare, legal, engineering and similar professions; enabling non-cash benefits transfer tracking and governance (like transfer of non-financial benefits); payments and verification of loan/grant disbursements; invoice clearing/settlement for real estate contractors; inspections of restaurants, chemical or food processing facilities; and record-keeping from voter rolls to marriages and real estate holdings.

These and similar tasks are ideally suited to blockchain, so much so that Dubai has announced a national blockchain strategy, a partnership between its "Smart Dubai Office" and the "Dubai Future Foundation".[11] Meanwhile, in the U.S., the National Association of State CIOs (NASCIO) refers to the technology as "transformational."[12]

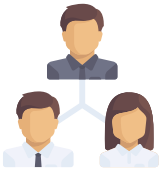
The above are only a smattering of initiatives being planned or already underway in a number of industries. As Behlendorf explains, "This is more than just a means of reducing costs and streamlining processes. Fundamentally, blockchain is a trust tool—a means of ensuring the highest integrity in your interactions." As such, the technology is positioned to play an important, or even transformative, role across virtually everywhere contracts, payments, records or related documentation play a role.

11 http://www.smartdubai.ae/dubai_blockchain.php; December 2016; accessed August 22, 2017.
12 Blockchains: Moving Digital Government Forward in the States; 2017; NASCIO.

THE BLOCKCHAIN PALETTE: ADDING COLORS TO THE CANVAS

To be precise, blockchain isn't so much new as it is a meta-technology. That is, it is programming code (blockchain) that is being developed to enhance or serve as an overlay across an array of existing internet, cloud, database and/or "related" technologies. However, as this epoch unfolds, each of these related technologies will in turn begin to evolve in ways that further complement and enable distributed ledgers, hence the term DLT, which for many is synonymous with blockchain. Evolution in these enabling technologies will further accelerate blockchain growth.

Marley Gray is a principal architect for Microsoft and the director of the Enterprise Ethereum Alliance, a group working to develop enterprise-scale platforms on which to build blockchain applications. According to Gray, this meta-technology is best understood first in terms of its key attributes and capabilities and then by its technical architecture. In Gray's view, the four most relevant aspects of blockchain for senior executives include:



CRYPTOGRAPHIC

At the heart of blockchain solutions is their ability to authenticate participants. As Gray explains, "Blockchain solutions use an array of behavioral, technical and biometric means for ensuring that any person writing to the blockchain is indeed the person they claim to be."

Technical measures might include identifying the device or server by which the blockchain is being accessed. Behavioral measures might include the sorts of specific actions being taken by the individual or business entity. Biometric might be anything from the speed at which the individual can type to the angle by which they hold their smartphone. Combining a range of such measures into an overall score greatly reduces the risks of impersonation. Moreover, the algorithm can learn over time, adjusting as conditions evolve.

SHARED (CONSENSUS)

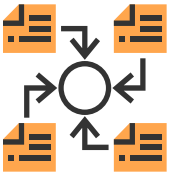
Any parties to a blockchain-enabled transaction or contract have agreed in advance to its terms. One of the principal terms is that counterparties will all rely on a "single version of the truth"—a single file or record which may include data or logic (the terms of the agreement), or both. As Gray explains, "We have all agreed to the form, we agree to the logic, and we agree the record is a shared truth. So, we don't have to double-check each and every book [or entry]."

DISTRIBUTED

The details of any interaction are logged across an array of nodes or distributed ledgers. These nodes can be private (writing to the ledgers of just two counterparties or perhaps including selected others in an ecosystem or

> "Blockchain solutions use an array of behavioral, technical and biometric means for ensuring that any person writing to the blockchain is indeed the person they claim to be."
>
> **MARLEY GRAY,** PRINCIPAL ARCHITECT, MICROSOFT; DIRECTOR, ENTERPRISE ETHEREUM ALLIANCE

those acting in the role of "trusted agents") or public (written across a wide range of ledgers, accessible to anyone). Since details are rewritten precisely 'as is' on each node, public or private, "it becomes extremely difficult if not [wholly] impractical to even make an attempt at fraud," says Gray.



LEDGERS

Adding to the tamper resistance of each record, each action in blockchain is timestamped, generating a sort of complementary anagram of the published data. The resulting code is complex, and its association with the core record is immutable. This makes it impossible to make any changes to the data without losing its linkage to the initial anagram.

In short, timestamping memorializes the data by recording the core data and its anagram across all nodes in the blockchain. "Once entered, there is no way to change any entry by any means other than an additional, correcting entry," says Gray. For example, if one party makes any sort of mistake and needs to make a change, it can't be hidden—all parties across all nodes will see that mistake and its accompanying correction. "This is a good thing," says Gray, "because it all adds up to blockchain providing a secure, complete and trusted record that all can rely on."

PAINTING WITH BLOCKCHAIN

Understanding these fundamentals makes it easier to see how blockchain and enabling/complementary technologies are being developed and deployed in the real world. Think back to the early days of the internet. All could see what the worldwide web could deliver: a means of accessing data and various applications that could make use of that data. But how many noticed immediately that such a platform could be used to enable data sharing and applications that could transform or completely disrupt entire industries? "No one could have predicted such massively disruptive or successful businesses like Amazon, Google, Facebook or PayPal would come along," adds Microsoft's Gray, "and there will be similar levels of innovation and disruption that we can expect from blockchain."

Blockchain today is in a state very much like the internet at its commercial dawning. A key challenge today, says Behlendorf, "is determining the right layer for standardization." The analogy isn't perfect, but recall essential compatibility standards such as the hypertext translation protocol (http) for websites; the domain name system (DNS) for identifying discrete devices or nodes within a network; or even structured query language (SQL) for communication with databases. Standards such as these are essential for an art form—a technology—to take hold.

"So what we're trying to create [today] is common software so that the building blocks being developed can be used in any setting," says Behlendorf. Moreover, such a palette also means "that developer skills can be transferable, and not locked in to any single company or industry." A milestone in this journey, says Behlendorf, is the release of his group's Hyperledger "Fabric," which was placed in production in mid-July 2017. This consortia-built medium "provides a standardized, durable and reliable framework upon which developers can apply their design and coding skills for specific functional and technology specifications—and like other standardized frameworks, much of that work will be interoperable."

Practical, working specifications come to life during the next step: application development. Applications are like paintings: Developers use their technology medium to create artworks of value. Early blockchain works (masterpieces) include so-called cryptocurrencies like Bitcoin or Litecoin. But what other innovations can be created and industrialized or scaled using such a template?

