

# **Research on crypto-based financial services and their impact on the effectiveness of financial regulation**

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## Introduction

“Software is eating the world” wrote Marc Andreessen, co-founder and general partner of venture capital firm Andreessen Horowitz. He was not far off the mark. Businesses, governments, and sectors, including the financial sector at large, are undergoing digital transformation. New tools, business models, and approaches to governance are emerging. In the financial sector, digital currencies such as Bitcoin and Litecoin have been built on the premise that a decentralized infrastructure can offer better benefits to people, such as better security, privacy, and transparency. That decentralized infrastructure, named Blockchain, can be used for other applications besides virtual currency. It can be used to build decentralized apps, verify records, and bypass middlemen in various sectors and industries. On top of the relatively new blockchain (and the virtual currencies they underpin) several business models have been built, such as peer-to-peer lending, secure automated lending technology, lending based on data as collateral, and many others. Advances in cryptography have given birth to most of these new developments which are causing a paradigm shift. A new financial ecosystem is emerging. Emerging markets stand to benefit better given the fact that a large percentage of the populations do not having access to banks and much needed financial services.

This short report will shed light on new emerging financial services that are based on cryptocurrencies (or tokens) and the blockchain. While many of those services are useful, central banks and financial regulatory authorities around the world are working hard to ensure those services do not pose a material threat to the stability of the financial system. To succeed in doing this, regulators must be aware of the various factors driving and impeding the adoption of blockchain- and cryptocurrency-based solutions.

## Classification of crypto assets

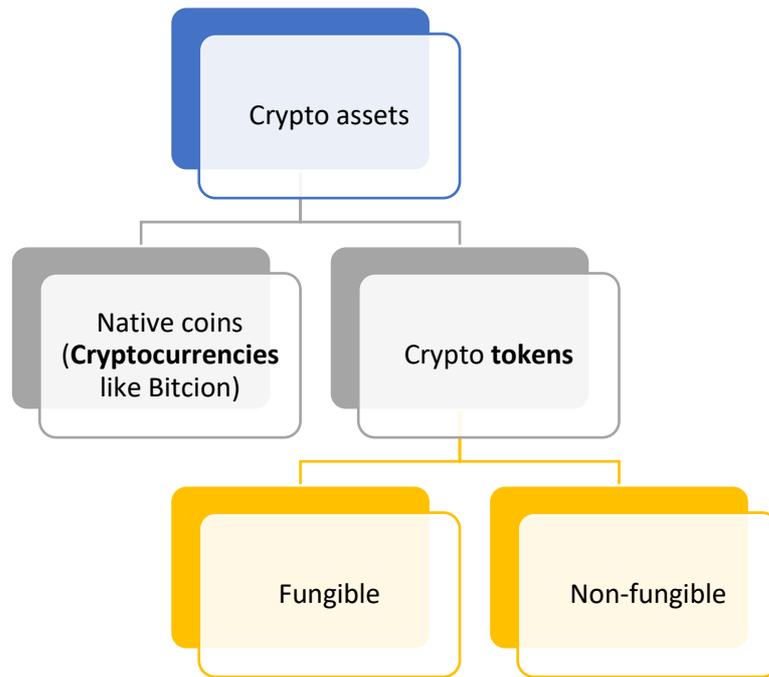
Generally, Crypto assets can be classified into two main categories native coins and crypto tokens<sup>1</sup>. **Native coins** such as Bitcoin compete with traditional forms of money and work outside of the authority of the central bank, while **crypto tokens (or digital vouchers)** hold some value in relation to the entity issuing them. Crypto tokens can be fungible or non-fungible. Non-fungible tokens have their own “phenotype” determined by its immutable genes (“genotype”) stored in the Ethereum smart contract. The development of tokens has been facilitated by the availability of Turing-complete codes for smart contracts on the blockchain allow crypto tokens to be easily created, published, shared, and exchanged.

A blockchain can be defined as *a time-stamped series of immutable (tamper-proof) record of data which is managed by a cluster of computers.*<sup>2</sup>

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<sup>1</sup> [https://link.springer.com/chapter/10.1007/978-3-030-02330-0\\_9](https://link.springer.com/chapter/10.1007/978-3-030-02330-0_9)

<sup>2</sup> <https://www.blockchain-council.org/blockchain/the-best-blockchain-business-models/>



## The taxonomy of three main token classes according to the Swiss Financial Market Supervisory Authority:

The classification below does not distinguish between native coins (cryptocurrencies) and crypto tokens.

1. **Payment tokens** can be used to pay for goods and services
2. **Utility tokens** (such as ICOs) are limited in that they can only be used for the purpose or the application they had been built for. ICOs are taking place less often nowadays.
3. **Asset or debt (security) tokens** are like shares or debt instruments. They are usually offered through security token offering (STO). Tokens in this case are cryptographic analogous of traditional assets.
4. There can also be **hybrid tokens** that combine some features of different kinds.

### Tokenization, its benefits and use cases of tokens<sup>3</sup>

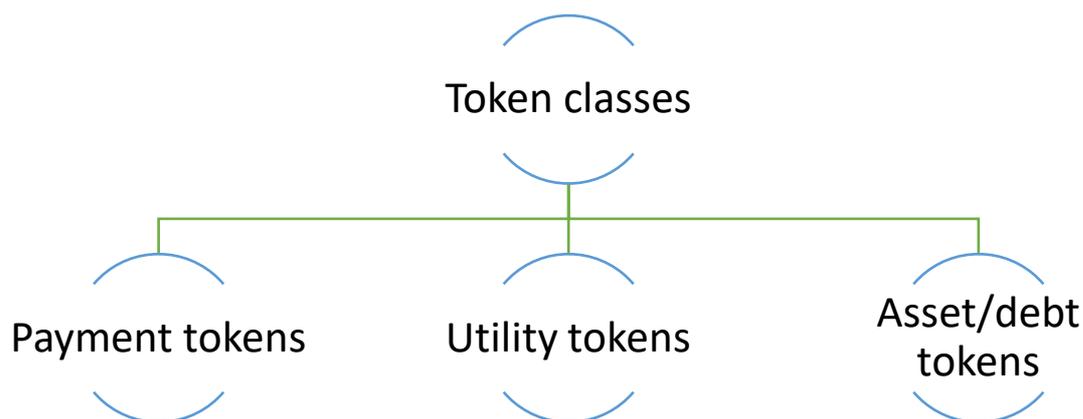
**Tokenization of assets** is the concept of using blockchain technology to securitize assets. It is the process of issuing a blockchain token that digitally represents a real tradeable asset. The issued “security tokens” are created through a type of initial coin offering – or in this case – security token offering (STO). They can either represent regulated financial instruments (equities, bonds, loans, and funds), tangible assets (real estate, artworks, precious metals), or intellectual property (copyright to works of authorship).<sup>4</sup> Tokenization is a valid business model and several [companies](#) provide tokenization services.

