

# THE (R)EVOLUTION OF MONEY

Blockchain Empowered  
Digital Currencies

# Foreword

## **Can cryptocurrencies wrest some control away from central banks and traditional financial players, and disrupt the market as we know it?**

The potential is certainly there! While blockchain empowered digital currencies are far from mature, their disruption of the current financial system is inevitable. Cryptocurrencies are creating a money revolution. By making some intermediary functions redundant, they call into question the paradigm of traditional fiat currencies and the role of central banks and financial institutions. However, central banks and other influential financial sector players around the globe can certainly play a major role in shaping this landscape. In response to this new paradigm, central banks and financial institutions are experimenting with, and prototyping their own cryptocurrencies.

Accenture believes that central banks have the unique convening power needed to bring together disparate players in the financial sector, minimizing fragmentation in the market and establishing a strong foundation for the use of cryptocurrencies. One that has the necessary governance structures, rules and policies in place to ensure economic growth and consumer protection, while also supporting the adoption of progressive approaches to currency control and use.

**By acting now, central banks can help shape the future of cryptocurrencies!**

# Introduction

## **Cryptocurrencies threaten to disrupt financial markets because they can be issued without the involvement or backing of a central bank or other traditional financial sector role players**

Incumbents are taking the threat that cryptocurrencies represent—among others, loss of control, the emergence of a non-regulated environment, market fragmentation, and loss of revenue—very seriously, with leading financial players exploring their own cryptocurrency models.

The technology that underpins cryptocurrencies, the distributed consensus ledger (DCL), is revolutionary. It provides complete and secure transaction records without using a central registry. This enables direct peer-to-peer transactions, eliminating the need for traditional players, namely third-party intermediaries like financial institutions or clearinghouses.

Accenture believes that central banks that act now can help shape the role that cryptocurrencies will play in the economy. A central bank-issued cryptocurrency can support the bank's mandate of maintaining economic stability, protecting the consumer and controlling money supply. But to take this step, central banks will need to evolve beyond their traditional roles. A central bank can issue fiat currency on the blockchain in the same way it issues fiat currency as physical cash.



**01**

# WHAT IS A DIGITAL CURRENCY?

**A cryptocurrency is a token on a distributed consensus ledger (DCL) that represents a medium of exchange and a unit of account. A cryptocurrency can be obtained, stored, accessed and transacted electronically. It facilitates peer-to-peer exchange without necessarily going through a third-party intermediary.**

While cryptocurrency transactions are recorded on the DCL, users are only known by their virtual addresses, making them pseudo-anonymous. Cryptocurrency transactions are thus more transparent than cash i.e., the exchange is fully recorded from first issuance, but also more anonymous than any other form of online payment. What makes cryptocurrencies secure is the DCL and/or blockchain technology that underpins them.

All money in circulation today is owned by the central bank and commercial banks of that currency's legal jurisdiction, except for cash when in the hands of individuals where money deposited in a bank account is owned by the bank. The bank has a liability to the depositor, but can use the money to give to someone else as a loan.