Accessing standards available in Fabric or Ethereum, developers can now create applications appropriate for their sector. For example, a healthcare provider can create a secure and efficient customer portal, a manufacturer might build tighter linkages with its suppliers, or a

government agency might build a better system for managing licenses, approvals or other records. All can embed enhanced cryptography or smart contracts—algorithms that automatically execute payments, ownership transfer, settlement or other key elements within a contract—within their blockchains in order to enhance security, accelerate settlement/payment and reduce the need for human intervention.

In essence, just as internet and mobile technologies today deliver services and experiences that were unimaginable 20 years prior, blockchain is enabling a similar revolution. Though today we cannot see where this is leading, with hindsight, says Behlendorf, "we'll all be saying, 'why didn't I think of that?'"

INTERMEDIARIES: DEALERS IN THE ART OF BLOCKCHAIN

A stumbling block for many organizations is again the public/private nature of blockchain. To continue the analogy, blockchain is a work-in-progress canvas that can either be public (in a museum for all to see) or private (in the hands of private collectors and owners). Of course, the more nodes collecting and storing the data, the greater its security and authenticity, but also the less its privacy.

So what about situations where counterparties need greater discretion in their dealings or where data privacy rules mean the details of any transaction cannot be repeated across some public blockchain? Fewer nodes lessen the benefits of mass record-keeping. This is where middleware software can be written and/or where intermediaries can stand in to segregate elements or workflows within the blockchain.

Middleware is the linkage between the blockchain and existing processes and applications. Often, new business models, such as where an intermediary stands in to oversee administration of a range of blockchain nodes, can perform the same function. Middleware or new business models can be configured so that data and logic—applications—that do not need high levels of secrecy or privacy can run on public blockchains. But more critical workflows and data, or information to be shared only with discrete, select counterparties, can be housed in a private blockchain.

Private forums, by definition, will not have as many nodes as public blockchains. For instance, access on a private network might be on a one-to-one basis, or it might be expanded to include trusted third parties as referees/assurance providers. Or it could include an ecosystem of similar entities where all counterparties are obliged to observe certain standards and regulations, such as in banking or healthcare. Note also that end-to-end processes may in certain instances engage both public and private blockchains as needed or appropriate.

Where privacy is essential, intermediaries can stand in as a trusted agent between one or more counterparties. Data is timestamped in the cloud by an intermediary who can provide full attestation that it is using the blockchain's cryptographic, shared, distributed, ledger attributes to track data and execute logic.

Another point relevant to the public/private discussion is that of scalability. One of the knocks on blockchain is that it can run only as fast as its slowest node. But as Microsoft's Gray explains, "With the introduction of middleware—of models using trusted agency—we don't execute all of our logic on all of the nodes." By running certain elements on agreed-to trusted nodes, processes become "vastly more scalable."

Another role for intermediaries is to develop software that can serve as a translator between the blockchain and any participant's existing IT platforms. There is no question that blockchain can create value for organizations. But if accessing that value requires pulling the plug on vast legacy infrastructure such as CRM platforms or ERP systems, blockchain's growth will be stunted. Again, as more intermediaries develop the needed translation programs and associated services, the pace of blockchain development and deployment will only accelerate.

CASE STUDY: NORTHERN TRUST STREAMLINES PRIVATE EQUITY DEALS

At Northern Trust, Peter Cherecwich, corporate and institutional services president, believes that blockchain has the potential to "revolutionize" a wide swath of business processes for a wide range of industries. For example, "in the diamond industry, they're using blockchain to create an immutable record of everything there is to know about each [stone], from where it was mined to who took possession along the way to final ownership."

As for his own group, "we're now live with a private equity (PE) application." To understand how it works, think about a standard home purchase. "When you buy a house, you have to physically exchange contracts, perhaps assign power of attorney, obtain approved inspections, title, etc." Acquiring a stake in a company using PE "isn't all that different," says Cherecwich. "It's a highly manual process involving a wide range of [counterparties/stakeholders]."

Consequently, the PE investment process is an ideal opportunity for blockchain. All parties can now view all activity in a single, immutable record. There is no need for reconciliation, since everyone involved in the transaction is working from the same set of documents. Then, on top of the blockchain code, Northern Trust places a smart contract, "so that once everyone accepts the terms, the money exchanges at the exact same time."

The arrangement is an example of an intermediary stepping in as a trusted agent, overseeing the blockchain. Working as the external fund administrator, Northern Trust uses its blockchain application to execute a wide range of PE transactions. Indeed, in each case there is a single version of the truth. But overall, the blockchain is private, with access limited to appropriate parties only. "We assign the nodes," says Cherecwich, so that whether a participant is a limited partner, general manager, asset manager, investor, auditor or regulator, "they have access to only the data needed for their role."

As smooth and streamlined as the now "up and running" product might be, its achievement "took considerable effort," says Cherecwich. For starters, since the blockchain application is cloud-based, the group had to work with regulatory officials to obtain the appropriate legal domicile for any transaction. "The cloud server is based in London," explains Cherecwich. But Northern Trust needed the transactions to take place, officially, in Guernsey. So, working with officials, "we designed our solution [keeping the] elements of encryption and key management on Guernsey to maintain the offshore integrity of the fund." In addition, Northern Trust needed to gain buy-in from key participants in the blockchain application. When someone buys a house or a diamond, they have the house or diamond in their hand, says Cherecwich. But in financial services, "all you have is the blockchain." So helping people become comfortable with something "new and different becomes an issue of change management." However, says Cherecwich, "once people get a look at what we're doing—how this is actually a better, more secure and efficient process than what they're used to—doubts subside."

Going forward, Cherecwich believes blockchain and associated solutions will lead to significant improvements in efficiency, security, auditability and cost. As for Northern Trust, in addition to its "live" PE application, many others are in development—essentially anywhere it feels it can improve its services for clients. And while Cherecwich agrees that financial services companies appear to be ahead of the curve in blockchain today, over time, "I believe we're going to see [blockchain] take off in manufacturing, logistics and a wide array of additional industries."

> "Once people get a look at what we're doing—how this is actually a better, more secure and efficient process than what they're used to—doubts subside."
>
> **PETER CHERECWICH,** CORPORATE AND INSTITUTIONAL SERVICES PRESIDENT, NORTHERN TRUST

CASE STUDY: AETNA ADVANCES THE ART OF IDENTITY AUTHENTICATION

Since passwords are both difficult to manage and subject to compromise, Jim Routh, chief security officer at Aetna, says, "they've been creating friction in [healthcare] for the past 25 years—and things are only getting worse." But using blockchain, "we have a project called 'Personal Authentication,' [that is] increasing security while eliminating the use of passwords."

