

# THE BLOCKCHAIN REPORT

WHY THE TECHNOLOGY BEHIND BITCOIN IS  
SEEING WIDESPREAD INVESTMENT AND  
EARLY APPLICATION ACROSS THE FINANCE  
INDUSTRY

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# KEY POINTS

- **Investors are flocking toward blockchain technology, which is best known for powering Bitcoin and other cryptocurrencies.** Spending on capital markets applications of blockchain is expected to grow at a 52% compound annual growth rate (CAGR) through 2019, according to Aite Group, to reach \$400 million that year.
- **Blockchain functions as a distributed ledger, or database — every party that uses the database has access to it and participates in its production and upkeep.** If applied effectively, the technology could give banks a secure, digital means to process and record transactions and eliminate middlemen.
- **This, in turn, would help banks and other financial institutions cut costs and increase efficiency.** Blockchain technology could cut costs across the financial industry by up to \$20 billion annually by 2022, according to [Santander](#).
- **Banks and major financial institutions are working both collaboratively and independently to develop blockchain tech.** Over 50 major financial institutions are involved with collaborative blockchain startups, like R3 CEV or Chain. And many are investing in the technology on their own as well.
  - **Money transfer and settlement is one of the primary potential blockchain applications.** Major banks, Goldman Sachs, and Visa Europe all look to be exploring blockchain for this purpose.
  - **Shareholder management is another top use case for blockchain.** The blockchain's function as a database is particularly relevant to financial institutions because they hold vast databases of customer information. Nasdaq is exploring this application of blockchain.
- **Putting blockchain to use for real-world transactions is likely not that far off.** If working groups' tests are successful, firms could be using it to transact real value as early as the end of this year and we could see widespread industry application within the next few years.
- **Despite blockchain's advantages, there are some risks that are slowing down blockchain development and mainstream adoption.** Because the technology is new and relatively untested, security is still a concern, as is lack of regulations across countries.

# INTRODUCTION

As customers become increasingly digitally savvy, financial services providers are looking to provide customers with the same services they're accustomed to, but in ways that increase efficiency and improve security while keeping costs down.

That's where blockchain technology comes in.

Blockchain technology was invented and released in 2009 by a person or group of people known by the pseudonym Satoshi Nakamoto as a way to digitally and anonymously send payments between two participants without involving a third party to verify the transaction. It was initially designed to facilitate, authorize, and log the transfer of bitcoins and other cryptocurrencies. But interest in Bitcoin among financial institutions and the broader public has waned due to some important problems with the cryptocurrency, while at the same time, blockchain has been gaining attention.

**Blockchain is in essence a shared database, populated with entries that must be confirmed and encrypted.** You can think of it as a kind of highly encrypted and verified shared Google sheet where each entry in the sheet is dependent on a logical relationship to all its predecessors. It provides a means of securely and efficiently creating a tamper-proof log of sensitive activity, which can run the gamut from cross-border money transfers to a record of shareholding.

Blockchain's conceptual framework and underlying code is useful for a variety of financial processes because of the potential it has to give firms a secure, digital alternative to previously bureaucratic, time-consuming, paper-heavy, and expensive banking processes. As a result, it's seeing increased investment — both in dollars and in research and development (R&D) labor — on the part of financial institutions across the spectrum, from legacy players and banks, to card networks and exchanges, to software firms and startups.

In this report, we look at what blockchain is and the financial and nonfinancial use cases where it's gaining traction. We look at the growth in funding for blockchain-based initiatives,

especially as interest in Bitcoin among VCs and legacy banks begins to slow, and when we expect the technology to come into use for real-world transactions. And we lay out the most important legacy players, consortiums, and startups testing out blockchain technology.

# INVESTMENT IN BLOCKCHAIN IS ON THE RISE

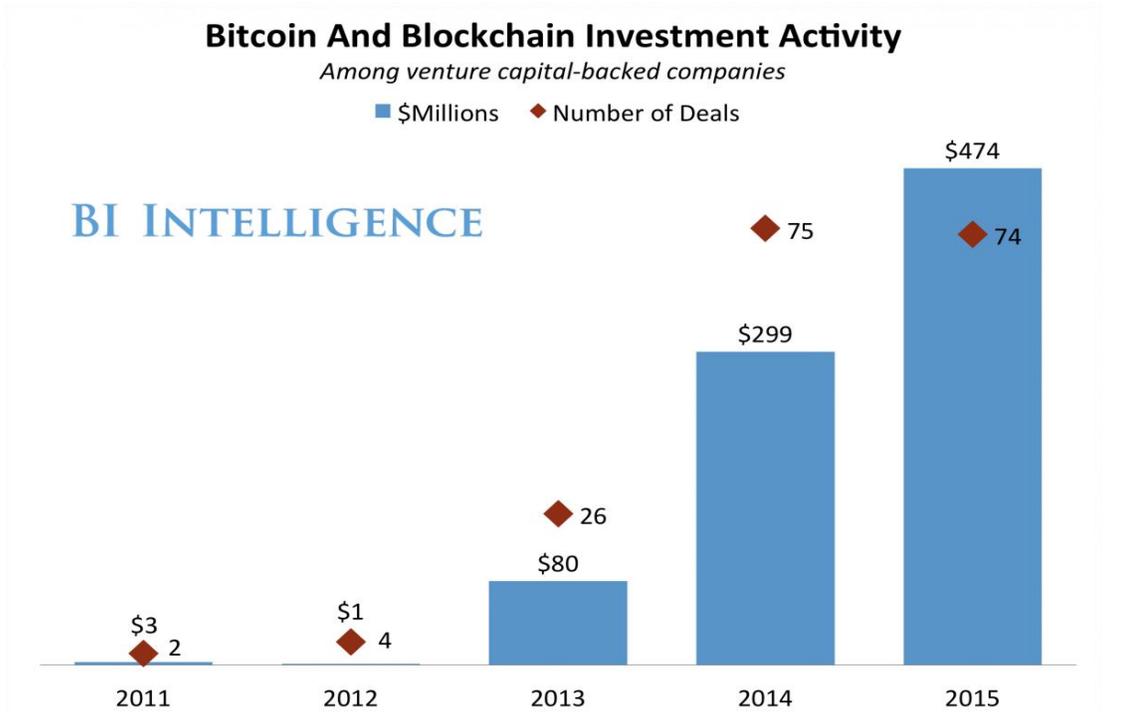
For many years now, Bitcoin has been a hot topic as an alternative payment network, particularly in the wake of the 2008 financial crisis. But thus far, its popularity has proved limited to a fairly small subset of users. As a result, adoption has been sluggish and universal acceptance is unlikely.