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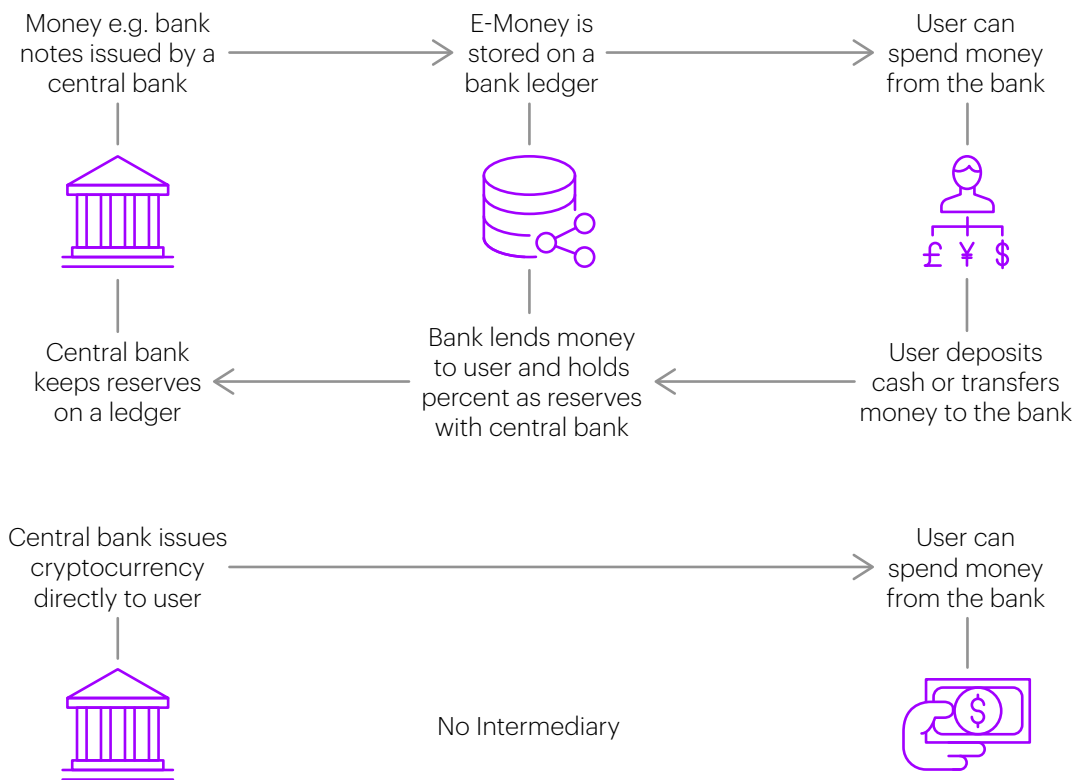
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With cryptocurrencies, funds are owned by those who hold the keys—this is a fundamental difference to conventional banking. Commercial banks could have a role in issuing and safeguarding keys—wallets instead of bank accounts, but their ability to source deposits to make loans is materially different with cryptocurrencies.

# Distinguishing e-money from a cryptocurrency

The flow of e-money and cryptocurrencies can differ substantially. With the former, a central bank typically goes through the banks to distribute money into the markets. However, with a cryptocurrency, the central bank can distribute directly to a consumer. This has not been previously possible as banks have played the role of middlemen in transactions.

**Figure 1: Distinguishing e-money from a cryptocurrency**



# Understanding the distributed consensus ledger (DCL)<sup>1</sup>

The DCL<sup>2</sup> is a ledger of transactions replicated on multiple nodes on the Internet or a virtual private network (VPN). Each transaction is signed uniquely by a user's private key. Transaction integrity and confirmation are enforced through cryptography, and agreed through the consensus of DCL nodes. DCLs can be constructed using blockchains, so called because transaction updates are made in 'blocks' on the DCL to create a chain of historical transactions stored in a shared network of nodes. However, other structures are possible. DCLs can be private or public.

## Parameters of a DCL

A DCL can be described by seven core characteristics or parameters depending on the combination of attributes. Each parameter can provide the features to define an instantiation of a blockchain on a DCL.

Figure 2: Parameters of a DCL



### Object

The unit of value or account which can be a currency, vote or token.



### Protocol

The rules or protocols in the network can be private or public.



### Consensus

The method used by the network to reach an agreement. This can be consensus, proof of stake (PoS), proof of work (PoW), proof of burn (PoB).



### Identification

defines whether participants need to identify themselves and to what degree—anonymous, pseudo-anonymous or total identification.



### Access

Access can be open, limited or closed, depending on the application (permissioned or permissionless).



### Hierarchy

Is the network autonomous or attached to another network or asset e.g. connected (sidechain)



### Structure

The data structure used can either be a blockchain, a DCL or another data structure.

# **02 HOW CAN FINANCIAL MARKETS LAUNCH A CRYPTOCURRENCY?**

**A cryptocurrency can be launched within an open or a closed system. An open distributed and/or decentralized cryptocurrency can be exchanged for fiat currencies and can also be arbitrarily pegged to them, while a closed cryptocurrency, which is centralized, can only be used in the environment for which it was designed for.**