The system essentially eliminates the need for passwords "using a risk model that takes user behavioral attributes along with biometric and device fingerprint attributes to create a risk score notifying the application how much access to provide in real time," says Routh. This means continuous authentication throughout the use of the web and mobile applications.

To build each score, the system collects an array of so-called "benign" details. Behavioral details could include the pace at which a customer walks, or the ways they move. A device footprint might include the IP address, the device configuration or the menu of installed plugins or other applications. This is combined with biometric information from the device, depending on what the consumer has chosen. All of which, says Routh, "should raise no privacy concerns: these details are benign—simply used to compare to a mathematical representation of normal behavior. [They] help to create the risk score, but the information is not stored."

A PIN is issued during registration, and the devices registered by the consumer are bound to the identity. The risk engine uses behavioral data along with device configuration data immediately to create a baseline model for continual comparison. The model uses unsupervised machine learning to improve with each user interaction.

Of course, usage patterns can change over time. Or a customer can acquire a new laptop or smartphone or even sprain a wrist or ankle, altering the biometrics. No matter, "the score adjusts over time," and if the user's identity ever raises any serious security issues, "the system escalates the identification process appropriately," says Routh. Numerous attributes feed the risk engine and improve the model over time.

In addition to enhancing identification processes at Aetna, Routh and his team are working with the National Health Information Sharing and Analysis Center (NH-ISAC) Identity Management Working Group to bring such tools to the industry at large. Says Routh, "We're working to improve data sharing with those who need detailed data to improve health care."

The end-game, says Routh, is reaching the point where "providers, payers and patients—the entire healthcare ecosystem—can all share information, appropriately and securely, in a connected network." Blockchain, says Routh, "is a game-changer and is being added to the identity-proofing process for Aetna consumers in 2018."

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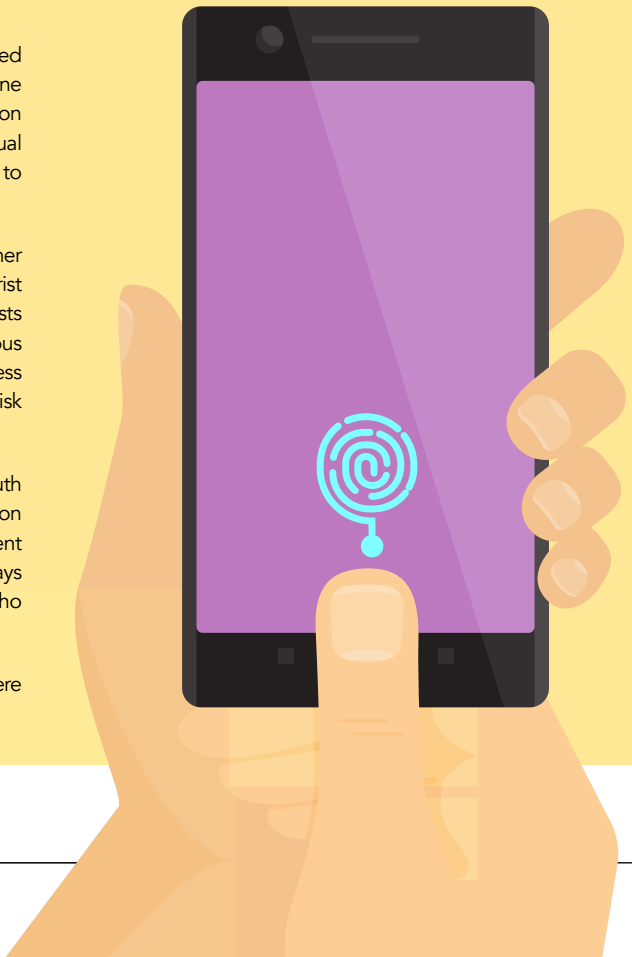
>
> **JIM ROUTH,**
> CHIEF SECURITY OFFICER, AETNA



CASE STUDY: INNOGY INNOVATION HUB INITIATES THE AGE OF "THE MACHINE ECONOMY"

Carsten Stöcker, senior manager, Machine Economy Programme at energy-focused innogy SE, focuses on an array of new technologies and business concepts. This includes not only blockchain, but also machine-to-machine (M2M) solutions, along with new decentralized models for ecosystems. According to Stöcker, we are now in the midst of the fourth industrial revolution, an era that features "blurring between the physical, digital and biological worlds."

A good example of this blurring of the lines is the arrival of ride-sharing services like Uber and Lyft, where a technology overlay drives a physical transaction. Seeing this—and similar business models—Stöcker and his team set out "to invent the Uber for energy." The group got in touch with Ethereum and began work on a peer-to-peer (P2P) energy-trading platform built on blockchain.

Blockchain and associated technologies introduce the ability to "significantly improve authenticity and integrity of data, [allowing it] to follow physical objects, services or people, [guiding] them through an entire value chain," says Stöcker. When combined with attributes such as cryptographically secure identities, "blockchain creates truly reliable and immutable records to make it easier and less expensive for any two parties to transact with one another in a verifiable way."

The work thus far has resulted in at least eight promising proof-of-concept models, but also three new up-and-running products. Working examples include:

- P2P Energy Trading—a corporate venture with Conjoule GmbH
- Share & Charge—a network to enable electronic vehicle charging via innogy's venture, Motionwerk GmbH
- Twin of Things—digital copies of actual machinery/equipment capturing the story of physical object and machines

Enter the machines.