But as Bitcoin itself has faltered in the mainstream, the technology that allows for the transfer of Bitcoin — the blockchain — has gained increased scrutiny and interest.

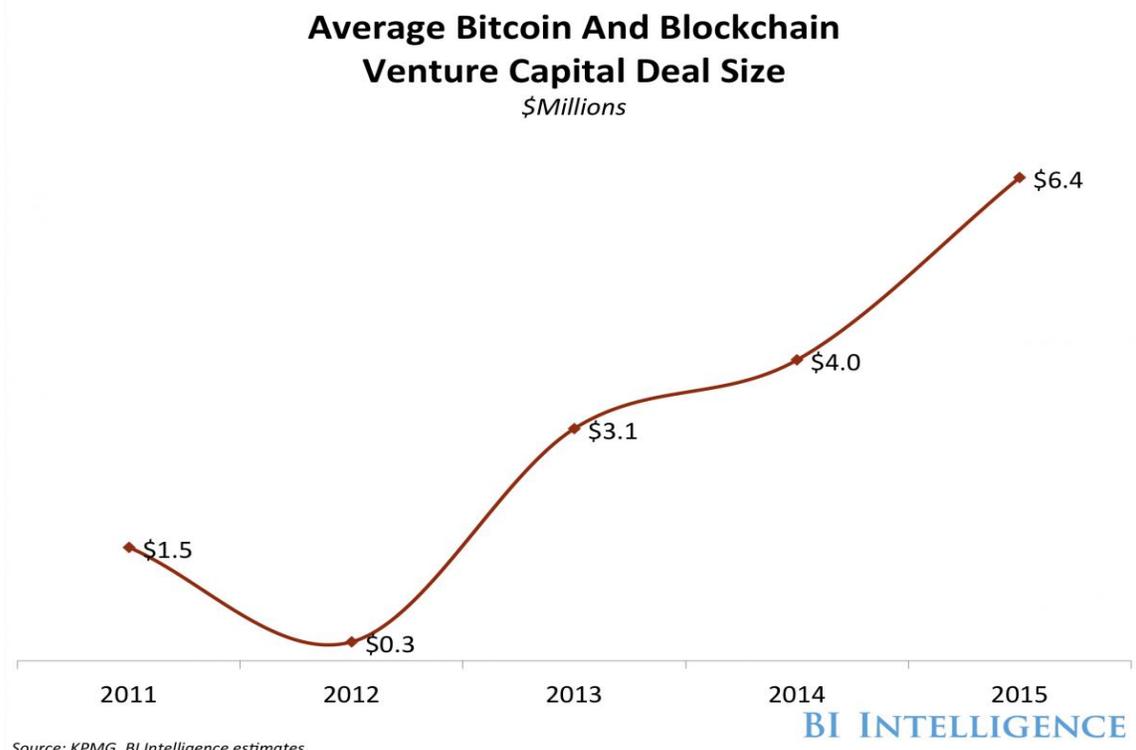
Collaborative groups of financial institutions are putting the service to the test for services across the spectrum, including shareholder and database management, settlement, transfer, trading, and more. And if these tests are ultimately successful — and so far, results have been promising — it could begin the process of a broad-based transformation of the way processes are executed across the financial industry.

Increased interest in blockchain is reflected in venture capital funding trends:

- Overall industry investment in Bitcoin or blockchain activity is on the rise.** In 2011, just two Bitcoin and blockchain-related venture capital deals, worth a combined \$3 million, took place, according to [KPMG](#). That number sunk in 2012. But in 2015, over \$474 million venture capital dollars were invested in Bitcoin and blockchain firms in 74 deals. That means that not only are the investment dollars increasing, but so is average deal size.