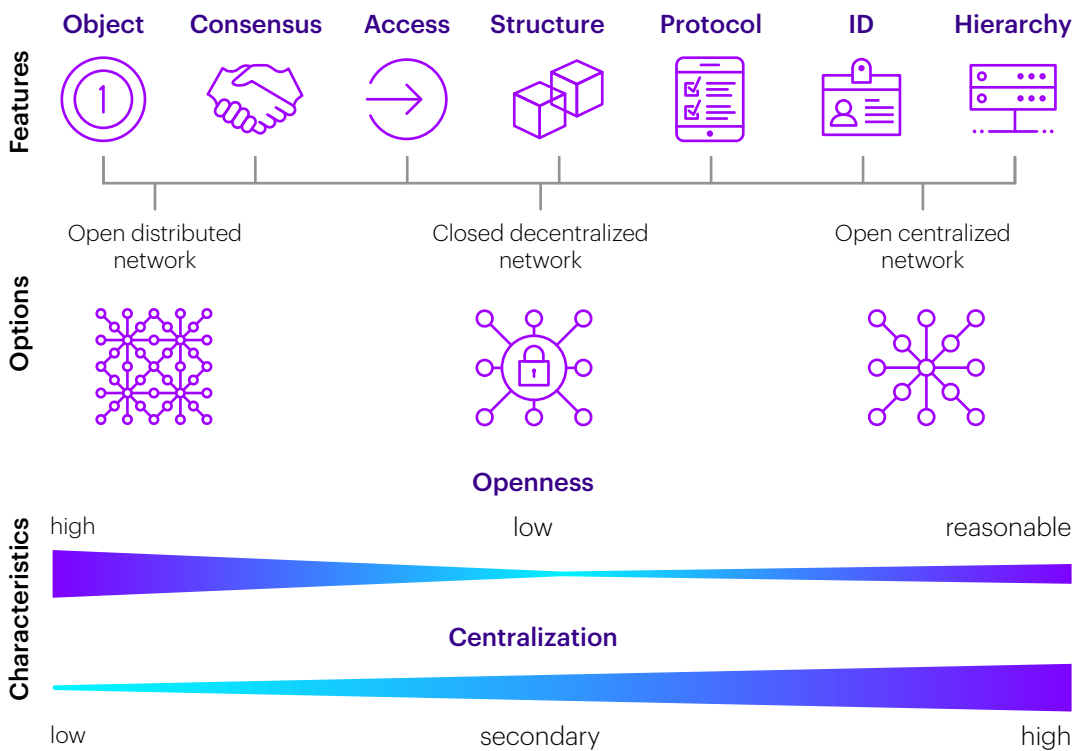


Different combinations of the basic elements of a DCL allow for a variety of cryptocurrencies to be launched: open and distributed, open-distributed and/or decentralized, closed and centralized,<sup>3</sup> etc. see the sidebar for a closer look at two different types of network models.

There are several non-technical considerations which must be investigated and assessed such as the form of the currency; as well as a wide set of monetary and macroeconomic aspects such as the key functions of money such as store of value, vehicle of exchange and unit of measurement.

These aspects also need to consider the effects of emission, inflation, reserves and liquidity. Any such initiatives would be wholly incomplete without taking such considerations into account and must be addressed for completeness.

**Figure 3: Elements to launch a blockchain empowered digital currency**



# Cryptocurrency model

## Open-distributed network

In an open-distributed network, the object is a cryptocurrency token. The agreement method is PoW and access is open, thus permissionless, allowing anyone to participate in the network. The identity of participants is pseudo-anonymous.

## Open-centralized network

In this type of network the system is permissioned and for use by a closed group, only members can participate. The system is governed by protocols that members follow and identity of participants is known through some type of know-your-business (KYB) or know-your-customer (KYC) procedure.

## Key success factors

The current cryptocurrency market is highly competitive and fragmented. The market fragmentation is further compounded by traditional fiat currencies (for example the Dollar, Euro, Pound, Yen etc.) which compete directly in this space. Despite the expectations of current cryptocurrency users, market proponents suggest that a wide and large scale acceptance of these cryptographic based digital currencies can be difficult to achieve. The counterargument is that many traditional fiat currencies exist and each plays a vital role within the global economy.

Accenture has identified eleven critical success factors that enable a cryptocurrency to be used in the broader economy for trade and commerce. The cryptocurrencies should be:

- Cost effective to issue
- Available immediately
- Governed and regulated

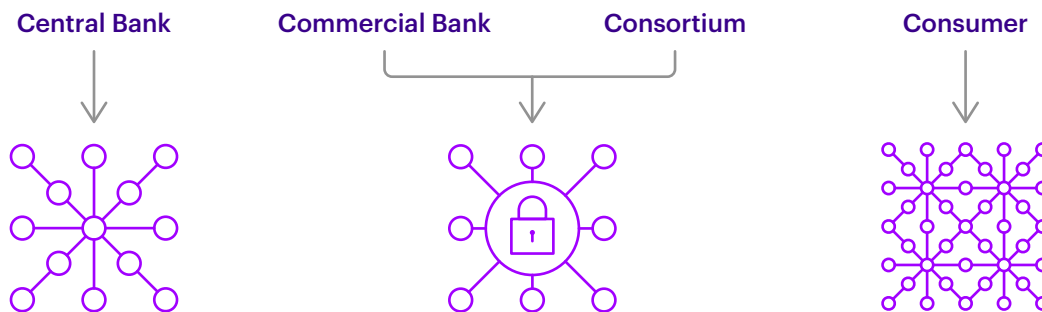
- Instantly liquid - liquidity should be instantly generated or generated on demand
- Secure and immutable - cannot be double spent
- Trusted - backed by a lender of last resort (e.g. a central bank)
- Free from fractional reserve banking in its crypto-form
- Transparent with transaction finality (directly or remotely)
- Add purpose to economic activity (commerce) and have sustainable value
- Have standards to enable interoperability
- Be legitimate - a competent authority to impose these standards

Given these eleven success factors, Accenture sees the central bank as the entity most able to bring these market participants together and create a governance structure in which cryptocurrencies can thrive and gain much wider acceptance.

## Launching a cryptocurrency

There are four market participants that can launch a cryptocurrency—a central bank, a commercial bank,<sup>4</sup> a consortium and a consumer - see figure 4. The cryptocurrency model they choose will depend on the purpose and intended user base of the cryptocurrency.

**Figure 4. Market participants**



# **03 HOW CAN FINANCIAL MARKETS LAUNCH A CRYPTOCURRENCY?**

**A central bank can launch a centralized or a decentralized cryptocurrency. In either instance, ultimate control will rest with the central bank. To launch a cryptocurrency, however, the central bank will need a solid governance structure, a set of rules, consensus from all market participants and a regulatory framework that sets and manages the relationship between the participants.**

## A centralized cryptocurrency

In a centralized cryptocurrency model, the system is closed to unauthorized users and the central bank maintains copies of the ledger itself. The central bank is the issuer of the cryptocurrency and controls its supply. Such a system can complement or substitute for the current fractional reserve banking system in which commercial banks hold reserves with the central bank. The central bank will encourage banks to hold a portion of their reserves in its cryptocurrency instead of fiat currency. These crypto-reserves will continue to be used for transactions such as interbank trade, settlement and clearing. This will create a future in which banks and other financial market participants can settle amongst themselves directly.

The Central Bank of Russia (CBR) is investigating issuing its own national blockchain cryptocurrency. Russia believes the cryptocurrency system should be centralized, permissioned, licensed and operated under regulatory policy to avoid illicit activities and protect consumers. The issuance and exchange procedures will be regulated; issuers will be licensed and anonymity will be minimized. Users will be able to purchase the cryptocurrency online using rubles.

## A decentralized system

A decentralized cryptocurrency system will see a central bank partner with commercial banks and other financial institutions that are regulated, or with private sector agents. The role of the central bank will be to create the governance structure, govern the supply of the cryptocurrency and ensure consensus among participants.

In a partnership with financial institutions, these entities will oversee digital ledger procedures such as governing user (company or individual) processes, issuing keys, and ensuring compliance with KYB or KYC procedures by linking the user's information to the private key. Users will be in control of their private key and since only the public address is made known, the user is pseudo-anonymous. When transacting within the system, users will interact directly among themselves. Upon completion, the transaction is posted on the public ledger and an audit trail is established. Such a system is similar to the current system in which commercial banks in Scotland, Hong Kong and Macao have the right to issue the fiat currency under the supervision of a central bank or monetary authority.

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In partnership with private sector agents, the central bank can set the interest rate paid on the cryptocurrency and allow the private sector to determine the quantity in circulation by offering to buy and sell in exchange for well-defined asset classes. The central bank may alternatively allow the private sector to bid the interest rate up or down until market equilibrium is reached. The private sector can also compete to process cryptocurrency transactions for a fee.