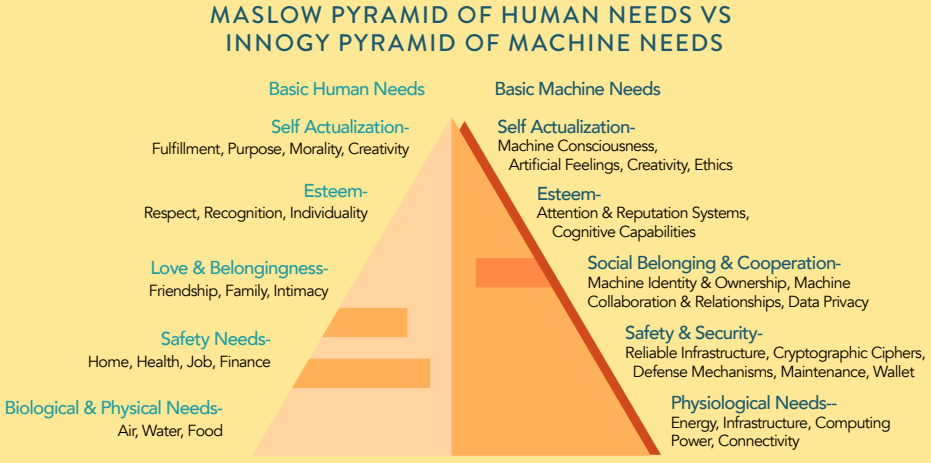
A particularly intriguing element in Stöcker's work is the realization that with blockchain, transacting "parties" may also include machines. According to Stöcker, "Machine-centered business models and forms of value exchange are now fast emerging." Any machine or device can be equipped with its own blockchain wallet and can follow its algorithm or other instructions to independently transact as appropriate for its role in the value chain.

As Stöcker explains, "In the near future, we can expect that a machine will be able to pay its assembly, its maintenance, its energy and also its liability insurance by [exchanging] data, computing power, storage or physical services with other machines." So blockchain is one of the key technologies enabling machines to become sellers and buyers, ultimately forming their own machine economy.

Machines able to execute autonomous decisions can revolutionize numerous aspects of the energy business, introducing a range of efficiencies at scale. But success in such a world requires understanding the unique needs of machines as well as the algorithms that drive them. Regulatory and legal foundations will also need updating. But going forward, says Stöcker, "as machines drive more buying choices, [we] understand machines as new customers and look for global business model innovation based on both human and machine needs."

Figure 1: innogy Pyramid of Machine Needs

The emergence of "machine-centered design" in a world where machines, and not just people, shop for products and services in a global economy, and the need to consider a "hierarchy of needs" for machines as well as people in creating products and services.



Source: innogy SE, When a Machine Is the Customer – Designing for Machines, https://medium.com/@cstoecker/when-a-machine-is-the-customer-designing-for-machines-cad5131ea319

INNOGY: BLOCKCHAIN'S VALUE PROPOSITION

Key characteristics of blockchain, says Stöcker, include:

Reduced transaction costs

Interoperability

Direct counter-party transactions between previously unknown parties

Secure transactions; limited credit risks

Data integrity/trust

Users in control of their data

Entirely new business models, transforming the future of whole industries

Economically viable nano-transactions

Machine-centered design

WHAT IT MEANS: PAINTING A PORTRAIT OF THE FUTURE

The immediate and potential future benefits of blockchain accumulate so rapidly it can be hard to keep track. But to summarize, blockchain's core capabilities include:

- Immutable, permanent, trusted records
- Clearly established asset provenance
- Indelible tracking of changes in ownership or value over time
- Ability to expedite/control exchanges in value

What this all means is that blockchain establishes incontrovertible records—a single, shared version of the truth. Moreover, the complete history of any agreement/deal is replicated across vast, distributed ledgers and networks. This makes it extremely difficult, if not close to impossible, to easily alter information or commit similar accidental or fraudulent acts.

In practice, all of this confers tremendous capabilities within any blockchain. Fundamentally, counterparties can condense processes to their core, which can be encoded for automated execution. Processes execute as programmed—becoming "smart contracts"—based on subsequent and ongoing entry of variables such as payments or market rates. Counterparties can see precisely what is happening in real time, processes are fully automated, and there is no need for continuous audit since reconciliation and control are essentially front-loaded in the blockchain.

Note also that blockchain is remarkably friendly to our fast-arriving technology future. Nodes can be individuals, companies or even robots, such as an AI platform or IoT device. So commercial relationships can be automated, governed wholly by objective

processes. Increasingly, blockchains will also include components known as oracles—programs that gather specific market data from designated, reliable and auditable sources to be used for valuation and related functions within smart contracts. For example, a variable-rate loan calculation might need a single source for its LIBOR rate.

THE ROLE OF CONSORTIA

Cherecwich of Northern Trust suggests there are three key paths by which successful blockchains will tend to arise. The first is where a single organization takes the lead and builds the application, "as we did with our PE offering." The second is where a regulator or government steps in and mandates the use of blockchain, for example, the Australian Securities Exchange. The third means, says Cherecwich, "is the path of the consortium."

Today there are numerous consortia exploring opportunities in blockchain. These are essentially members of an ecosystem working together using blockchain to address pain points and stimulate innovation. Ethereum and Hyperledger are just two leading examples, but others include the International Securities Association for Institutional Trade Communication (ISITC), R3, B3i, and Hyperledger Healthcare. Note that both blockchain development and consortia are global phenomena: China boasts the China Ledger Alliance, Japan claims the Blockchain Collaborative Consortium, and Europe hosts groups such as the FCA Sandbox Project (UK), Fundchain (Belgium) and the Dutch Logistics Group.

Consortia are by no means a guarantee of success. As Behlendorf explains, though they may all be working in the same ecosystem, such groups consist of a wide range of participants including not only customers and providers, but also regulators and competitors. "The process can be a bit messy; it can take a great deal of time, requiring patience and diplomacy." And in truth, not all consortia will achieve their desired goals. However, says Behlendorf, "cooperation and collaboration between related groups" is one of the most reliable means of achieving "breakthrough results."

Accordingly, Behlendorf recommends that organizations seek out and get involved in any such group that might be addressing issues of relevance. Note that involvement can include anything from attending working sessions to contributing cash or participating in pilots.

But even if there is no such consortium in existence today, that is no excuse for not climbing the blockchain learning curve. "Your technology team and your business unit leaders should get out there and attend some of these blockchain events," says Behlendorf. From there, "allocate a significant portion of your R&D to play with this technology; get a business-level conversation started to identify the opportunities." Companies do not have to be pioneers, but neither can they afford "to fall too far behind with these technologies," says Behlendorf.