Source: KPMG

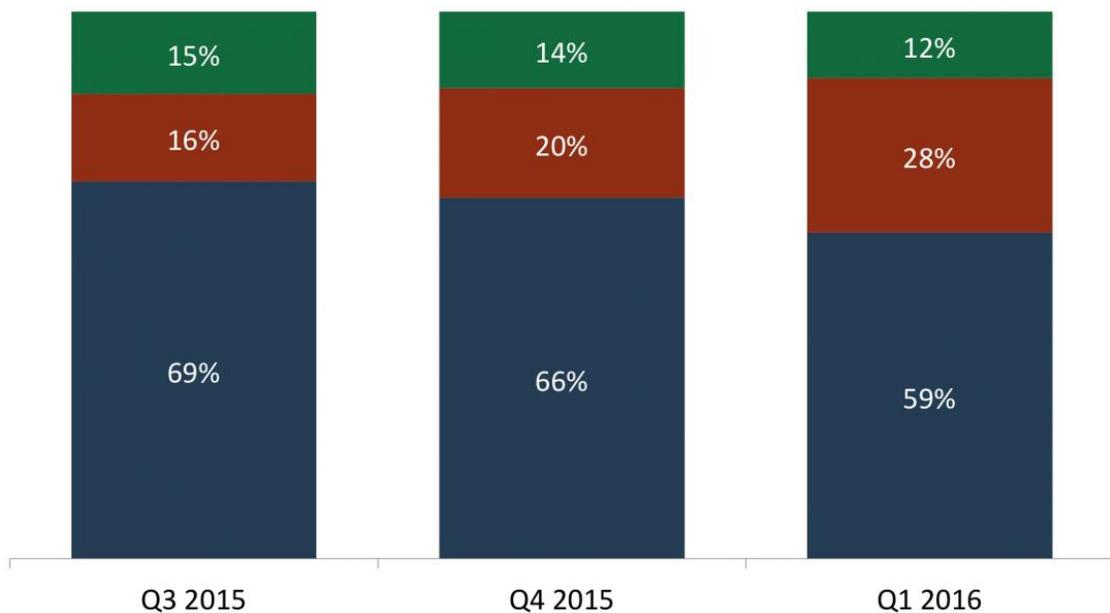


Source: KPMG, BI Intelligence estimates

- **Blockchain funding is on the rise.** In [Q3](#) 2015, blockchain and hybrid firms accounted for 31% of all-time VC investment in Bitcoin and blockchain firms. That rose to 34% in [Q4](#) 2015 and 40% in [Q1](#) 2016, according to CoinDesk. (For reference, this CoinDesk data tracks "all-time funding" through a given quarter, rather than quarter-specific data.)
- **It's also important to note rising investment in Blockchain over time is not just driven by new funding to Blockchain and hybrid firms.** CoinDesk reclassifies earlier funding from Bitcoin to blockchain (or vice versa) when a company pivots its business models from one to the other. That blockchain's share is rising is not only a result of increased investment overall, it's also a result of many major firms that previously were Bitcoin-based shifting focus to blockchain. This indicates the growth of research, development, and innovation in the area.

### Share Of Global Blockchain And Bitcoin Venture Capital Funding To Date, By Firm Type

■ Bitcoin ■ Blockchain ■ Hybrid (Bitcoin and Blockchain)