**The Bank of Canada** is experimenting with a cryptocurrency, CAD-Coin, using R3CEV technology. CAD-Coin is a digital version of the Canadian dollar based on blockchain technology. Major Canadian banks, Bank of Montreal, Canadian Imperial Bank of Commerce (CIBC), Royal Bank of Canada, Scotiabank and Toronto-Dominion (TD) Bank, as well as other parties such as Payments Canada and R3CEV, are involved in the initiative. Participants will pledge cash collateral into a special pool which the central bank will convert to CAD-Coin. This prototype will test how large transactions between banks might be settled in future. The bank has reiterated that it is not launching a cryptocurrency like Bitcoin or Ether for public use anytime soon.<sup>5</sup>

Inspired by the **Bank of England's (BoE)** discussions of cryptocurrencies, researchers from the University College London (UCL) created a centrally-controlled cryptocurrency, the RSCoin. The supply RSCoin will be controlled by a central bank. The cryptocurrency will be based on DCL technology to ensure that it is not a complete departure from privately distributed cryptocurrencies. RSCoin could be used as a reserve currency as it is more flexible and has lower costs. It is not impacted by exchange rates so better facilitates global trade. According to a UCL paper, "the ultimate goal for RSCoin is to achieve not only a scalable cryptocurrency that can be deployed and whose supply can be controlled by one central bank, but a framework that allows any central bank to deploy its own cryptocurrency."<sup>6</sup>

# A commercial bank cryptocurrency

Like a central bank, a commercial bank can launch a centralized or decentralized cryptocurrency.

A commercial bank's centralized cryptocurrency system will be closed and permissions will be required to gain access to it. In this system, the commercial bank maintains copies of the ledger and determines the supply of the cryptocurrency. Such a system can also be repurposed for recognition and loyalty programs. Bank of New York (BNY) Mellon's BKoins are currently being used as an internal currency to understand how blockchain technology can impact the bank.

A decentralized cryptocurrency system can be launched by a single bank or a number of banks who come together to facilitate payments or clearing and settlement. In the case of a single bank, the bank may use the cryptocurrency within its own network or give other users access to the system. In its labs, Citi is testing CitiCoin, an open source Bitcoin-based digital currency, which will be used for global payments and trade. Japan's Mitsubishi MUFG coin provides an example where the system will be open to other users such as those currently on prepaid systems.

In the case where banks partner to launch a decentralized cryptocurrency, the DCL is controlled by the members and a minimum number of members must sign the block to make it valid. The banks will set up their own governance structure and rules, and determine the supply and issue of the cryptocurrency. These systems have to conform to KYB or KYC procedures. A good example of such a system is the Utility Settlement Coin (USC).

Four banks, UBS, Deutsche Bank, Santander and BNY Mellon have joined forces to create their own cryptocurrency, USC, which they plan to launch in 2018. The banks expect USC to become the industry standard for blockchain settlements and want to use the new cryptocurrency in transactions between their branches to facilitate operations, reducing transactions time and costs. USC aims to allow financial institutions to pay for securities, such as bonds and equities, using the cryptocurrency to avoid waiting for traditional money transfers to be completed. The main difference between USC and Bitcoin is that the four banks will be the centralized issuer of the currency.<sup>7</sup>

## A consortium cryptocurrency

A consortium can launch a decentralized system which is either open or closed i.e. permissioned private ledger or permissioned public ledger. In both cases, members transact within a set of rules and the governance structure established by the consortium. The permissioned private ledger is restricted to members. Transactions are also restricted to members and permissions are required to participate in the network. These cryptocurrencies can be used to process and settle international transactions within the network. The permissioned public ledger in contrast is open source and anyone can view and transact within the system.

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A group of Russian banks, BINBANK, MDM Bank, Bank Otkritie, Tinkoff Bank, Sberbank, and other partners have announced their intention to join payments provider, QIWI Group's, blockchain consortium. The aim of the consortium is to create and test approaches such as joint settlements, customer identification procedures and platform for multilateral cooperation in innovations.

## A consumer cryptocurrency

A consumer can launch a distributed cryptocurrency in which anyone can participate. The digital ledger will be open source and allows for peer-to-peer transactions using a PoW or PoS for agreement. Transactions are performed by consumers and third party intermediation is replaced by a framework of internal protocols that govern the system and allow the verification of transactions. Users are able to interact directly without exposing their identities or personal information but their address is public and a record of transaction is maintained on the public ledger, making the system pseudo-anonymous. Purchased or mined cryptocurrencies are stored electronically or in a digital wallet with no physical presence. An example of such a distributed cryptocurrency is Bitcoin.