<sup>3</sup> <https://medium.com/ico-launch-malta/what-is-an-asset-backed-token-a-complete-guide-to-security-token-assets-f7a0f111d443>

<sup>4</sup> <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/financial-services/lu-tokenization-of-assets-disrupting-financial-industry.pdf>

## Tokenization offers many benefits, including:

- **Tradability:** Tokens enable any asset to be traded on the blockchain. Those assets can be traded 24 hours a day, 7 days a week.
- Tradability can in turn lead to **increased liquidity** of illiquid assets which have become tokenized (such as real estate, vehicles, and so forth).
- They enable **fractionization:** which enables small ownership of large assets and micropayments (paving the new for new business models)
- Fractionization can also enable **revenue sharing.**
- **Stabilization** of the value of assets: Agri-backed token such as tokens backed by soybeans can be traded and they can be used as stable coins.
- **Protecting intellectual property** in the case of IP-backed tokens.
- **Protecting other ownership rights** such as in the case of land registration
- **Crowdfunding and fundraising,** although this has been limited with the recent crackdown on ICOs

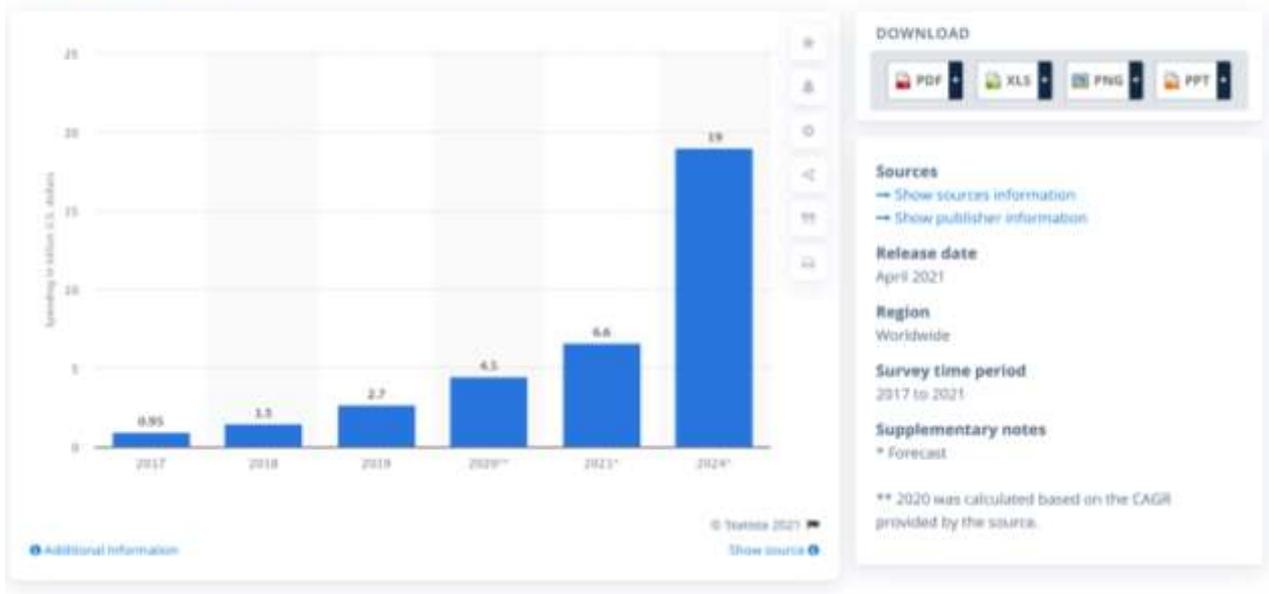


## Spending on blockchain is growing

Capital is flowing in increasing volumes towards blockchain solutions. In 2019, over 2.7 Billion USD were spent on developing such solutions. More expenditure is expected in the upcoming years.

## Worldwide spending on blockchain solutions from 2017 to 2024

(in billion U.S. dollars)



## Blockchain framework

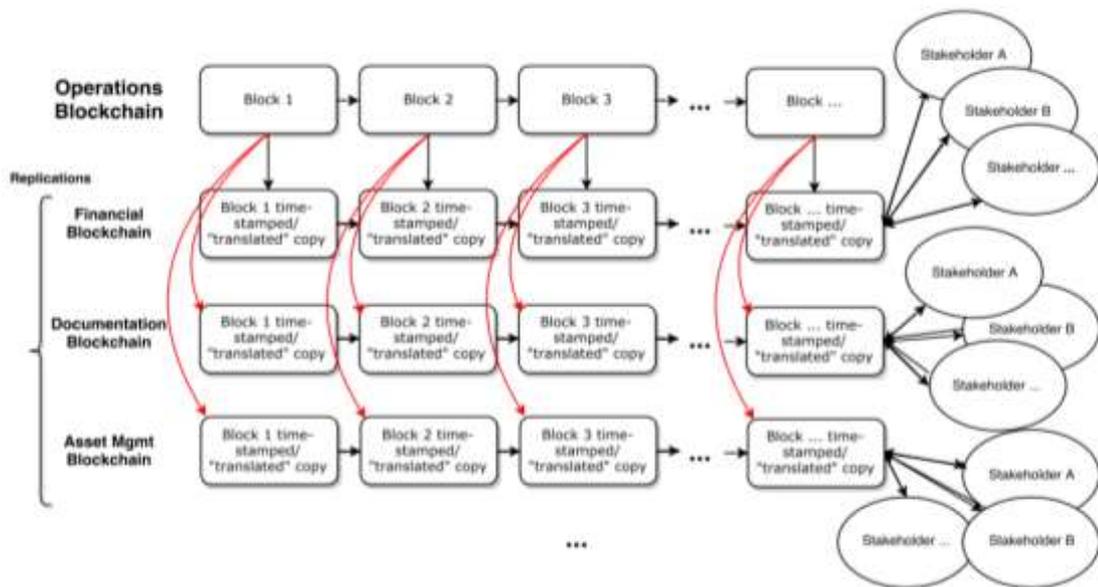


Figure 1: Source: Sustainability 2018, 10, 185

## Regulating cryptocurrencies:

Regulating cryptocurrencies depends on several issues such as:

- **Are crypto assets securities?** If they are then authorities like the Ministry of Finance in Norway, or the SEC in the United States, will be responsible for regulating them.
- **Are crypto assets (both currencies and tokens) considering a legal tender?** A [report](#) by the Library of Congress describes the state of regulation of cryptocurrencies around the world. Bitcoin and other Cryptocurrencies are not considered as a legal tender around of the world (except in EL Salvador which plans to make Bitcoin a legal tender on September 7<sup>th</sup> 2021<sup>5</sup>). Japan is working towards the regularization of cryptocurrencies as means of payment, and Switzerland is ahead in that area as well. Bitcoin or other cryptocurrencies may become legal tenders in the future.

## Business models that are based on the blockchain and cryptocurrencies<sup>6</sup>:

- **Blockchain as a service (BaaS):** blockchain offers many benefits to businesses, including consensus, replication of records, immutability, and security. IBM<sup>7</sup> and other companies offer their cloud-based infrastructure to enable their clients to build application on the blockchain. This infrastructure allows companies to experiment, test, and conduct research. It works similar to a web hosting service where clients can host their decentralized apps<sup>8</sup>.
- **Utility token business model (such as Ripple):** users buy tokens to be able to buy the services provided by the issuer of the tokens. Banks or other members who are parts of this model can transfer money to one another efficiently.
- **Blockchain based software products:** business can purchase a blockchain solution and integrate it into their system. This means that companies can buy a ready (Turing-complete) system instead of developing it from scratch.
- **P2P blockchain business model:** this model enables the removal of intermediaries and the direct interaction between different users, which can be useful in different platforms. This can be useful in lending, file storage, and other services.
- **Blockchain professional services:** clients can hire experts from companies like Microsoft, IBM, or others to develop the service for them. This is more like a done-for-you service often used by startups.
- **Cryptocurrency & Altcoin Development:** a company can offer customized crypto coin development services for specific needs.
- **Token Development & Exchange (Ethereum):** a company can develop a token for a specific use based on the request of the client.
- **Cryptocurrency Exchange /Trading:** this is the brokerage business model where a company can earn money on every transaction. In this model, companies can earn money either from commissions or spreads, or both.
- Bitcoin Wallet Service Startups
- **Bitcoin Forking Startups:** forking means changing a part of the code of an existing cryptocurrency to create a new cryptocurrency. This requires programming skills.

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<sup>5</sup> <https://www.reuters.com/technology/bitcoin-become-legal-tender-el-salvador-sept-7-2021-06-25/>

<sup>6</sup> <https://www.blockchain-council.org/blockchain/the-best-blockchain-business-models/>

<sup>7</sup> <https://www.ibm.com/topics/blockchain-for-business>

<sup>8</sup> <https://www.investopedia.com/terms/b/blockchainasaservice-baas.asp>

- **Cryptocurrency MLM Service development:** an MLM marketing scheme can be built on the blockchain to reward high performers. A company can offer the development of this MLM software to clients.
- **Decentralized Exchange with Atomic Swaps:** a decentralized exchange can solve the problem of hacking, which tends to happen frequently. However, with decentralization there is the issue of trust between two users who want to perform an exchange. This issue can be solved in decentralized exchanges by using an Atomic Swap Protocol, which compensates for the lack of trust. With an atomic swap, parties fully control their cryptocurrency at each step of the exchange, eliminating the risk of hacking that exists when an exchange acts as an intermediary.<sup>9</sup>
- **ICO – Initial Coin Offering:** initial coin offerings enable companies to raise funds by issuing tokens. Those tokens can have utility use or can just represent ownership. ICOs have become less popular recently due to incidents of fraud and money laundering. Authorities in several countries have cracked down on them.
- **STO – Security Token Offerings:** a security token is the digital representation of an actual security, and it can be traded on the blockchain. Security tokens fall under the remit of current securities regulatory frameworks in most countries. Owning a token can mean owning the right to ownership or profit or revenue sharing.<sup>10</sup>
- **Private Blockchain Implementation for Business**
- **Cryptocurrency mining:** some cryptocurrencies can be more rewarding to mine than Bitcoin. Mining, in general, involves some speculation on the future price of the crypto asset, and ensuring that the benefits will exceed the costs<sup>11</sup>.

## How do companies like Nexo, BlockFi, Celsius make money and pay their clients 5% APY?

1. **They are lending money to institutions and individuals.** To get that loan of fiat clients must deposit cryptocurrency into their accounts and give it as collateral. Sometimes the worth of collateral can be up to three times bigger than the loan. This way the platforms can control the risk in case of the spike in volatility. The crypto is locked until the client re-pays the loan plus interests.
2. **Crypto mining.** Platforms use cryptocurrencies in collateral as network validators. After they validate blocks in a blockchain they get mining rewards and fees.
3. **Defi yield farming.** Some cryptocurrencies (Tether) also can be provided as liquidity in liquidity pools. These are smart contracts running on Ethereum and they are decentralized exchanges. The fees for exchange are paid to liquidity owners. The

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<sup>9</sup> <https://www.apriorit.com/dev-blog/684-blockchain-atomic-swaps-to-implement-a-decentralized-exchange-dex>

<sup>10</sup> <https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/audit/deloitte-cn-audit-security-token-offering-en-201009.pdf>

<sup>11</sup> <https://www.weusecoins.com/en/mining-guide/>

range is 5 to 15% APY. It is possible that these platforms are using this system to earn some extra cash.