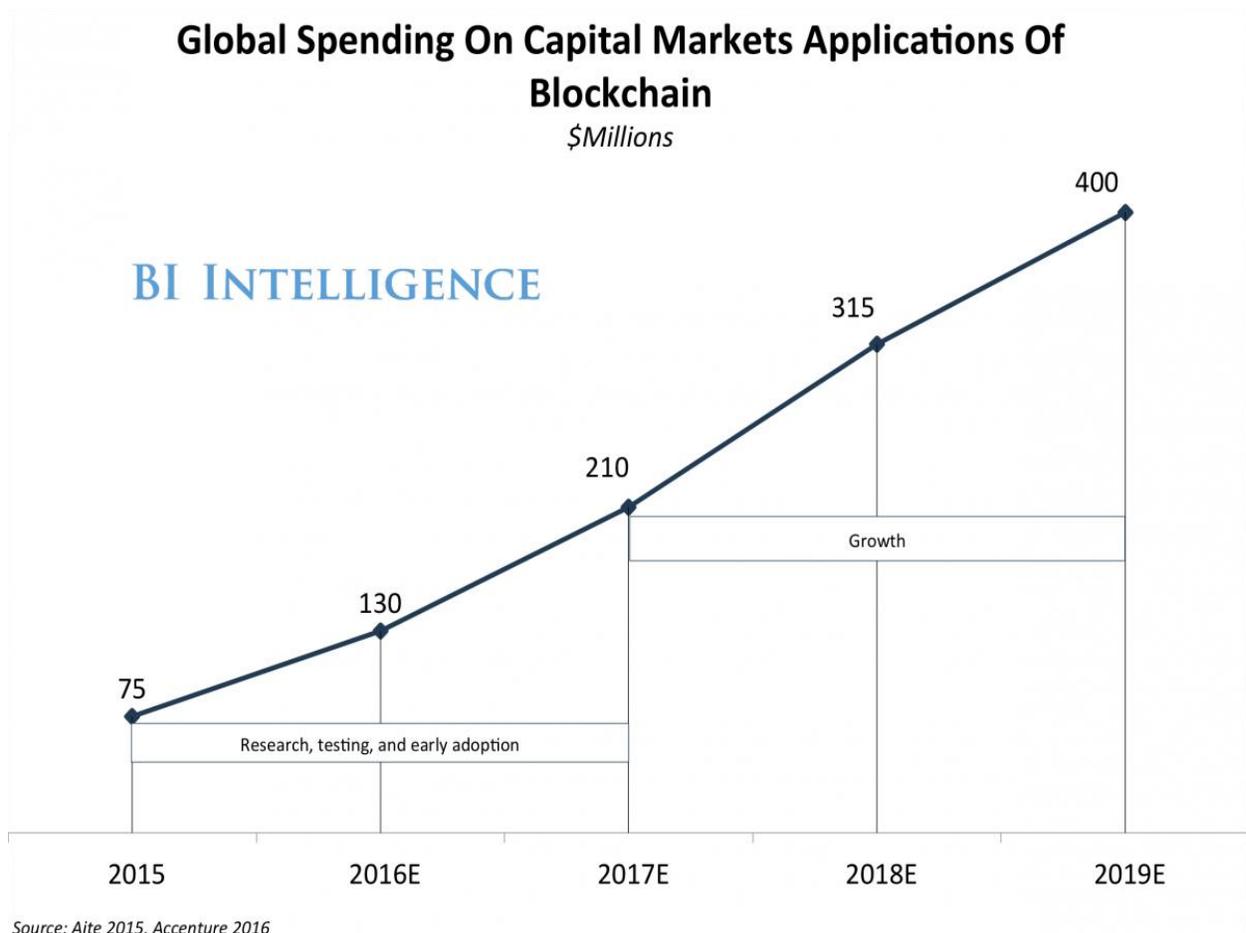


*Note: CoinDesk reclassifies firms' funding retroactively if they change their model*  
 Source: CoinDesk

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Moreover, VC activity doesn't even do justice to the trend, because much of the blockchain investment thus far has come from banks and other financial institutions, which don't count in venture capital funding totals. That means that the amount raised for blockchain and hybrid firms, as well as the breakdown in how much funding goes to each firm type, is significantly more than the CoinDesk data indicates.

In total, spending on capital market applications of blockchain, including by investment firms and stock exchanges, is expected to grow at a 52% CAGR through 2019, according to Aite Group, to reach \$400 million that year, up from \$130 million in 2016.



With that rise in funding, combined with the accelerated R&D that it reflects in the space, **we believe blockchain could see implementation by 2017-18, and achieve mainstream scale and adoption in three to five years.**

- **Spend through 2017 will likely be focused on research, testing, and early adoption.** Finance-related blockchain investment and R&D began heavily in late 2014 and 2015. In early 2016, firms began running pilots and testing proof-of-concepts and real-time use cases for the service. It's likely that will continue through this year — and major firms believe they can have real-time blockchains up and running by this time — which will allow the tech to be put into practice.
- **Following that, money will be dedicated to growth and scale.** Spending is expected to transition from research, testing, and early adoption spend to growth and scale spend in 2017, which indicates a degree of mainstream implementation and would allow room for larger-scale testing, fine-tuning, and scaling through the rest of the decade.

**That timeline fits with the trajectory of other upstart fintech ventures.** For instance, Foundation Capital, an early investor in alternative lending firm Lending Club, first invested in the firm in 2010. Lending Club hit an over \$1 billion valuation in 2013, and rapid scale occurred just last year.

## WHAT IS BLOCKCHAIN?

The way to think about blockchain is as a distributed ledger, or database — every party that uses the database has access to it and participates in its production and upkeep. While blockchains can be put to use for a variety of different purposes, the data within a given blockchain is connected. Meaning, each blockchain stores one particular type of data — that could be a record of the transfer of a certain currency or of the ownership of shares within a private business.

Ledger entries are called blocks, and blocks are composed of data representing a set of transactions that have occurred. The transactions themselves could represent many things including payment transactions, mortgage transactions, or wills, and this is why blockchain has application beyond Bitcoin. The essential ways Bitcoin transactions are verified and recorded can be applied to many other existing financial transactions with lower overhead and greater security than how those transactions are currently processed.

Here's how a typical blockchain event works:

- **Transaction data is bundled into blocks.** Individual transactions are submitted to the network from the involved parties through nodes. A [node](#) is an individual device that participates within the network and holds a copy of the ledger. Then, all of the transactions submitted to the network during a set period of time are bundled into a block. But because there's no centralized authority, blocks must then be verified as legitimate to make sure the transactions occurring and recorded through blockchain aren't being tampered with. Once verified, the block is added to the blockchain.
- **Those blocks can be verified through a variety of different methods, depending on the requirements of that particular implementation of blockchain.** In all cases, verification involves the solving of mathematical puzzles related to the transactions themselves. Some methods require more complex and extensive problem solving and, thus, much more computing power. The type of verification method is typically related to how many parties are involved in a given blockchain, what their relationship is to the other parties, and how important speed and efficiency is to the blockchain use case. Regardless of the verification mechanism, though, the purpose is the same: to check a specific block relative to previous blocks in the chain, and then determine whether or not it's legitimate and belongs.
- **If verified, the block is added to the chain, where it is permanently stored as encrypted data that is accessible to all nodes within the network.** This permanence is a key value of blockchain because it makes record keeping highly secure since the record is permanent and can be accessed at any time by any invested party. This is beneficial both in terms of reporting and security.
- **And inherent in the blockchain's network is so-called "fault tolerance."** Because nodes work together to verify blocks, and the ledger lives across multiple nodes, if one node is compromised, the others can continue to process and verify transactions. That prevents outages, maintains security and privacy, and allows for ongoing efficiency, if problems do occur, according to [The Wall Street Journal](#).

How blockchain is put into practice, and which verification mechanism is used, largely depends on the needs of stakeholders. Blockchain implementations can be categorized into two basic types:

- **Unpermissioned blockchain:** This is an open, publicly available, and universally accessible ledger designed so that the parties that use it do not have to know or trust

each other. The downside is that solutions for overcoming the trust problem are computationally expensive and relatively time consuming. Meaning, there has to be a huge number of nodes involved to reach a reasonable level of security. Additionally, there is always the slight risk that the anonymous data contained in the network could be cracked since that data is publicly available. That being said, this would be very difficult because so many parties are viewing the ledger at all times.