# 04 STAY AHEAD OF THE GAME!

**While we do not see cryptocurrencies replacing fiat currencies any time soon, they will inevitably disrupt the financial services industry. As various participants continue to investigate this landscape, some of the challenges will be ironed out, drawing more users to the cryptocurrency system.**

But even with wider acceptance, we believe that the cryptocurrencies will not replace the current banking and monetary system. Banks will still play their role in the wider economy, and the role of the central bank will become increasingly important. Accenture believes it is therefore important for central banks and the wider financial services community to act now!

## Benefits of cryptocurrencies

Cryptocurrencies will undoubtedly benefit market participants.

The benefits include:

- **Immediate asset availability** - the cryptocurrency will be available immediately for consumers and businesses to spend, without any waiting period.
- **Immediate access to liquidity** - the cryptocurrency will be highly liquid - liquidity generated instantly on demand.
- **Free up working capital** - the need for banks to hold reserves will be minimized as the money held for use as reserves will be available for other purposes thus optimizing intraday liquidity.
- **Transaction efficiency** - cryptocurrency transactions are fast and immediate - they improve efficiency by cutting out the middle man and avoiding lengthy back-office reconciliation processes.
- **Transaction security** - central bank-issued cryptocurrency transactions can be tracked protecting security. Security is also enhanced as there is no double spending.

Over and above these benefits, a central bank-issued cryptocurrency can have a much larger impact on the wider economy and for all market participants because it can:

- **Boost economic growth** - a central bank issued cryptocurrency can permanently boost economic growth. Barrdear and Kumhof, researchers at the BoE, found that "...central bank digital currency (CBDC) issuance of 30 percent

of gross domestic product (GDP), against government bonds, can potentially permanently raise GDP by as much as 3 percent, due to reductions in real interest rates, distortionary taxes, and monetary transaction costs.”<sup>8</sup>

- **Act as an enabler for mobile and digital commerce** - it can replace current immediate payment models by delivering the currency into the market in a more immediate, efficient and effective manner.
- **Ensure stability in the financial system** - a cryptocurrency can help maintain financial stability and provide policy makers with more effective tools to smooth out financial booms and busts. In periods of high inflation for fiat currencies, banks can hold cryptocurrencies, thus protecting their wealth.
- **Work as a crypto-reserve currency** - commercial banks can keep a portion of their reserves in cryptocurrency rather than in fiat currency, thus complementing the fractional reserve banking system. An efficient central bank issued cryptocurrency can be attractive for international trade and commerce acting as an instrument for global value exchange.
- **Effectively monitor the supply of money** - a central bank issued cryptocurrency can help policy makers control the amount of money in the economy, as well as the supply of the cryptocurrency. This is currently not possible as banks create money by using deposits as loans.
- **Lower costs** - cryptocurrencies will enable the banking system to cut the costs of bank-note issuance, circulation and handling. In addition, transaction costs will be significantly reduced especially for cross border transactions. Banks can use the technology to exchange currency “on us”, lowering costs by not requiring unnecessary intermediaries and clearing houses.
- **Allow for traceability** - transactions in central bank issued cryptocurrencies can be tracked, and simultaneously ensure that the users information remains protected, thus protecting privacy. A central bank issued currency follows KYB and KYC procedures which will allow the central bank to identify users when there is a need to.

# The way forward

There are a number of challenges that a central bank will face when deploying a cryptocurrency. A central bank needs to:

- **Establish a governance structure** - a central bank is in the best position to define a framework and build standards that will allow participants to collaborate. It can bring together a fragmented industry created by self-interest of financial players, and enable cooperation and interoperability.
- **Give policy direction** - as cryptocurrencies are difficult to regulate, it is not surprising that regulators have reacted differently, introducing uncertainty. A central bank is able to give clear policy direction.
- **Regulate the economy** - a central bank issued cryptocurrency will follow KYB and KYC procedures ensuring some degree of control over illicit activities such as money laundering, terrorist financing, drug trafficking, tax evasion and fraud.
- **Provide legal backing** - a cryptocurrency that is issued by a central bank will be able to give the cryptocurrency status of legal tender under a government's legal framework. The cryptocurrency will be able to represent a liability as well as a store of value.

We see the role of central banks becoming increasingly more important and more visible to all users in the economy. At present, the central bank acts through the banking system and is removed from direct interaction with the users. A central bank-issued cryptocurrency will enable the central bank to liaise directly with consumers. For example, a central bank will be able to parachute payments directly to consumers, making funds immediately available and bypassing inefficient and time consuming distribution mechanisms. The central bank will simultaneously continue to fulfil its mandate of maintaining economic stability, being the lender of last resort, protecting the consumer, and effecting policy tools to control money supply including the cryptocurrency.