### What are the risks?

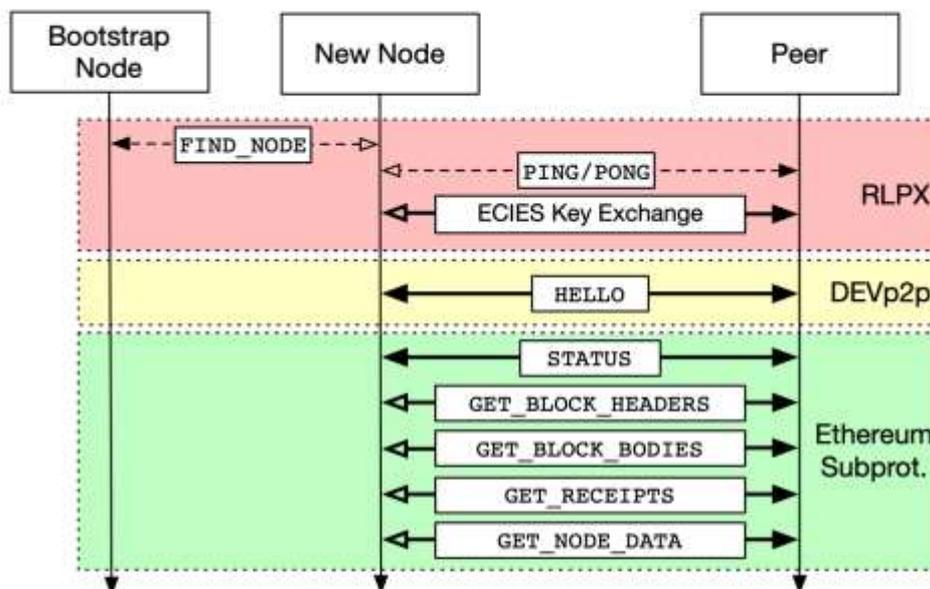
- 1. Centralization.** The companies get full access to the client's private keys and their cryptocurrencies.
- 2. Possible hacking.** There is always a risk that the platform can get hacked. Most of these companies don't have insurance in case of theft.
- 3. Bankruptcy.** The platform can go broke and client funds can be lost and not accessible.

### Table of services

Platform	Service type	Country	Domain
<a href="#">HandleCrypto, NBX</a>	Cryptocurrency Exchanges	Norway	Finance
<a href="#">MiraiEx</a>	Investment in cryptocurrencies	Norway	Finance
<a href="#">Coinpanda</a>	Easy-to-use tax solution for cryptocurrencies	Norway	Trading
<a href="#">BlockFi</a>	Digital Asset backed loan, saving account, Visa Card	USA	Lending
<a href="#">Celsius – unbank yourself</a>	Asset backed loan, saving account	England	Lending
<a href="#">Blockbonds</a>	Banking services to people without access to them	Norway	Mobile banking
<a href="#">Nuspay</a>	Blockchain-powered ICO platform	USA	Financing
<a href="#">Nexo</a>	Tax-efficient Instant Crypto Credit Lines, saving account, Mastercard	Estonia, Bulgaria	
<a href="#">Seba bank AG</a>	Licensed bank providing services with digital and traditional assets	Switzerland	
<a href="#">Bankex</a>	Asset backed loan	USA	Lending
<a href="#">BigGate</a>	Mobile-based cryptocurrency wallet application	Norway	Wallet
<a href="#">Vipicash</a>	Facilitating global transfers using blockchain	Norway	Money transfer
<a href="#">SALT lending</a>	Asset backed loan	USA	Lending
<a href="#">Lendonomy</a>	Peer-to-peer lending	Norway	Lending
<a href="#">Zweispace</a>	Self-executing will system	Japan	
<a href="#">Incent</a>	Digital wallet loyalty platform	Australia	

Sagittae	Decentralized mutual risk-sharing platform	The Netherlands	Insurance
Enso Finance	Defi tool for creating permissionless trading strategies	Switzerland	Social trading and wealth management
Ambrpay	Solution with subscription payments in cryptocurrencies	Switzerland	Payment in crypto
Finoa	Digital asset financial services for professional investors	Germany	Custody
Neufund	Fundraising and investing platform, ESOP manager	Germany	Fundraising
Crypto	Cryptocurrency exchange, Visa Card	Hong Kong	Trading
Luno-exchange	Cryptocurrency trading platform	South Africa	Trading
GeoPay	Cross-border payments	South Africa	Money transfer
Abra	Asset backed loan, saving account	Malawi, Morocco	Lending
BitMari	A platform that allows contracting sponsors to purchase farming contracts for agricultural projects in Africa.	Zimbabwe	Fundraising
Kobocoin	Cryptocurrency	Africa	Currency
Uniwasp	Automated market maker – decentralized trading protocol – provides liquidity		Trading – market making

S.K. Kim et al.



**Figure 1: Ethereum Network Protocols**—We provide an overview of RLPx, DEVp2p, and Ethereum subprotocol and display a typical workflow for a new node joining the Ethereum network. These protocols run on top of UDP (dotted-line) and TCP (solid line), through a series of request (solid arrow) and response (hollow arrow) messages.

## Fintech blockchain service categories

The table below depicts only a few types of fintech services available today. There are several others that are not covered.

Type of service	Examples
<b>Banking (which includes blockchain banks)</b>	Bankex, Coinfirm(AML), Blockbonds, Seba bank AG, Bloom, Enso Finance, AmbrPay, Colendi, and Blockchain banks Nexo, BlockFi, Celsius)
<b>Trading</b>	Finoa, Numerai, Neufund
<b>Crypto exchanges</b>	HandleKrypto, Enigma, Coinbase (Paradex)
<b>Crowdfunding</b>	WeiFund, TaoDust
<b>Lending</b>	Nexo, Teneos
<b>Insurance</b>	Aetsoft, Sagittae, Insurwave
<b>Will/inheritance</b>	Zweispac, Safe Haven

## Crypto- and blockchain-based financial services in Norway

### VipiCash

VipiCash is an online platform facilitating global money transfers using **blockchain technology**. Users place their order on the platform and the goods are delivered to the receiver's address. Money can be sent for groceries, school fee, health service, energy, transport etc. As of May 2018, the platform is in private beta. VipiCash has received support from DNB NXT Accelerator.