- **Permissioned blockchains:** Permissioned blockchains are only available to specific parties. These parties typically know one another, and as a result, trust isn't as significant an issue as in public implementations. These are the implementations that are most likely to be implemented by legacy financial institutions.

It's also worth noting that **major innovators in the space are modifying the core of blockchain technology — the relationship between nodes and the way verification occurs — in order to add an additional layer of privacy to these transactions.** For example, collaborative blockchain hub R3 CEV (discussed further on) recently introduced a blockchain-like platform called Corda, which limits verification to the parties directly involved in, or actively granted access to, a given transaction. It's possible that further innovation like this could make distributed ledger technology even more anonymous and private moving forward.

## BLOCKCHAIN'S VALUE

Blockchain becomes more valuable and secure as more parties are involved in a given blockchain network. As a result, blockchain innovation isn't a hugely competitive "horse race" for now, since working together is critical to the technology's success. Instead, the blockchain firms that are seeing the most immediate success are those that are investing in a broad partnership network and collaborative innovation.

In a sense, blockchain technology isn't like most disruptive technologies, launched by startups and designed to grab market share from legacy businesses. Instead, blockchain is a disruptive, widely available technology that legacy businesses are primarily using to rethink their own processes in order to operate more effectively and efficiently amid a changing financial landscape. Blockchain itself isn't in a position to take market share. It's in

a position to help companies cut down on operational inefficiencies and establish better security. The winners and losers will be those that can effectively leverage the technology.

As a network, blockchain offers a number of key advantages to stakeholders:

- **Security and compliance:** Blockchain is a highly secure platform because of the large number of parties that have access to the encrypted data and help to verify it. Those numbers help ensure the effectiveness of the platform's verification mechanism and create an implicit check on the system to make sure no tampering has occurred. The parties can also ensure that the system continues to run if one party malfunctions. The tamper-proof, streamlined structure of information in blockchain also has the potential to make it much easier for regulators to evaluate compliance with regulations.
- **Decreases bureaucracy:** Blockchain can replace many of the functions that traditionally occurred offline, like shareholder management, ownership transfer, or record keeping. That helps eliminate friction and streamline a variety of processes.
- **Eliminates middlemen:** Many transactions require middlemen to verify their accuracy — for instance, if funds are being settled, they have to flow through a clearinghouse between the two banks involved. It's worth noting that there's often still a third party involved — the tech firm that provides the blockchain — but its role is simply as the provider of a software-based platform on which groups can transact, rather than as an intermediate party through whom the transaction has to pass.
- **Cuts steps:** And that also simplifies processes. Cutting out this middleman simplifies transaction flow, which could speed up processes — while inter-bank settlement can take hours or even days as it currently stands, blockchain transactions occur in a matter of seconds or faster. It could also further increase security by limiting the number of parties who have direct access to customer data.
- **Lower costs:** Santander estimates that because of the efficiency it provides, blockchain technology could cut financial industry costs up to \$20 billion annually by 2022, which could give banks and financial institutions major savings over time.

**Given the potential for blockchain, it's becoming increasingly important for financial firms of all types to get involved in blockchain early, from legacy financial firms to clearinghouses and credit networks to startups.** That's because the technology is beginning to scale fast, and could offer broad potential down the line.

- For **fintech startups**, developing blockchain technology could ultimately lead to partnerships and relationships with legacy financial institutions. Expertise in a still-new space could prove appealing to these legacy firms looking to get involved. And if fintech startups become experts in the space, blockchain implementation could also lower their costs, which could boost firms' competitive advantages.
- **Incumbent banks** stand to gain from considerable savings in operating costs. But interbank blockchains, in particular, have the opportunity to forge new partnerships between banks, which could lead to increased service offerings for consumers. And the fee reductions that blockchain could provide could either enable banks to pass on savings to consumers, or keep prices steady and increase profits.
- For **cloud providers**, offering services tailored to blockchain opens up a new revenue opportunity. Since control of a blockchain implementation is decentralized, having a third-party software service where involved parties can interact is a near necessity. IBM, Amazon, and Microsoft have already announced cloud-based services specifically tailored for blockchain.
- And for **established middlemen**, like clearinghouses and card networks, who are most at risk of becoming obsolete due to blockchain, it's critical to get involved now in order to create a role for themselves in the blockchain ecosystem rather than being phased out by it. In addition, these groups could use blockchain to build faster credit transaction processing or to enter into the remittance space.

# HOW FIRMS ARE USING BLOCKCHAIN

## BLOCKCHAIN CONSORTIUMS AND PARTNERS

### R3 CEV



### Digital Asset Holdings



### Open Ledger Project



### Chain



### Other



### Digital Currency Group



### Ripple



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Because of the way blockchain simplifies processes and replaces humans or complex systems with technology, a massive number of financial services firms are investing in blockchain research, largely through startups and collaborative organizations. These groups fall into two general categories:

- **Legacy-backed consortiums:** These groups are bringing vast arrays of traditional financial institutions together in order to run tests and evaluate the possibilities and various use cases for traditional blockchain technology. Some, like R3 CEV and Chain, are building and testing various use cases for blockchain or blockchain-based technology, like inter-bank transfer and shareholder management. Others, like Digital Currency Group, are working with legacy firms to fund and develop smaller blockchain startups. And others still, like the Hyperledger Project and the Linux Foundation, are attempting to build blockchain protocols to develop a global standard framework for blockchain technology. All of these collaborative consortiums are using their partners not just for funding, but for working groups, idea-sharing, and pilot tests for use cases that involve multiple parties.
- **Startups:** These firms, like Ripple and Abra, are more like traditional startups — they solicit funding from venture capital firms and banks, and then use that funding to build specific blockchain-based technology that can be licensed, sold, or applied by financial institutions.

