Blockchain Technology

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Although blockchain technology was originally developed to support cryptocurrencies, states are increasingly looking at the technology for wider applications. This *issue brief* discusses the history of blockchain technology, its current and future applications, and recently proposed Colorado legislation related to this technology.

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History of cryptocurrency. The most well-known virtual currency, Bitcoin, emerged in 2008. Bitcoin, an electronic cash, or cryptocurrency, was developed to allow payments to transfer from one party to another without requiring a third-party, like a bank or a government, to verify the transaction. Similar to traditional currencies, cryptocurrency can be traded, saved, and exchanged for goods and services. Cryptocurrencies use digital tokens as the unit of value, meaning that each unique cryptocurrency requires users to buy a digital token to access and use that cryptocurrency.

Bitcoin and other cryptocurrencies are fundamentally made possible by a technology named blockchain. Blockchain is a technology that records transactions digitally through a network of computers instead of a through a third-party. Because Bitcoin and other cryptocurrencies are not controlled by a central bank or a government authority, no central agency is required to monitor and record transactions. Instead, virtual currencies rely on a distributed ledger that is shared by participants in the network who record and verify the transactions.

Distributed ledger. Consider a simple transaction between friends. Peer 1 wants to give Peer 2 an apple. The transaction occurs without a third party monitoring and verifying that Peer 1 gave Peer 2 the apple. Both Peer 1 and Peer 2 agree that the transaction occurred, and the transaction is "verified" by virtue of this agreement, rather than by a third-party.

A distributed ledger is the same concept, but on a larger scale. In the blockchain, all transactions are recorded on a virtual ledger, which is distributed to users on the network. When a transaction is requested, users on the network attempt to verify it. If a user fails to verify the transaction, it cannot be entered into the ledger, and the transaction cannot be processed. In this way, transactions are authorized or denied by the network as a whole. Once the transaction is verified, it is added as a "block" of information in the ledger, and becomes part of the blockchain. The updated blockchain is then digitally synchronized across all users so that the blockchain remains accurate. This concept of recording data through multiple users is called distributed ledger technology or DLT.

Cryptography. Information in the blockchain is secured and recorded through cryptography. Each user has a private and a public key. A private key is kept secret like a password, is only known to the user, and cannot be reissued or recovered if lost. Public keys are freely shared through a network of multiple users. Together, the keys allow users to send information to the blockchain, verify its accuracy, and record it. Blockchain technology is potentially less vulnerable to cyberattacks than traditional data storage methods because the information within the individual blocks is

decentralized across a network. This decentralization ensures that the data cannot be changed by an individual user.

Applications of DLT Technology

Although blockchain technology was originally used to develop cryptocurrencies, its application has become much wider as DLT has been utilized in a variety of industry and transaction types.

Finance. Financial institutions, such as banks, are beginning to apply blockchain technology to areas like regulatory reporting and money transfers. DLT may allow financial institutions to better track the transactional history of money and to decrease administrative costs by having DLT immediately verify the release of payments instead of waiting for third-party verification. One financial institution, Deutsche Bank in Germany, is researching using blockchain technology to simplify international money transfers. More information on this research can be found here: https://www.db.com/newsroom_news/2018/how-blockchain-technology-is-changing-the-financial-industry-10-theses-en-11684.htm

Food industry. Food operators have begun researching the application of blockchain technology as a method to track and simplify food supply chains. Because many parties are part of the food distribution chain, including farmers, regulators, and distributors, DLT may allow for more effective food origin tracking. Walmart has started working with IBM on two pilot projects that use DLT to track the distribution of mangos and pork to pinpoint food safety issues before these products are sold and later consumed. More information on IBM's food safety blockchain program can be found here: https://www.ibm.com/blockchain/solutions/food-trust

Energy sector. Blockchain technology is being researched as a tool that consumers can use to track the source of the energy they consume. Using DLT to record the history of energy grid source transactions, a consumer may have the ability to track where his or her electricity is sourced, such as from a power plant or from a community solar garden. Another possible use of blockchain in the energy sector is allowing consumers to trade renewable energy. Using DLT could allow a consumer with a solar panel to send renewable energy into the electrical grid, which could be transferred to a consumer who is interested in increasing his or her use of renewable energy. Ernst & Young has begun researching the use of blockchain technology in the energy sector. More information on this research can be found here: https://www.ey.com/en_us/digital/blockchain-s-potential-win-for-the-energy-sector

Colorado State Legislation

Three bills considered during the 2019 legislative session promote the use of blockchain technology.

Senate Bill 19-023 creates the Colorado Digital Token Act, which exempts cryptocurrency from state security laws if the primary purpose of the digital token is consumptive and not for speculative or investment purposes. The bill requires that a person must file a notice of intent with the Securities Commissioner in order to receive an exemption for all future transactions.

House Bill 19-1247 directs the Commissioner of Agriculture to convene an advisory group to study the potential applications for blockchain technology in agricultural operations. The Commissioner may seek gifts, grants, or donations to fund the study. The bill directs the advisory group to study the potential use of blockchain in a variety of agricultural operations, including tracing certain products from farm to shelf, monitoring field conditions, and verifying organic products.

Senate Bill 19-184, which was postponed indefinitely, would have required the Colorado Water Institute at Colorado State University to study the potential uses of blockchain technology to manage, track, and establish water rights and water markets.