### BigGate

[BitGate](#) is a mobile-based cryptocurrency wallet application. It allows users to buy, sell, secure and send cryptocurrencies. Provides electronic ID-solutions for automated on-boarding. Users can purchase Bitcoin through integrated API from Safello.

### HandleCrypto

[HandleCrypto](#) is a cryptocurrency exchange, licensed by the Financial Supervisory Authority of Norway. You are able to make fast and easy purchases and sales of cryptocurrencies for the Norwegian Krone (NOK) It also offers automated conversion between hundreds of cryptocurrencies. As of February 2020, HandleKrypto is part of the BitGate Group.

### Neonomics (Not blockchain or crypto, but related to financial regulation)<sup>12</sup>

Neonomics bridges the gap between compliance and innovation, growing a huge network of banks and FinTechs. Interconnectivity Solution by Neonomics enables secure, seamless and instant inter-bank communication via one API.

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<sup>12</sup> <https://ibsintelligence.com/neonomics-to-boost-bill-kill-apps-financial-offerings/>

Blockbonds

[Blockbonds](#) offers banking services to people without access to them, mainly through crypto. SPENN, an advanced financial platform built into a user-friendly mobile banking app, is currently available in some African countries such as Tanzania, Rwanda, and Zambia. Blockbonds strives to democratize the access to financial markets for everyone in the world, by bridging the crypto sphere with traditional finance.

Lendonomy

[Lendonomy](#) is a peer-to-peer service in Norway that helps young people between 18 and 27 to build a justified credit history and gives good understanding of borrowing money. App users borrow, lend and share small amounts of money with each other all while building an internationally verifiable and transferrable credit history on the blockchain.

Coinpanda

[Coinpanda](#) helps you calculate and file your taxes for digital currencies. It enables the user to Connect all exchanges directly with API keys and synchronize your transactions automatically.

MiraiEx

[MiraiEx](#) is a platform to invest in cryptocurrencies. Offers possibility to buy and sell Bitcoin and Litecoin using BankID-verification and regular domestic bank transfers.

Norwegian Block Exchange

[NBX](#) is a cryptocurrency exchange, custodian and payment system. Was founded by Bjørn Kjos the founder of Norwegian Air Shuttle and Bank Norwegian.

## Crypto- and blockchain-based Financial services based outside of Norway

Nexo

[Nexo](#) is the world's leading cryptoasset-backed lending institution. Clients obtain an instant loan in fiat currency (EUR, USD, etc.) or cryptocurrency by placing their digital assets in an Nexo Account as a collateral. The borrowers do not need to sell them and keep the full benefit from the assets' value appreciation. Nexo offers an instant crypto loan, which eliminates the need for inconvenient credit checks. They have third-party guarantees of its crypto assets. Offer super high yields on US dollars and some of the highest rates on crypto currencies. Right now, you can get up to 12% on stablecoins and 8% on Bitcoin.

Other Crypto Lending Platforms: Celsius, BlockFi, Youhodler, Crypto.com.

Seba Bank AG

[Seba Bank AG](#) (CHF 100 M capital) is licensed by the Swiss Financial Market Supervisory Authority FINMA. They provide a smooth, secure and easy-to-use bridge between digital and traditional

assets. Clients can secure, trade and manage their crypto currencies, digital assets, and conventional securities all in one place.

#### Nuspay

The US-based startup [Nuspay](#) creates the Blockchain-powered Nuspay ICO Platform. Mediated by Ethereum ICO and ERC-20 tokens, the solution facilitates cryptocurrency exchange and trading to support funding of crypto projects and accelerate the time-to-market of new FinTech ideas.

#### Bankex

[Bankex](#) is Bank-as-a-Service on blockchain, building Proof-of-asset-Protocol. The heart of solution is a digital asset custody platform, that enables financial operations using any type of convertible digital currency and any type of digital asset.

#### Incent

Australian startup [Incent](#) develops a digital wallet loyalty platform, backed by Blockchain and a cryptocurrency, called INCT. The platform aims at rewarding users for any vendor-incentivized activity in the digital realm. A person securely connects one's bank account with Incent and receives loyalty points in the form of cryptocurrency for spending actions, favored by businesses.

#### Zweispac

Through its Smarter Contract platform, Japan-based startup [Zweispac](#) is developing a self-executing will system with a blockchain that will automatically distribute assets of an inheritance trust to beneficiaries upon confirmation of the trustee's passing, eliminating the need for executors and court battles regarding the integrity of the will.

#### Crypto based visa card

[Crypto.com](#) is a cryptocurrency and payment platform. Provides Visa card which allows cardmembers to earn cashback in the form of Crypto.com's cryptocurrency token. Later it can be traded into other digital coins or even into fiat currency. (Based in the US)

#### Sagittae

[Sagittae](#) introduces mutual **risk-sharing** based on distributed ledger technology. It is a decentralized alternative to traditional insurance, completely eliminating the need for expensive and bureaucratic insurance conglomerates and costly middleman structures.

#### Enso Finance

[Enso Finance](#) The company offers cryptocurrency services like asset purchasing, yield farming, liquidity mining, tolerance band rebalancing, restructuring, flash swaps, collateralization, and arbitrage, thereby enabling individuals to familiarize themselves with such products and to advance their technical and fundamental skills to trade more effectively.

#### Finoa

[Finoa](#) is a German-based Startup. Finoa developed the world's first fully digital warm-storage banking-grade custody and asset-servicing solutions for Institutional Investors in

Digital Assets.

The initial Digital Asset custody product will serve as the base to grow the product portfolio in the future towards more financial services for Digital Assets, such as Prime Brokerage, Tokenization Services, Lending, Staking or Investment Services/Wealth Management.