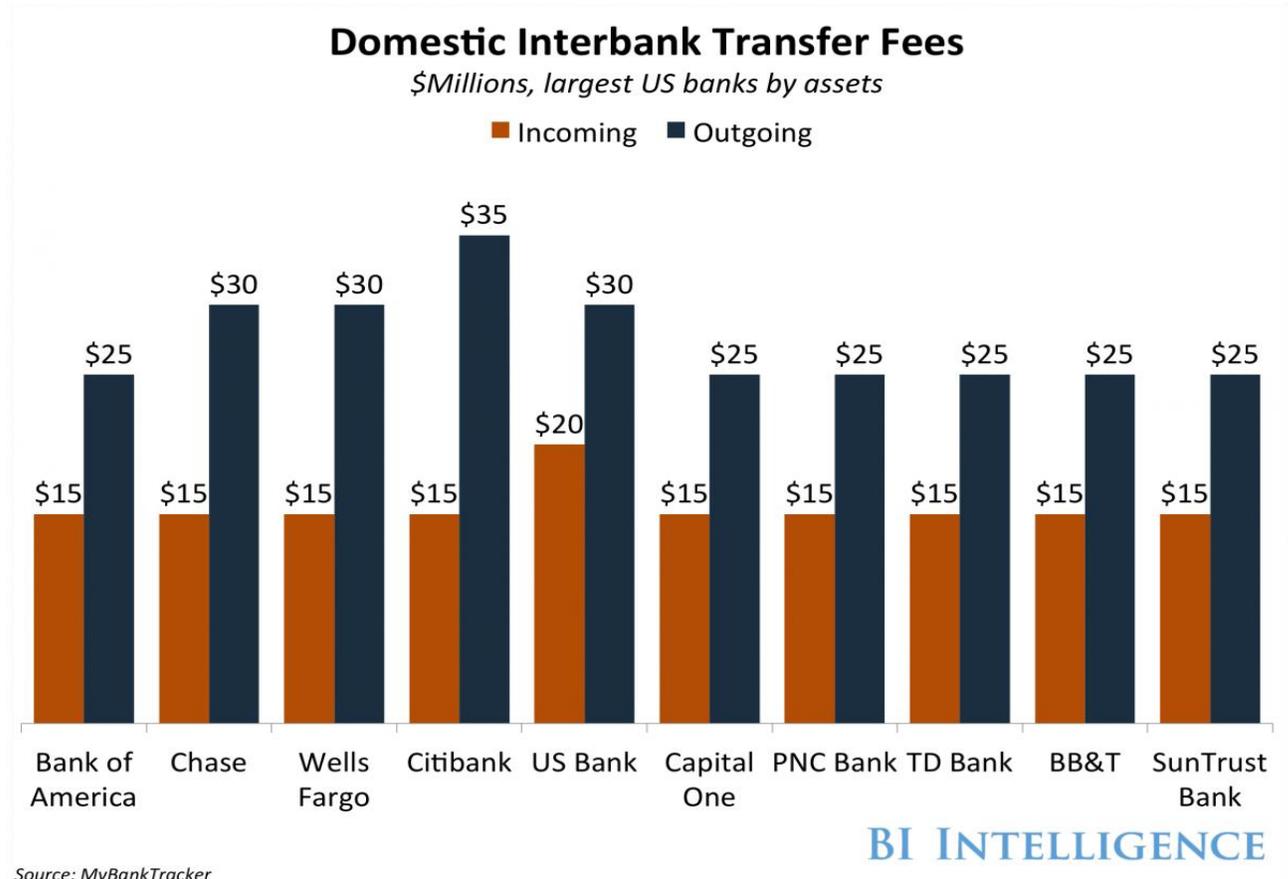
It's also important to note, some of these organizations and firms are hybrids — that is, they're companies working with financial partners to test blockchain use cases, while also building and researching proprietary products or unique platforms. In all cases, blockchain is being put to the test for the purposes of rethinking systems within legacy institutions rather than being leveraged to build wholly new business models.

As these bodies develop, they could coalesce into a shared standard adopted by all financial institutions — particularly since many of these firms share partners. But it could also lead to diversification in the space, giving banks many options to buy into different platforms for different blockchain use cases.

## **Transfer And Settlement**

For financial institutions and customers alike, interbank transfer, currency exchange, and settlement are cumbersome, expensive processes. For context, transfer fees are extremely expensive. Among the top 10 banks in the US, domestic fees can go as high as \$20 for incoming and \$30 for outgoing transfers, and for foreign transfers as high as \$25 incoming and \$65 outgoing. And these fees can be higher if currency conversion is involved, because banks often give consumers the highest available conversion rate and charge an additional