CASE STUDY: FORTUM: BLOCKCHAIN ENERGIZES THE ENERGY SECTOR

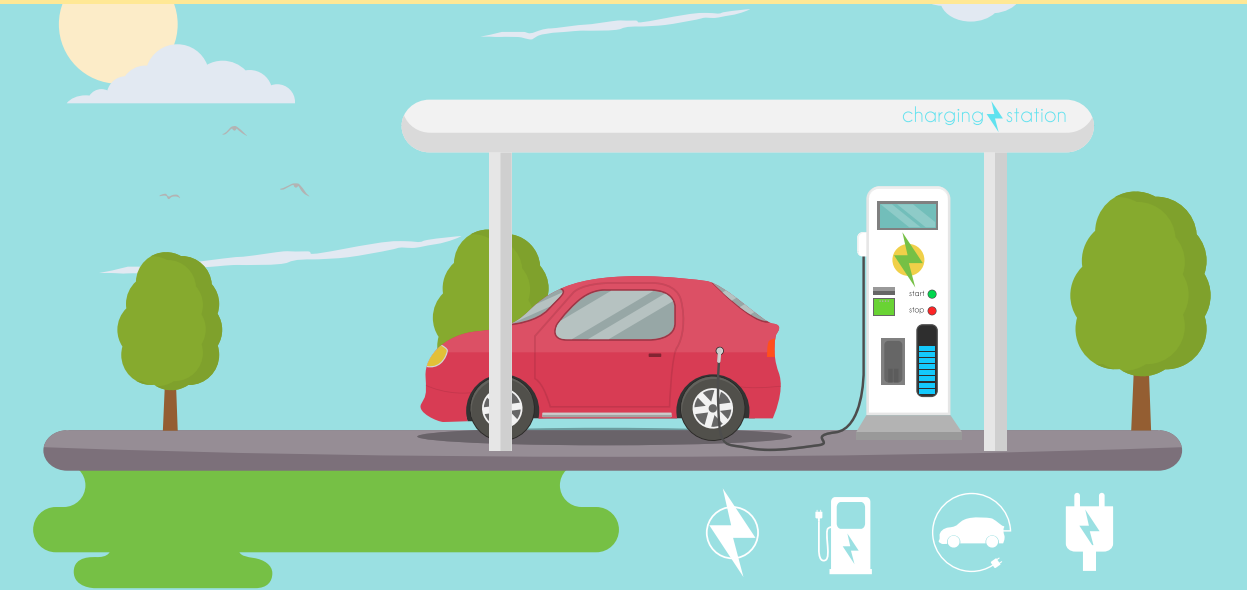
Blockchain can create competitive advantage for virtually any industry. Catarina Naucler, research and innovation manager at the Finland-based energy producer Fortum, says that "for us, we were not certain what we could do with blockchain, but we saw this as an important technology." Accordingly, "we decided to take a closer look and gain some experience; to find opportunities but also to make certain we don't overlook anything and fall behind."

Fairly quickly, Naucler's team developed a compelling initial business case. "When you think about driving an electric vehicle across Europe, going between countries, you, as a customer, should be able to pull into any charging station, and the energy companies should be able to make that work for you." Blockchain, says Naucler, should be useful for improving the efficiency, as well as the security, transparency and other elements, of the resulting intercompany settlements.

> "Things may be moving slowly today, but very soon, blockchain will be reshaping supply chains and industry models. It facilitates disintermediation and disruption."
>
> **CATARINA NAUCLER,** RESEARCH AND INNOVATION MANAGER, FORTUM

So, at Fortum, work began on a pilot, coding in blockchain, building bridges between another energy company [innogy—see case study, p. 14] and Fortum's own internal systems. Building on the success of this first step, Fortum is now joining other utilities in the Energy Web Foundation, a group focusing on developing blockchain-enabled capabilities, such as data analysis, smart grid management and the trading of green certificates, for alternative energy producers.

"Overall," says Naucler, "we're learning a great deal, both about blockchain and how to work with others to bring advances like these to market." As for blockchain itself, Naucler sees the technology as revolutionary. "Things may be moving slowly today," she explains. "But very soon, blockchain will be reshaping supply chains and industry models. It facilitates disintermediation and disruption. And it's my role to make certain Fortum is right in the middle of it all."



BLOCKCHAIN IN PRACTICE: EARLY WORKS OF ART

Leaders across a wide range of industries are taking note of the capabilities blockchain offers and are taking steps to overcome the learning curve as well as establish quick wins. Below are a few examples of companies putting blockchain into practice.

BARCLAYS: PILOTING SWAPS AND SMART CONTRACTS

Dr. Lee Braine from the Investment Bank CTO Office at Barclays explains that "we became involved in blockchain over two years ago, as we began exploring the inner workings of cryptocurrencies." But as the group delved more deeply, "we found we weren't as interested in virtual currencies, or even their versions of blockchains, so much as we were in some of the fundamental technology ideas beneath." Approaching blockchain from an architectural perspective, Barclays found there were two aspects in particular that it really liked.

"First," says Braine, "the current topology in financial services is that each bank maintains its own records." This means "we spend a great deal of time reconciling our records against other parties' records." A core feature of blockchain "is that amongst all participants, there is a single source of truth. So there should be much less need to reconcile, and that reduces administration and accelerates processes."

Second, blockchain has the ability to capture and facilitate common processes. That is, agreed-to processes can be encoded once and then run by different participants. Without blockchain, "each party would often run its own custom processes, and so any minor difference in definitions or coding could lead to reconciliation errors," says Braine. But in blockchain, everyone is on the same page. "These two benefits alone, greater consistency of data and greater sharing of common processes," says Braine, "could lead to potential long-term savings of 20% to 40% in operating costs."

Of course, there are other aspects of the cryptocurrencies blockchain model that aren't as attractive for banks. One of the key issues is information privacy: Whereas virtual currencies run on a public blockchain, "for us, confidential data must be protected, and so we require a more controlled and secure model."

Another issue is the "proof-of-work" feature of public blockchain models, which determines who gets to process the next block of transactions. This mean that, for example, any anonymous Bitcoin node can potentially participate in processing transactions. In banking, however, "there are important anti-money laundering controls, such as Know Your Customer (KYC) and monitoring, which must be followed," says Braine, "and also Know Your Supplier (KYS)

"These two benefits [of blockchain] alone, greater consistency of data and greater sharing of common processes, could lead to potential long-term savings of 20% to 40% in operating costs."

DR. LEE BRAINE, INVESTMENT BANK CTO OFFICE, BARCLAYS

due diligence—meaning that much stronger governance processes are required for processing transactions."

Smart swaps

Choosing those aspects of blockchain it favors, and rejecting those it dislikes, Barclays is moving forward on an array of initiatives. One is a process for entering into, servicing and eventually completing the entire life cycle of derivatives contracts, such as interest-rate swaps. Here, Barclays is working with the International Swaps and Derivatives Association (ISDA) on industry standards and also with R3, a consortium building a distributed ledger platform for financial services. Their concept was first publicly demoed as a prototype last year at The O2 arena in London. Working from ISDA master agreement templates, "we showed the agreements being populated, trades being created and, by using smart contract logic that performed the swap functionality as time passed, payments were generated and the contract executed automatically."