#### Ambrpay

Swiss startup [Ambrpay](#) develops a solution to enable subscription payments in cryptocurrencies. The payments gateway allows users to make recurring Ethereum transactions to a specific address. The solution works for both custom and fixed models, with payments in crypto or fiat. Ambrpay's solution is easy to integrate and serves the need of software-as-a-service (SaaS) subscriptions, as well as donations.

#### Neufund

[Neufund](#) creates blockchain-based solutions and services, which include a fundraising and investing platform, an employee stock option plan (ESOP) manager, a light wallet, post-investment instruments, and more.

#### Teneos

Israel-based startup [Teneos](#) plans to boost the crypto economy with Blockchain-capacitated credit management solutions for individuals, businesses, and financial entities. The solution assists users in configuring their crypto assets as collateral, setting credit limits and obtaining flexible cash loans in their desired currency.

#### Alkemi Network

This network is building a bridge between centralized and decentralized finance. Alkemi is building an on-chain liquidity network with a suite of tools and products that serve as onramps for everyone to participate in decentralized finance. The flagship protocol, Alkemi Earn (Earn), facilitates institution-grade borrowing and lending within a compliant environment via Alkemi's primary 'permissioned' liquidity pool of digital assets (ETH, wBTC and stablecoins). Earn will also offer access to Alkemi's secondary 'permissionless' liquidity pool of digital assets at the network's Token Generation Event.

## Crypto- and blockchain-based Non-financial services

### Tokens in Norway

Choose

[ChooseCoin](#) is a cryptocurrency backed by CO2 emission permits. The platform tokenizes the carbon cuts and enables companies and people to monetize their CO2 cuts. Users are rewarded for their climate positive efforts. The platform offers carbon neutrality by buying and deleting CO2 emission quotas. Multiple plans are available on the platform based on

different carbon cuts. The clients of the company include Designers Remix, Fortum, Telia, Santander, and more.<sup>13</sup>

## Tokens outside of Norway

### Asset-backed tokens:

Tokenization of assets is the concept of using blockchain technology to securitize assets. It is the process of issuing a blockchain token that digitally represents a real tradeable asset. The issued “security tokens” are created through a type of initial coin offering – or in this case – security token offering (STO). They can either represent regulated financial instruments (equities, bonds, loans, and funds), tangible assets (real estate, artworks, precious metals), or intellectual property (copyright to works of authorship).

## Verification services in Norway

### Norway

#### Diwala

[Diwala](#) is a decentralized platform for skill verification of individuals. Allows the users to create an unchangeable record of skills & achievements, that is verified with blockchain technology. Users can create a digital resume, showcasing their verified skills, education and sales. Provides a private encrypted key to users, that enable sharing of verified details & documents.

#### Taqanu

[Taqanu](#) Bank is a blockchain-based digital identity management platform. The platform runs alongside a railed attestation network called the Abacus Fabric. The network keeps track and keep the record of secure identity transactions on the blockchain. Users can input identity facts, to be declared, sourced, audited and proven on the attestation network.

## Verification services outside of Norway

[Bloom](#) is an end-to-end protocol for identity attestation, risk assessment and credit scoring built on the Ethereum blockchain. Bloom allows both traditional and digital currency lenders to serve billions of people who currently cannot obtain a bank account or credit score.

#### Colendi

The Swiss fintech startup [Colendi](#) innovates in providing a global financial passport to its clients. Founded in 2016 the company aims to be source for a democratized credit scoring evaluation method based on blockchain technology, with users receiving an ID that serves as a global financial passport. Its goal is to create a tool for unbanked people and small businesses around the world to have greater access to micro-financing.

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<sup>13</sup> <https://tracxn.com/explore/Blockchain-Startups-in-Oslo>

## Decentralized Apps (dapps) based outside Norway

### Secured-automated lending technology (SALT) services

In this kind of service, crypto assets are used as collateral. The service is built on an ERC-20 smart contract.<sup>14</sup> SALT lending provides personal and business loans to their members. Users buy a membership to the SALT lending platform by purchasing a SALT token, which is the platform's cryptocurrency. When someone becomes a member, they can borrow money from an extensive network of lenders.

### PoolTogether

[PoolTogether](#) is a protocol for no-loss prize games on Ethereum. Modeled on the well-established concept of "no loss lotteries" and "prize savings accounts" the protocol offers a chance to win prizes in exchange for depositing funds.

### Mysterium Network

[Mysterium Network](#) is A decentralized VPN (dVPN) service powered by users, with crypto payments enabled. Distributed networks like Mysterium can make the adoption of crypto currencies faster by providing a business model to users with spare capacity. Users will eventually want to cash out.

### Golem Network

[Golem](#) is a decentralized marketplace for **computing power**. It consists of a network of nodes that implement the Golem network protocol. It aims to create a decentralized supercomputer.

### LTO Network

[LTO Network](#) is a hybrid blockchain for securing, verifying and exchanging business critical information.

### Corda

[Corda](#) enables users to build permissioned distributed solutions and networks, as opposed to completely transparent blockchains.

## Others based in Norway

### UNIOST

[UNISOT](#) provides blockchain-based ERP system. It provides complete business solutions using big data, cloud computing, blockchain, and machine learning. Provides supply-chain solutions for businesses such as transactions, traceability, product origin, etc. Offers both free and premium cloud-based ERP module for business.

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<sup>14</sup> [Is SALT Blockchain-Based Lending the Future of All Personal Loans? \(investopedia.com\)](#)

Triwer (Website not found)

Triwer is a blockchain-based mobile application for last-mile deliveries. The blockchain application is powered by smart contracts and enables users to book-on-demand last mile delivery services. The request is routed to a network of crowdsourced delivery agents. Features include real-time tracking, proof of delivery, complimentary packages insurance, cryptocurrency payments, and more. Its mobile app is available for iOS and Android devices.

<sup>15</sup>

Arcane Crypto

[Arcane Crypto](#) develops and invests in projects focused on bitcoin and digital assets.