As more cryptocurrencies are launched, it is important that central banks and the wider financial services community act now to put a stable foundation in place that can benefit all stakeholders.

# 05 CONCLUSION

**Cryptocurrencies have the potential to disrupt the financial system. There is an opportunity to gain first mover advantage for those that act now. More importantly, they help shape the role that cryptocurrencies play in the economy.**

Given the success of Bitcoin and other cryptocurrencies that are gaining prominence, it would be a mistake to conclude that consumers, consortiums or large financial institutions would not be successful in launching cryptocurrencies. However, Accenture believes that a cryptocurrency's chances of success are much higher if launched by a central bank.

A central bank can bring market participants together and create a governance structure in which cryptocurrencies can thrive and gain much wider acceptance. With central bank support, there are also a myriad of other advantages for the economy. Cryptocurrencies are borderless, and central banks that act now increase the attractiveness of their fiat currency as a medium of exchange in payments, clearing and settlement.

The cryptocurrency landscape is still evolving and the definitive answers have yet to emerge to satisfy fundamental questions like:

- What are the broader policy and economic implications of launching a central bank-issued cryptocurrency?
- How will a central bank-issued cryptocurrency impact the banking system?

Perhaps the most important question we can ask right now is: are central banks doing all they can to determine a clear strategic direction with regards to cryptocurrencies that will support growth and protect the economy without stifling innovation?

# Appendix 1

## Understanding the Distributed Consensus Ledger (DCL)

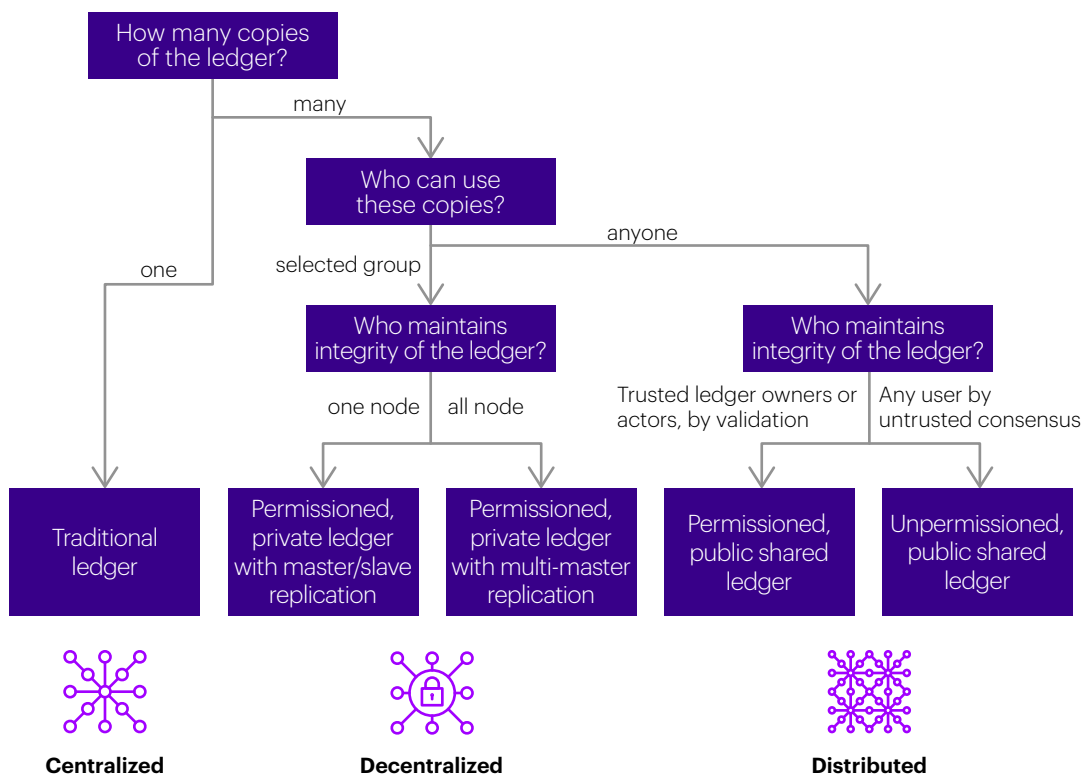
A DCL can be public or private.

