Blockchain—a peer-to-peer network that sits on top of the internet—was introduced in October 2008 as part of a proposal for bitcoin, a virtual currency system that eschewed a central authority for issuing currency, transferring ownership, and confirming transactions. Bitcoin is the first application of blockchain technology.

The parallels between blockchain and TCP/IP are clear. Just as e-mail enabled bilateral messaging, bitcoin enables bilateral financial transactions. The development and maintenance of blockchain is open, distributed, and shared—just like TCP/IP’s. A team of volunteers around the world maintains the core software. And just like e-mail, bitcoin first caught on with an enthusiastic but relatively small community.

TCP/IP unlocked new economic value by dramatically lowering the cost of connections. Similarly, blockchain could dramatically reduce the cost of transactions. It has the potential to become the system of record for all transactions. If that happens, the economy will once again undergo a radical shift, as new, blockchain-based sources of influence and control emerge.

Consider how business works now. Keeping ongoing records of transactions is a core function of any business. Those records track past actions and performance and guide planning for the future. They provide a view not only of how the organization works internally but also of the organization’s outside relationships. Every organization keeps its own records, and they’re private. Many organizations have no master ledger of all their activities; instead records are distributed across internal units and functions. The problem is, reconciling transactions across individual and private ledgers takes a lot of time and is prone to error.

For example, a typical stock transaction can be executed within microseconds, often without human intervention. However, the settlement—the ownership transfer of the stock—can take as long as a week. That’s because the parties have no access to each other’s ledgers and can’t automatically verify that the assets are in fact owned and can be transferred. Instead a series of intermediaries act as guarantors of assets as the record of the transaction traverses organizations and the ledgers are individually updated.

In a blockchain system, the ledger is replicated in a large number of identical databases, each hosted and maintained by an interested party. When changes are entered in one copy, all the other copies are simultaneously updated. So as transactions occur, records of the value and assets exchanged are permanently entered in all ledgers. There is no need for third-party intermediaries to verify or transfer ownership. If a stock transaction took place on a blockchain-based system, it would be settled within seconds, securely and verifiably. (The infamous hacks that have hit bitcoin exchanges exposed weaknesses not in the blockchain itself but in separate systems linked to parties using the blockchain.)

A Framework for Blockchain Adoption

If bitcoin is like early e-mail, is blockchain decades from reaching its full potential? In our view the answer is a qualified yes. We can’t predict exactly how many years the transformation will take, but we can guess which kinds of applications will gain traction first and how blockchain’s broad acceptance will eventually come about.

In our analysis, history suggests that two dimensions affect how a foundational technology and its business use cases evolve. The first is novelty—the degree to which an application is new to the world. The more novel it is, the more effort will be required to ensure that users understand what problems it solves. The second dimension is complexity, represented by the level of ecosystem coordination involved—the number and diversity of parties that need to work together to produce value with the technology. For example, a social network with just one member is of little use; a social network is worthwhile only when many of your own connections have signed on to it. Other users of the application must be brought on board to generate value for all participants. The same will be true for many blockchain applications. And, as the scale and impact of those applications increase, their adoption will require significant institutional change.

We’ve developed a framework that maps innovations against these two contextual dimensions, dividing them into quadrants. (See the exhibit “How Foundational Technologies Take Hold.”) Each quadrant represents a stage of technology development. Identifying which one a blockchain innovation falls into will help executives understand the types of challenges it presents, the level of collaboration and consensus it needs, and the legislative and regulatory efforts it will require. The map will also suggest what kind of processes and infrastructure must be established to facilitate the innovation’s adoption. Managers can use it to assess the state of blockchain development in any industry, as well as to evaluate strategic investments in their own blockchain capabilities.

Single use.

In the first quadrant are low-novelty and low-coordination applications that create better, less costly, highly focused solutions. E-mail, a cheap alternative to phone calls, faxes, and snail mail, was a single-use application for TCP/IP (even though its value rose with the number of users). Bitcoin, too, falls into this quadrant. Even in its early days, bitcoin offered immediate value to the few people who used it simply as an alternative payment method. (You can think of it as a complex e-mail that transfers not just information but also actual value.) At the end of 2016 the value of bitcoin transactions was expected to hit $92 billion. That’s still a rounding error compared with the $411 trillion in total global payments, but bitcoin is growing fast and increasingly important in contexts such as instant payments and foreign currency and asset trading, where the present financial system has limitations.

Localization.

The second quadrant comprises innovations that are relatively high in novelty but need only a limited number of users to create immediate value, so it’s still relatively easy to promote their adoption. If blockchain follows the path network technologies took in business, we can expect blockchain innovations to build on single-use applications to create local private networks on which multiple organizations are connected through a distributed ledger.

Much of the initial private blockchain-based development is taking place in the financial services sector, often within small networks of firms, so the coordination requirements are relatively modest. Nasdaq is working with Chain.com, one of many blockchain infrastructure providers, to offer technology for processing and validating financial transactions. Bank of America, JPMorgan, the New York Stock Exchange, Fidelity Investments, and Standard Chartered are testing blockchain technology as a replacement for paper-based and manual transaction processing in such areas as trade finance, foreign exchange, cross-border settlement, and securities settlement. The Bank of Canada is testing a digital currency called CAD-coin for interbank transfers. We anticipate a proliferation of private blockchains that serve specific purposes for various industries.

Substitution.

The third quadrant contains applications that are relatively low in novelty because they build on existing single-use and localized applications, but are high in coordination needs because they involve broader and increasingly public uses. These innovations aim to replace entire ways of doing business. They face high barriers to adoption, however; not only do they require more coordination but the processes they hope to replace may be full-blown and deeply embedded within organizations and institutions. Examples of substitutes include cryptocurrencies—new, fully formed currency systems that have grown out of the simple bitcoin payment technology. The critical difference is that a cryptocurrency requires every party that does monetary transactions to adopt it, challenging governments and institutions that have long handled and overseen such transactions. Consumers also have to change their behavior and understand how to implement the new functional capability of the cryptocurrency.

A recent experiment at MIT highlights the challenges ahead for digital currency systems. In 2014 the MIT Bitcoin Club provided each of MIT’s 4,494 undergraduates with $100 in bitcoin. Interestingly, 30% of the students did not even sign up for the free money, and 20% of the sign-ups converted the bitcoin to cash within a few weeks. Even the technically savvy had a tough time understanding how or where to use bitcoin.

One of the most ambitious substitute blockchain applications is Stellar, a nonprofit that aims to bring affordable financial services, including banking, micropayments, and remittances, to people who’ve never had access to them. Stellar offers its own virtual currency, lumens, and also allows users to retain on its system a range of assets, including other currencies, telephone minutes, and data credits. Stellar initially focused on Africa, particularly Nigeria, the largest economy there. It has seen significant adoption among its target population and proved its cost-effectiveness. But its future is by no means certain, because the ecosystem coordination challenges are high. Although grassroots adoption has demonstrated the viability of Stellar, to become a banking standard, it will need to influence government policy and persuade central banks and large organizations to use it. That could take years of concerted effort.