What this demonstrates, says Braine, is how smart contracts on distributed ledgers can be used to not only accelerate trading processes, but also to increase standardization, reduce the need for reconciliation, and generally streamline and automate business processes from start to finish.

Smart contracts, in particular, can be a boon for financial services, says Braine. So the bank has been working closely with the University College London to better define what smart contracts are, and how business processes and agreements can be automated, tracked and enforced. "We publicly released a couple of research papers with the hope of supporting the industry in developing legally enforceable smart contracts."

The key to the success of smart contracts, says Braine, **"is realizing that these aren't necessarily just computer code, but can also be viewed as digital representations of contractual agreements."** To be truly effective, "the smart contract code should tie back to a traditional legal contract so that, if there ever was a dispute, we could then perform the electronic equivalent of going to a filing cabinet to refer to our original agreement. But in this case, all parties to the agreement would see the same electronic file."

Further work remains to be done across many aspects of blockchain, but Braine is confident that progress will reach a critical mass and that all manner of banking networks, technology platforms and financial products "will begin going live in production—maybe not in 2017, but certainly from late 2018 or 2019. There will be a lot of innovation across the industry, including incumbent operators of financial market infrastructure rolling out novel distributed-ledger solutions."

IATA: MINTING A NEW AIR TRAVEL CURRENCY

The work of consortia and other industry groups will be critical for blockchain to achieve its full potential. The International Air Transport Association (IATA) is another organization actively pursuing the development of blockchain. With a mission "to represent, lead and serve the airline industry, this should come as no surprise," says Juan Iván Martín, head, innovation at IATA.

Martín goes on to explain "that a critical part of IATA's vision is to be the force for value creation and innovation" across the global air transport industry. And part of that role means to explore new concepts and technologies. When Bitcoin emerged in 2009, "we began asking ourselves, could this be a means of improving settlements between airlines?" This is particularly relevant given that IATA processes hundreds of billions of dollars in industry funds through its financial settlement systems every year. And then the idea was born: Create an IATA coin, or an industry-wide means for settlement on a peer-to-peer basis.

Along the way, "we executed a number of [traditional] international wire transfers," specifically sending 1,000 CHF from a Swiss account to the U.S., then sending the payment in US dollars to South Africa, then sending rand to Thailand and finally sending baht back to Switzerland." Using existing processes, "the

> "From the pilot, we proved that this would be a very effective way to get away from batch processes, accelerate information flows, improve transparency and security, and ultimately reduce cost."
>
> **JUAN IVÁN MARTÍN,** HEAD OF INNOVATION, INTERNATIONAL AIR TRANSPORT ASSOCIATION

payments and currency conversions in the exercise took considerable time and expense," says Martín.

Then the group did the same exact exercise using two different public blockchain mediums, Bitcoin and then Ethereum. What they learned **"is that blockchain could execute the transactions at a fraction of the time and a fraction of the cost."** But owing to the lengthy, public nature of both blockchains, "the value of the cryptocurrencies was very unstable."

This then triggered the idea, says Martín, "of taking greater control of the process and providing more stability by creating our own IATA coin." The group moved into a proof of concept, followed by the development of a prototype mobile application, followed by a full-blown pilot. "From the pilot, we proved that this would be a very effective way to get away from batch processes, accelerate information flows, improve transparency and security, and ultimately reduce cost," says Martín.

Today IATA and its members are reviewing the efficacy of its newly minted coin and accompanying processes, and another IATA Coin pilot has been greenlighted. For the record, Martín is confident the project will move ahead. **"We want to innovate, we want to be on the leading edge, but representing 275 different airlines, we need to ensure that we are fully aligned with our members' needs before moving forward."**

In the meantime, various internal working groups are busy wrestling "with literally thousands of details, standards and questions needing to be addressed before we can launch at a global scale," says Martín. Work on blockchain itself is also ongoing "as we are looking to add even more features like smart contracts." But overall, says Martín, "I believe IATA coin, with all its benefits, will become a reality."

HSBC: BLOCKCHAIN/DISTRIBUTED-LEDGER TECHNOLOGY CAN GROW NEW BUSINESSES

Kaushalya Somasundaram, head of fintech partnerships and strategy at HSBC, says that over the past six months, her group has progressed rapidly through the education phase into proof-of-concept mode. Certainly, "the [high-level] R&D will be ongoing," says Somasundaram. But the group has "tightened our focus from the nearly hundreds of possibilities we saw early on down to the 20 or so 'live' projects" currently under consideration or in progress.

Winnowing the field

Somasundaram says that blockchain—or more broadly speaking DLT—is a field where numerous competing models, vendors and market participants are still battling for position or simply struggling to find the most optimized common ground. "Many different parties are approaching similar challenges from different directions, so in terms

of models and providers, it is very difficult to predict the winners."

For HSBC, says Somasundaram, "we've been looking at the various consortiums and the fabrics," but what isn't clear is how everything will eventually fit. "It's likely there will be several models, of survivors," and when that becomes more settled, "you will see this take off."

For the long term, "what's interesting for us is seeing the industry create a platform built on DLT but which becomes agnostic in terms of access," says Somasundaram. "We need interoperability, something that is scalable across the ecosystems, and then we can build our applications on top of whatever standards evolve."

"DLT can improve security, accelerate processes and reduce costs, and for trade finance, [blockchain]/ DLT is disruptive."

KAUSHALYA SOMASUNDARAM, HEAD OF FINTECH PARTNERSHIPS & STRATEGY, HSBC

End-to-end trade finance

As of now, HSBC is working on a number of proof-of-concept cases. One of the most interesting, says Somasundaram, is in trade finance. "This is something more than just the financing," she explains, "using DLT to capture the end-to-end processes; the procure-to-pay cycle—that involves every way from the port authority to the shipping companies, the buyers, the suppliers and agency banks—the issuers of insurance and documentation."

Imagine, says Somasundaram, "if all of this could take place on a single, trusted platform." One version of the truth "could be used to initiate the purchase, generate the trade documents, letters of credit and payments." DLT, says Somasundaram, "can improve security, accelerate processes and reduce costs, and for trade finance, [blockchain]/ DLT is disruptive."

Another promising area for blockchain is in shareholder proxy voting. With so many shares outstanding and in the hands of so many institutions and individuals, the process, traditionally, is hands-on, time-consuming and difficult to execute. "But with DLT," says Somasundaram, "we believe we can improve efficiency while also improving security and accuracy."