White rabbit

[White rabbit](#) is a decentralized content monetization platform. Allows users to reward the films and series they stream, on multiple peer-to-peer content streaming platforms. Offers users a personalized content library and a browser plugin. The platform recognizes content and utilizes blockchain to facilitate payment between the user and the films rights holders.

JS Genesis

[JSgenesis](#) is building a content platform on the blockchain.

[Iagon AS](#)

Iagon AS is a decentralized cloud computing platform.

AK Jensen Limited

[AKJ](#) provides services to hedge fund managers. Its [Crypto Fund Platform](#) enables aspiring crypto fund managers to build their own crypto funds. AJK Crypto is a fully compliant turnkey platform, managing all components necessary for the set up and day to day operation of a tier-one crypto platform.

Puropati

Puropati offers real estate development services based on the blockchain.

Bitfury

[Bitfury](#) offers [Exonum](#), which is a blockchain as a service solution. E-auctions and claims management in the insurance industry are among its applications.

Others based outside of Norway

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<sup>15</sup> <https://medium.com/iagon-official/blockchain-tech-company-triwer-joins-iagons-initial-adopter-program-6117c5a3cb6e>

## Protocol Labs

[Protocol labs](#) is a research, development, and deployment lab for network protocols. One of the projects that they are working on is Filecoin. Filecoin (FIL) is a cryptocurrency that powers the Filecoin network, a decentralized peer-to-peer file storage network that aims to let anyone store, retrieve, and host digital information. FIL tokens are used as payment for these services and as an economic incentive to ensure files are stored reliably over time.

## Block.one

[Block.one](#) is enabling people to build software on top of blockchain.

## HyperLedger Fabric (originally designed by IBM)

[Hyperledger Fabric](#) is intended as a foundation for developing applications or solutions with a modular architecture. Hyperledger Fabric allows components, such as consensus and membership services, to be plug-and-play. Its modular and versatile design satisfies a broad range of industry use cases. It offers a unique approach to consensus that enables performance at scale while preserving privacy.

## FedNow System

Real time payment system which is expected to launch in 2023. (Not decentralized)

## iov42

-[lov42](#) is the global blockchain operating platform on which governments, companies, and individuals can build groundbreaking applications. The platform combines digital identities linked to digital assets and strong digital certificates, creating the backbone for the future of the internet.

## Coinfirm

London-based [Coinfirm](#), founded in 2015, aims to act as a foundation for the safe adoption of blockchain by all actors in the economy, including traditional financial institutions, governments, regulators as well as ordinary citizens. **Its anti-money laundering (AML)** for virtual currencies and blockchain actors allow financial institutions and regulators to safely engage with the crypto world. It has also created its own token, the AMLT, and offers incentives for users to report ransomware and other scams.

## Certora

[Certora](#) is an Israeli startup that offers a Blockchain security platform. The startup's Prover technology is a Blockchain-independent and language-agnostic solution for cryptocurrency-based smart contracts. The tool integrates with existing compilers and debuggers for smart contracts. Further, the platform verifies the adherence of contracts to identify any bugs in smart contracts.

## Digix

[Digix](#) is an "asset tokenization platform" that allows consumers to purchase Digix Gold Tokens with Ethereum. These tokens are cryptographically linked to physical gold that can be redeemed at any time, and in addition to the security offered by any application built on

Ethereum, this particular solution cuts out the banks and brokers typically involved with the purchase of gold, reducing the consumer cost of such a transaction.

Other platforms, like **PolyMath**, and **T Zero** also work on tokenization of securities. Real estate and other assets can be tokenized on an ownership and a financing basis.

SpaceChain

**SpaceChain** is building an open and neutral infrastructure for the New Space Economy by integrating space and blockchain technologies.

MetaMask

[MetaMask](#) is a software cryptocurrency wallet used to interact with the Ethereum blockchain. It allows users to access their Ethereum wallet through a browser extension or mobile app, which can then be used to interact with decentralized applications. MetaMask is not a dapp, but can interact with dapps.

Three categories of banking services:

- Traditional banks
- Neobanks (Revolut, Monzo)

## Use of Crypto for Internet of things (IoT)

Internet of things is a group of internet-connected devices who share data over a wireless network with minimum human intervention. One of challenges in IoT is to incorporate payment system for products and services. Cryptocurrency is a perfect solution for this and so far, leads the charge. IoT is growing exponentially and it can raise one of the cryptocurrencies.

Most used IoT Cryptocurrencies

IOTA does not have scalability issues (system's ability to increase or decrease in performance and cost in response to changes in application and system processing demands) and it facilitates free micro-transactions between IoT devices.

IoTeX operates as a private blockchain within-a-blockchain. It is fast and scalable. Creates sidechains for each IoT function. Each sidechain can be used when needed and this raises

overall blockchain's efficiency. This also increases security. Lightweight design saves energy required for mining.

MXC is a specialized IoT crypto that makes IoT transactions simple. It can be used to buy products or services via IoT connected devices. It is possible to mine for MXC crypto through connected devices to the internet of things.

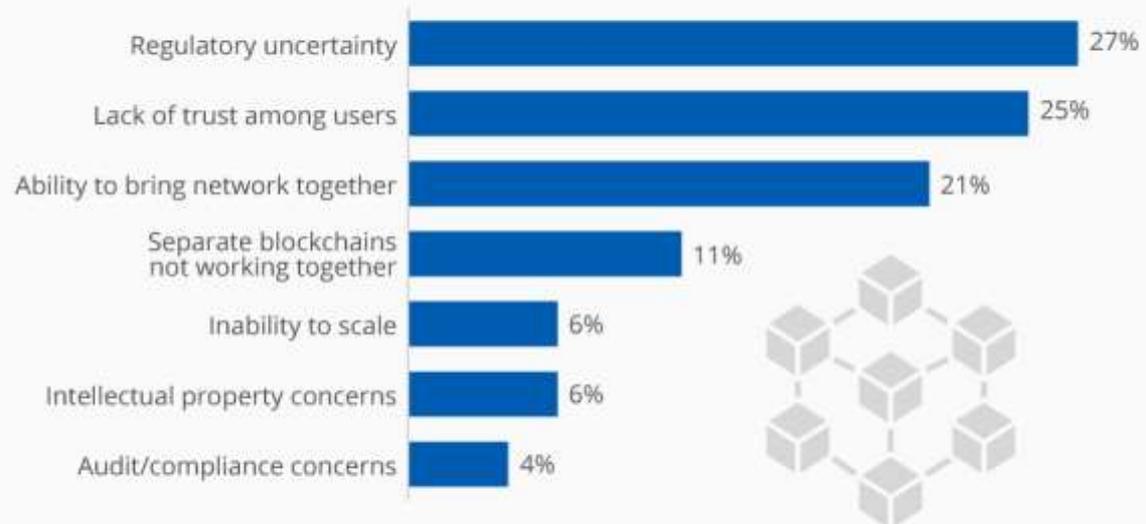
## Drivers and barriers influencing the adoption rate of crypto

Several factors are behind the increasing adoption of crypto- and blockchain-based solutions, while other factors are impeding this development.