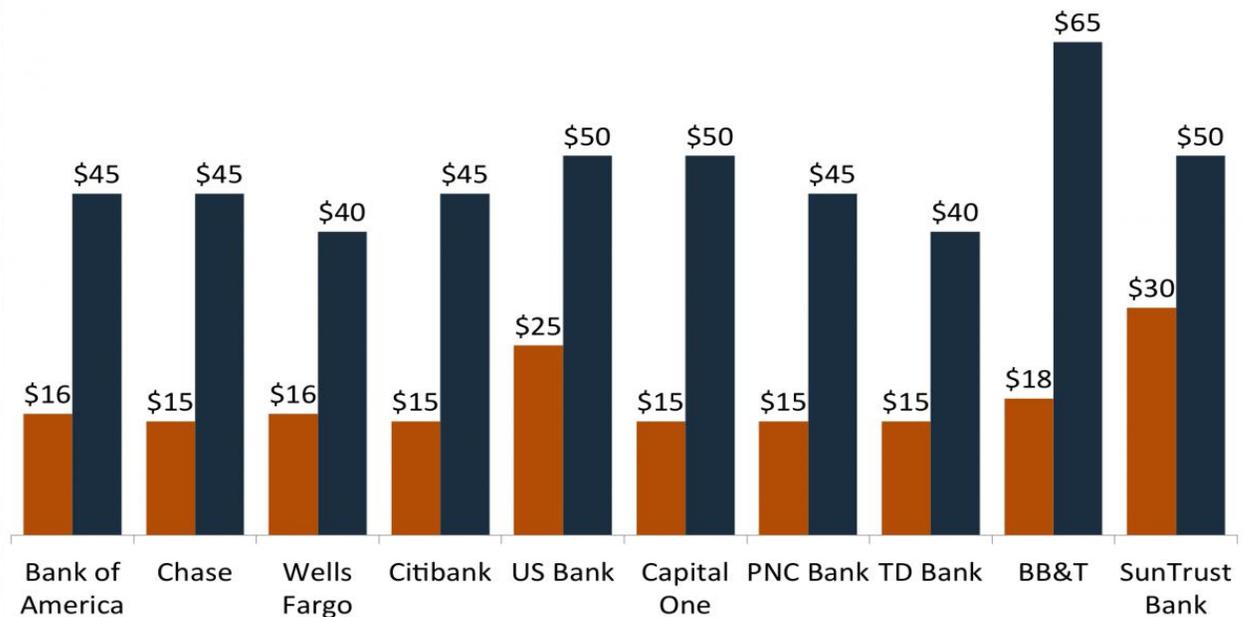
\$5-\$10 fee for these transactions. That's because banks are attempting to profit on top of a combination of wire and foreign exchange fees levied on the bank, plus payments associated with clearinghouses and other middlemen.



## Foreign Interbank Transfer Fees

*\$Millions, largest US banks by assets*

■ Incoming ■ Outgoing



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Source: MyBankTracker

Blockchain has the potential to simplify transfers and conversions in three key ways:

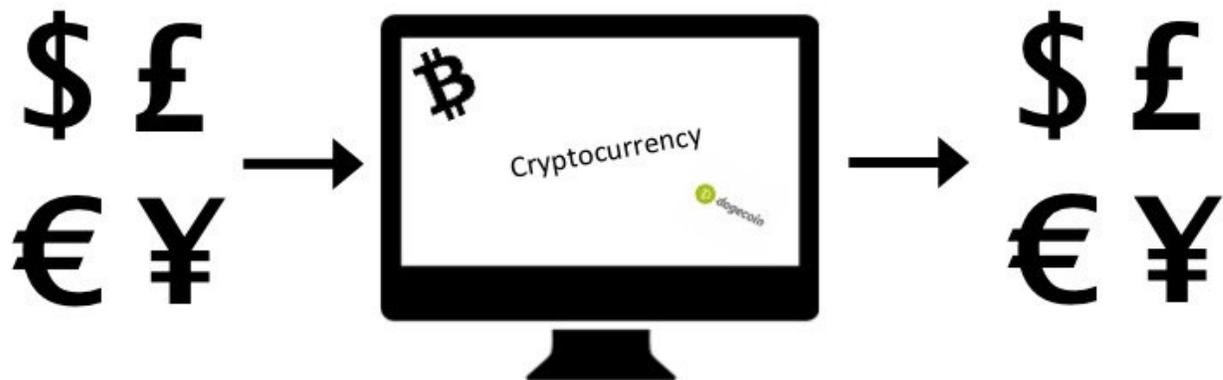
- **Speed:** Cryptocurrency transfers happen in near real time, whereas traditional wire transfers can take multiple business days. This could be particularly useful in the US, where real-time settlement is rare.
- **Price:** Because blockchain cuts out the middleman and allows funds to be transferred directly, it could reduce some of the fees charged by third-party firms.
- **Security:** Blockchain could eliminate middlemen involved in wire transfers, thereby limiting the number of parties with access to sensitive data.

As a result, a variety of organizations are testing and experimenting with potential use cases to simplify some of these processes:

- **R3 CEV:** This blockchain collaboration hub, which includes over 42 major banks and financial institutions and partners, recently completed a test involving several blockchain implementations and cloud hosts, to simulate transferring value between banks to determine which platform works best. The firm believes it could have a global

blockchain-based transfer platform of this sort up and running by the end of 2016, according to the [Sydney Morning Herald](#).

- **Bank of America:** The US Patent and Trademark Office revealed multiple Bank of America patent filings in late 2015. [One of these](#) focuses on using blockchain and cryptocurrency to ease the currency conversion process. The patent proposes that funds be converted to a cryptocurrency like Bitcoin, transferred through a popular digital exchange like Bitstamp, and then re-converted into the appropriate national currency. This process could also be used to settle domestic transfers, with the currency simply being converted back from cryptocurrency to its previous form.



Cryptocurrency is then traded on a common exchange, like BitStamp or OKCoin, and converted back to currency.