The benefits of blockchain

As for quantifying the benefits of a shift to a blockchain model, "that is very difficult, and will be different for every process being considered," says Somasundaram. "But what we do know is that wherever we use DLT, whether it's to digitize assets or track ownership or payments, the security and efficiency plays are there." She continues, "There are also clear advantages in terms of efficiency, cost reduction and improved customer experience."

Somasundaram also points to an even larger goal for DLT initiatives: business growth. Specifically, "where we can use this to solve pain points, to disrupt processes, we can design better products and services and grow market share." All told, says Somasundaram, "technologies like [blockchain]—and let's add machine learning and AI—they're combining to shape all of our future business models. Give things a year or two and you will begin to see how we are making all of this real."

OVERCOMING ROADBLOCKS CREATIVELY: NEW BRUSHES AND BRUSHSTROKES

Amid so many opportunities, why aren't more companies moving faster to take advantage of all blockchain has to offer? There are at least five notable roadblocks:

Steep learning curves

One of the most acute challenges is the steep learning curve associated with blockchain, an issue exacerbated by a handful of related issues. IT executives often explain that given its recent arrival, relative complexity and often negative (undeserved) cryptocurrency connotations, blockchain and related technologies are a difficult "sell" with the C-suite. In addition, it can be hard for technology executives themselves to get up to speed, as so many IT departments are already being swarmed by other innovations like AI and machine learning. IT executives are simultaneously being called upon to address the risks of cybersecurity, which as more and more companies adopt data-intensive business models, are multiplying.

Difficulties in developing or articulating business cases

Here, executives may face numerous challenges. First, there must be a very clear understanding of what blockchain is and how it will work in a given context. This starts with working to educate leaders as to how blockchain works and where it can be effective. Even so, proponents often fail to secure funding for their initiatives due to poor articulation of the business value. In addition, in cases where the IT team and business units fail to properly communicate, sometimes blockchain is improperly engaged, focusing on the wrong problems or issues. Mistakes such as these can deliver significantly lower than expected ROI, ultimately making future initiatives even less likely to gain funding.

Difficulty in predicting winners and losers

Which solution providers/developers will develop a following and scale? According to Gartner Research Vice President and Fellow Ray Valdes, "currently there are over 70 options in blockchain platform technologies."[13] Moreover, "most will [remain] immature for the next 24 months."[14] As a result, many executives are taking a "wait and see" approach, recognizing that many of today's players may be consolidated or missing over the short and long terms.

Talent constraints

Pools of technology talent are understandably strained, which is yet another reason companies are turning to an array of emerging outsourced and co-sourced business models such as blockchain as a service. But as companies further explore blockchain, says Microsoft's Gray, "they will reach a point where their processes are so improved that they will be spending fewer resources in unnecessary areas and on net, will actually reduce total operations overhead. They will become more efficient and effective."

Regulatory concerns—and patent worries

One of the misconceptions about blockchain is that this is a technology designed to evade the reach of government. Indeed, one of the characteristics of cryptocurrencies is the enablement of a means of exchange with no government oversight. So an often-cited challenge is developing blockchain models capable of complying with existing regulations. For example, Northern Trust had to work with regulators in order to codify the rules for domicile of a transaction in a cloud setting.

But Deutsche Bank's David Watson, Americas head cash management and global head of client connectivity and digital products of global transaction banking, believes that all that's needed to deal with regulatory issues is a systematic approach. In practice, blockchains are streamlining existing processes and removing duplicative or unnecessary steps. "But on balance, the

13 https://www.forbes.com/sites/gartnergroup/2017/07/25/10-avoidable-blockchain-mistakes-every-company-makes/#68d460074890; July 2017; viewed August 2017
14 Ibid.

practical details remain the same," says Watson. Indeed, there will be cases where a blockchain model may so radically alter a process that regulations may need to be rewritten. But, in most instances, says Watson, "this is the exception—we do not see key design principles conflicting with regulations as a huge challenge getting to market."

Executives may also be concerned by patent risk. Recall that in the early days of the internet, companies attempted to "patent" certain features such as banner ads and one-click ordering. But as for blockchain, Behlendorf is not concerned by patent risk.

For starters, most of the art of blockchain is based on code "that was part of computer science curriculum decades ago, but that didn't seem important at the time and was forgotten." Moreover, Behlendorf says, "the open source community already has a very good understanding of how to protect itself." For example, currently, the Linux Foundation works through a group known as the Open Invention Network, which pools patents for community use. "This is a model that could work well for blockchain," says Behlendorf.

Finally, leading companies like Blockstream, a firm actively involved in blockchain development, often patent their work but then make it freely available so that others incorporate Blockstream's technology into their own software. Should the marketplace become contentious—even though this is doubtful—this strategy can provide a means of defense. As Behlendorf explains, this increases the chances that those claiming patent rights are meanwhile using Blockstream's technology, "so there's some horse trading."

A BOON FOR REGULATORS

Although some cite regulator interest in blockchain as a potential barrier to adoption, others believe regulatory agencies could explore how the use of distributed ledgers and smart contracts by businesses could support regulatory supervision. "With distributed ledgers, it's common to assume that regulators could have their own nodes on the network," says Barclays' Braine. Then, depending on their preference, "they could drink directly from the information hose pipe (by viewing transactions in real-time) or periodically extract information via standardized reports. This could make distributed ledgers ideal for supporting some supervision tasks."

In fact, in the UK, says Braine, "the Financial Conduct Authority has set up a 'regulatory sandbox,' which is a supervised 'safe space' for businesses to test innovative products, services, business models and delivery mechanisms in the real market, with consumers. It is open to both authorized and unauthorized firms. In this manner, companies can trial blockchain solutions using a customized regulatory environment, with potential tools such as individual guidance, waivers and no enforcement action letters available to the FCA." In addition, says Braine, "we are also seeing quite a few central banks that, after taking initial looks at distributed ledgers during the past couple of years, are now keen to learn more via experimentation and research."

Microsoft's Gray believes governments can make use of blockchain on their own behalf to drive enormous improvements in effectiveness. Efficient access to data can revolutionize oversight and regulatory enforcement. But in addition, "governments can use blockchain to become more efficient in licensing, permitting and other activities that require data and record keeping. They can use blockchain to reduce their own costs while providing better services to businesses, consumers and citizens."