**Public and private DCLs** - a public DCL is permissionless and open to all.

Anyone can access it, set up a node and participate in consensus cryptography.

A private DCL is a closed group of nodes who set their own rules on consensus, access and participation.

Figure 5 – The Distributed Consensus Ledger (DCL)



# Appendix 2

## Centralized, decentralized and distributed systems

Centralized	Decentralized	Distributed
<ul style="list-style-type: none"> <li>• Give users rights and defines requirements</li> <li>• Closed or non-convertible currencies</li> <li>• Central authority control</li> <li>• Permissioned</li> <li>• Rules set by central authority</li> <li>• Identity of participants is known - KYB or KYC procedure</li> </ul> <p>Example: current banking system (fiat currencies)</p>	<ul style="list-style-type: none"> <li>• Rights to join and participate may be public or private</li> <li>• Closed or peer to peer, non- and convertible currencies</li> <li>• Central authority control e.g. consortium</li> <li>• Permissioned private or public</li> <li>• Rules set by consortium</li> <li>• Identity of participants can be pseudo-anonymous or can follow KYB or KYC</li> </ul> <p>Example: USC</p>	<ul style="list-style-type: none"> <li>• Grants equal rights to all participants</li> <li>• Peer to peer and convertible currencies</li> <li>• No central authority control – open source</li> <li>• Permissionless</li> <li>• Anyone can join and participate</li> <li>• Identity of participants is pseudo-anonymous</li> </ul> <p>Example: Bitcoin</p>

**Public and private keys** - a private key is a secret key held in a digital wallet used to sign transactions, linking them uniquely to the wallet (and its owner). A public key is derived from a private key and is the public address to which other wallets send transactions.

**Blockchain** - the blockchain is the public ledger of all Bitcoin transactions. Transactions are added by miners to the ledger in blocks which are linked sequentially in chronological order. Other ledgers often developed from copies of the Bitcoin software code also use blockchains.

A blockchain is a way to implement a DCL, which is a record of consensus with a cryptographic audit trail that is maintained and validated by several separate nodes. Entries can be altered but not deleted from a blockchain-based DCL.

**Cryptocurrency** - a cryptocurrency is a token on a DCL transaction that represents a medium of exchange and a unit of account. Sometimes referred to as “digital currency” or “virtual currency”.

**Digital wallet** - a digital wallet is an online or mobile account used to initiate ledger transactions (payments), and to access ledger balances and transaction history.

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Accenture is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations. Combining unmatched experience and specialized skills across more than 40 industries and all business functions—underpinned by the world’s largest delivery network—Accenture works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders. With more than 411,000 people serving clients in more than 120 countries, Accenture drives innovation to improve the way the world works and lives. Visit us at [www.accenture.com](http://www.accenture.com).

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Accenture’s Blockchain practice is a global team of multidiscipline industry and technical experts focusing on taking best of breed solutions to our clients. We apply innovation to achieve real transformation with the ultimate goal of unlocking trapped value in our client’s businesses. Our comprehensive suite of blockchain and distributed ledger technology services are crafted to help clients move from education and experimentation to production and value quickly and effectively. We work closely with leaders from across industries, regulatory and compliance agencies, the academic community and our key technology alliance partners to move blockchain technology forward so that, ultimately, it can help to improve the way the world lives and works.

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## REFERENCES

<sup>1</sup> Accenture Payment Services, Distributed consensus ledgers for payments, Copyright © 2015 Accenture, All rights reserved.

<sup>2</sup> For more details, refer to appendix 1

<sup>3</sup> For more details, refer to appendix 2

<sup>4</sup> Includes other non-bank financial institutions

<sup>5</sup> © THE FINANCIAL TIMES LTD 2016. Canada experiments with digital dollar on blockchain, June 16, 2016.

<sup>6</sup> Centrally Banked Cryptocurrencies, George Danezis and Sarah Meiklejohn, University College London.

<sup>7</sup> © THE FINANCIAL TIMES LTD 2016. Big banks plan to coin new digital currency, August 23, 2016; Blockchain offers banks the chance to rehabilitate their image, August 24, 2016.

<sup>8</sup> Bank of England, Staff Working Paper No. 605, The macroeconomics of central bank issued digital currencies, John Barrdear and Michael Kumhof, July 2016