- **Goldman Sachs:** Goldman attempted to patent SETLCoin, a proprietary cryptocurrency that would be used to settle securities trades on a blockchain-based platform. That could allow the bank to use blockchain to hasten the process of trade settlement and lower or eliminate the risk of incomplete trades, according to [Quartz](#).

- **Visa Europe:** The firm, which will be integrated with Visa Inc. this year, is working with blockchain startup Epiphyte to explore blockchain-based remittance platforms and develop a protocol that leverages that platform to offer remittance customers lower fees and faster transfers. It's particularly interesting that Visa Europe, a card network, is working to get involved in the blockchain space because card networks are an example of the middlemen that could be phased out by blockchain tech. By staking their claim early, they have the potential to build out a new revenue stream, which would be especially important should their core function be cannibalized by better technology.

## Shareholder Management

The blockchain can also function as a database, because it permanently stores data in a shared, accessible location that is highly secured. This is particularly relevant to financial institutions because they must hold vast databases of customer information, which is both cumbersome from a storage capacity standpoint and requires major security safeguards. As a result, financial institutions are looking to use blockchain to replace traditional databases for two main reasons:

- **Less paper:** Most simply, blockchain cuts down on the amount of paper financial institutions must use for record keeping. That eliminates several layers of bureaucracy and makes database management simpler and less expensive.
- **Shared access:** Blockchain technology allows data about ownership transfers to be stored in the same place that the transfers occur and are verified. That makes it a compelling option for shared record keeping, because it allows records to co-exist in permanent form in a place where everyone in the network has easy access to it, thereby eliminating steps that users need to take to retrieve and verify historical information.

For example, **Nasdaq** launched Nasdaq Linq, a blockchain-based shareholder management platform in late 2015. And in December of that year, Linq, which works with private market trading, processed its first transaction — the issuance of ownership to a new shareholder in blockchain startup Chain. If Linq continues to operate successfully, the companies that use it will have access to a comprehensive record of share issuance and transfer, which will simplify processes like auditing, governance, and transfer of ownership.

In this situation, Blockchain could significantly reduce settlement time and eliminate the need for paper certificates.

### **Nonfinancial Use Cases**

Parties outside of the financial system are also looking into the possibilities for blockchain. Though the implications for database management and the transfer of value often put money and trading top-of-mind, it's worth noting that **the broadest interpretation of the blockchain is as a tool that allows for a simple and public exchange of information between two parties while still maintaining the anonymity and security of that information.**

As a result, governments are looking into blockchain to manage databases, musicians for the transfer of royalty, and more. This illustrates not only the broad-based potential that blockchain technology holds, but also the potential for this technology to be developed within the financial industry, but then licensed or sold to players entirely unrelated to finance.

# CHALLENGES TO BLOCKCHAIN TAKING OFF

Despite these advantages, there are some risks that are slowing down blockchain development and mainstream adoption. Because the technology is still new and relatively untested, it's causing potential users to move with some trepidation:

- **Security:** As secure as blockchain is in theory, it still hasn't been put to the test for real-time, large-scale transactions. This is why industry players like MasterCard and Bank of America are treading cautiously. Though the technology seems to be safer even than existing technology, it's still new, and risk-averse financial institutions are proceeding with caution.
- **Regulation:** Cryptocurrency and blockchain remain largely unregulated in almost all countries worldwide. Even more, regulation that's beginning to take off in the

alternative finance space differs from country to country, which could make it impossible for technology like blockchain, that often works with networks that span across borders and operate in multiple countries to be compliant in all countries. That could make parties that are very excited to innovate hesitant to implement the technology because of the combination of associated risk and lack of possibility for recoup if there are losses suffered. But it's worth noting that digital currency groups are already working to mitigate the regulatory risk — agencies in the US, Australia, Singapore, and the UK have already teamed up to form the Global Blockchain Forum, a group that hopes to influence policy development and shape international best practices surrounding blockchain. Ideally, this would allow blockchain to be implemented for purposes like inter-bank transfers, remittances, and shareholder value transfers, across borders without violating regulatory policy in any of them.

- **Culture and legacy systems:** Both individuals and institutions tend to be resistant to change, which makes adopting new technology of any kind a slow and often cumbersome process. That inherent challenge, coupled with the newness and uncertainty surrounding blockchain, tends to make financial institutions very willing to investigate use cases for blockchain or run pilots using the technology, but less willing to put them into practice with actual funds.

But these risks aren't stopping financial institutions from aggressively pursuing the space — over 50 top firms have already gotten involved through partnerships, investment, and internal R&D. Instead, blockchain innovation hubs are thinking through these risks and trying to develop a blockchain network that can meet banks' needs while still maintaining its inherent benefits.

# BOTTOM LINE

- Blockchain functions as a distributed ledger, or database — every party that uses the database has access to it and participates in its production and upkeep.
- Spending on capital markets applications of blockchain is expected to grow at a 52% compound annual growth rate (CAGR) through 2019, according to Aite Group, to reach \$400 million that year.
- Blockchain technology could cut costs across the financial industry by up to \$20 billion annually by 2022, according to [Santander](#).
- Over 50 major financial institutions are involved with collaborative blockchain startups, like R3 CEV or Chain. And many are investing in the technology on their own as well.
  - Money transfer and settlement is one of the primary potential blockchain applications.
  - Shareholder management is another top use case for blockchain.
- If working groups' tests are successful, firms could be using it to transact real value as early as the end of this year and we could see widespread industry application within the next few years.
- Despite blockchain's advantages, there are some risks that are slowing down blockchain development and mainstream adoption, including security and lack of regulations across countries.

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