CASE STUDY: DEUTSCHE BANK USES BLOCKCHAIN TO IMPROVE CUSTOMER EXPERIENCES

David Watson, Americas head cash management and global head of client connectivity and digital products, global transaction banking, at Deutsche Bank says that for now, blockchain holds more promise than reality. "Blockchain is very good at cost reduction and increasing the security of transactions," says Watson, but going forward, the executive feels that cost reduction and heightened security in banking—as well as virtually every other industry that takes a hard look at the opportunities—barely scratches the surface of blockchain's potential.

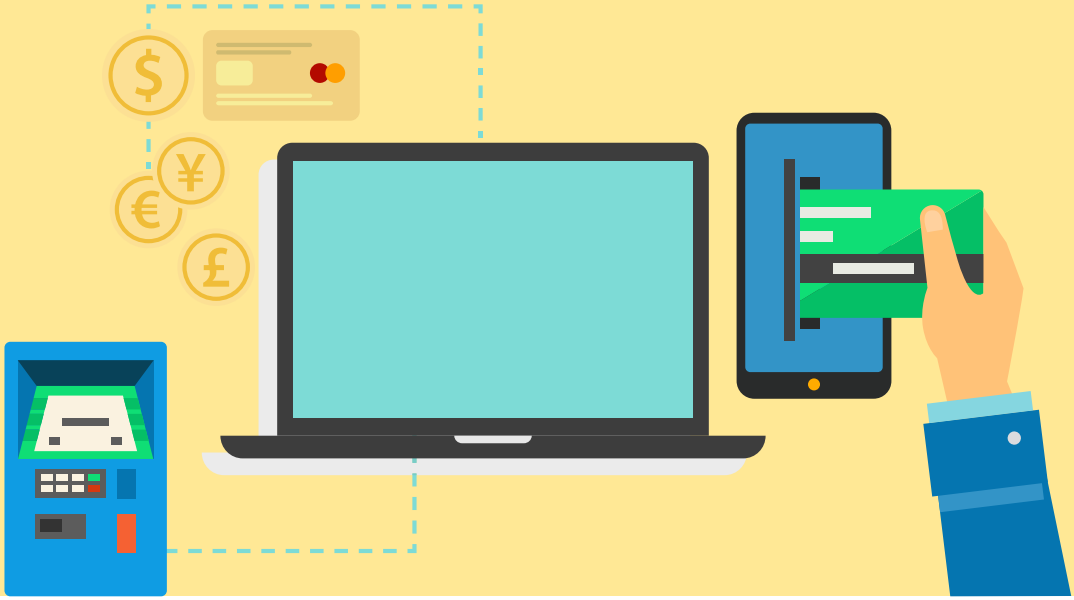
"In my view, when you look at blockchain, you have to have this mindset of 'how can we use this to fundamentally change our processes; to make dramatic improvements to our business models; to improve experiences for our customers?' Today, we are only in the beginning phases, steps 1, 2 and 3." But as blockchain evolves, as more consortia develop new platforms and processes, "the transformative opportunities begin to appear," he says.

This is the key reason Deutsche Bank is "collaborating" within various consortia and customer groups, working to drive the evolution of blockchain. However, as the use of blockchain evolves in any given industry, the bank needs to adjust its own service models accordingly. So, as Watson explains, Deutsche Bank is paying attention not only to banking but to other industries as well, "looking at the ways we can use blockchain to fundamentally rethink business processes and get closer upstream to our customer's needs."

> "When you look at blockchain, you have to have this mindset of 'how can we use this to fundamentally change our processes; to make dramatic improvements to our business models; to improve experiences for our customers?'"

DAVID WATSON, AMERICAS HEAD CASH MANAGEMENT AND GLOBAL HEAD OF CLIENT CONNECTIVITY & DIGITAL PRODUCTS, GLOBAL TRANSACTION BANKING, DEUTSCHE BANK

This is not to say blockchain is the only such enabling technology. But the point is, says Watson, "the further upstream the bank can move—using blockchain or other combinations of technology—the more value for us and our customers."



WHAT PORTRAIT WILL YOU PAINT?

The art of blockchain is advancing: It is driving innovation, efficiency and process improvement; it will no doubt deliver revolution and in certain cases, disruption. Today, casual observers may be noticing only the occasional press release about some limited new implementation. But those "in-the-know" can point to industry statistics and anecdotal evidence indicating a fast-approaching inflection point.

Though only a comparative handful of masterpieces are fully visible today, stay tuned: Just below the surface there are literally thousands of initiatives now moving from proof of concept into pilot, with many others just on the verge of entering full production.

As for the drivers behind this breakneck pace of adoption, blockchain can trace its allure to a wide range of compelling attributes. At its heart, there is nothing revolutionary about blockchain whatsoever. This is a meta-technology, simply capitalizing on a wide array of existing and proven technologies. But that becomes a key driver, because it also means there is very little technology risk to exploring blockchain.

Nonetheless, its ripple effects are profound. By delivering a single view of the truth, blockchain strips time, risk and cost from fundamental processes. Organizations can spend less time reconciling, auditing and authenticating. Add elements of smart contracts, and even execution becomes automatic and ongoing. Overall, organizations can expect to reduce their operating costs by anywhere from 25% to 45% wherever blockchain is applied—to say nothing of qualitative benefits.

Perhaps even more significant, leading companies will use blockchain to conceive and develop innovative and even disruptive products and services. Just as with the early days of the internet, the form of such developments may not yet be clear. Be assured, early adopters will use blockchain to digitize, enhance, disintermediate and in general leapfrog today's processes and business models.

Is it all mere hype? All indications suggest otherwise. But the real question becomes, in this age of hyper-competition, can your company afford to fall behind? The safe play—the wise play—is to begin climbing the learning curve. Engage your technology teams and business leaders. Look at your own pain points, those of your customers, suppliers and other stakeholders, and think: How could blockchain make a difference? Odds are, compelling business cases abound. Find your opportunity—then put brush to canvas.

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- **Barclays** Dr. Lee Braine, Investment Bank CTO Office
- **Deutsche Bank** David Watson, Americas Head Cash Management and Global Head of Client Connectivity & Digital Products, Global Transaction Banking
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Wipro Limited is a leading global information technology, consulting and business process services company. We harness the power of cognitive computing, hyper-automation, robotics, cloud, analytics and emerging technologies to help our clients adapt to the digital world and make them successful. A company recognized globally for its comprehensive portfolio of services, strong commitment to sustainability and good corporate citizenship, we have a dedicated workforce of over 160,000 dedicated employees, serving clients across six continents. Together, we discover ideas and connect the dots to build a better and a bold new future.

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