Drivers	Barriers
Spread of decentralized (dapps)	Slow transaction speed of bitcoin
Speculative potential	News about Ponzi schemes such as in South Africa (Mirror Trading International)
Shifting from trusting the entity to trusting the process	Lack of interoperability between different blockchain systems
Anonymity	Challenges in replacing or adapting to legacy systems
Tokenization	Lack of trust is parts of the process
The desire to remove the middleman (disintermediation)	Transaction fees
The ability to use spare capacity in dapps (decentralized apps)	Regulatory uncertainty
Lax regulations - Central banks (such as Kenya's) have considered using Bitcoin as a reserve currency	
Corruption	
Inflation and hyperinflation	
Having a younger population (like in Africa)	
The desire to remove the middleman	
Negative interest rates	
Meme culture	
Cryptography security	
The need for real time cross-border payments	
The sharing economy	
Emerging demand from institutional clients	

## What's Blocking Blockchain?

% of respondents rating these biggest barriers for blockchain technology adoption globally\*



As of September 2018

\* 600 organization executives were asked to rate the biggest barriers to blockchain over the next three to five years.



Source: PwC

statista

Source: [Statista](#)

Disparity between the price of cryptocurrency and the computing power needed to generate is increasing

Panel A: Bitcoin Price and Computing Power



Panel B: Ethereum Price and Computing Power



Panel A: Bitcoin Price and Network



Panel B: Ethereum Price and Network



## Africa's use of cryptocurrency

Cryptocurrency is traded all over the world, mostly for financial gain. In Africa, however, things are different. Cryptocurrencies are mainly used for commercial purposes in the growing continent. Most of the use is concentrated in Kenya, South Africa, and Nigeria.

### **Nigeria becomes first in crypto trading in the continent**

The recent years have seen a rise in peer-to-peer trading in Africa. Nigeria is still the leader in the continent, despite the recent crackdown by the government. Ghana and Kenya took the second and third place, respectively. South African ranked fourth as it lost some grounds in this domain.

Africa's biggest economy has made cryptocurrency legal and is issuing regulatory guidelines for digital currencies and crypto-based companies or start-ups.

### **Large crypto trading volumes in Africa**

Between January and March 2021, Trading volume in Nigeria exceeded \$99.1 million. In Kenya it was \$38.4 million. In Ghana, it was \$27.4 million and in South Africa it was \$25.8 million. In 2020, Nigeria had a record-breaking \$309 million in bitcoin trading volume, more than three times that of South Africa's \$98.4 million for the year.

### **Regulations around Bitcoin in Africa**

Kenya has pushed forward strongly with its central bank considering using Bitcoin as a reserve currency. This established the currency as a store of value, and shows that it has the bank of a central governmental authority, giving people a psychological impetus to accept it. Ghana's central bank also made regulations easier for companies and startups around Bitcoin.

**South Africa** and **Nigeria** took an opposite stand. Nigeria banned the use of cryptocurrency and prevented its banks from processing transactions that involved bitcoin. South Africa was hit hard with a Ponzi scheme conducted by Mirror Trading International which was based in the country. Authorities in South Africa criticized the use of cryptocurrencies following the incident, although they stopped short of banning it entirely.

### **Thriving cryptocurrency-based services in Africa**

Luno-exchange, which is a crypto trading platform based in South Africa, was established in 2013, and it features over 40 million users worldwide. It is among the many cryptocurrency projects in the continent. Other services include remittance services, such as Abra in Malawi and Morocco, GeoPay in South Africa, BitMari in Zimbabwe, and Kobocoin throughout Africa.

### **Factors driving the increasing demand for cryptocurrencies in Africa**

There are several factors behind the high rate of adoption. First, currency inflation and hyperinflation drive people away from national currencies to decentralized cryptocurrencies. Second, the high rates of corruption also make national currencies unappealing. Third, Africa has a [young](#) population in general, which is more likely to use

cryptocurrency than the older generation, which tend to be more skeptical. Fourth, a lot of people do not have access to the traditional banking system, and thus lack access to necessary financial services. With cryptocurrencies, this gap can be closed, and many people can get access to needed services such as sending and receiving money.



## Adoption of Cryptocurrency in Africa

Africa has adopted Cryptocurrency a lot more rapidly than many would have expected. This though, should not come as a surprise because; as a continent, it has embraced mobile money technology. Africa has a large tech-savvy youth-populous looking for monetary options that are not directly affected by inflation.

Countries such as Nigeria, Kenya, Ghana, Zimbabwe, and South Africa are currently leading the race with Cryptocurrency adoption with countries such as Uganda and Senegal not far behind. And with huge mobile penetration in these countries as well as internet availability, experts predict that the continent is ready for expanded crypto adoption.

The interesting bit about crypto use in Africa is that; unlike other regions in the world where cryptocurrencies are mainly used by financial traders, in Africa, the technology is used for commercial purposes by the everyday citizen.

As of June 2020, and as shown in the table below from [Reuters](#), transactions in and out of Africa below \$10,000 were up by 55%. This totaled to a whole-time high of \$316 million.

According to US-based firm Chainalysis, these numbers are likely to keep rising.

Month 2020		Total Volume in Millions	Estimated Number of Transfers
<b>Jan</b>		<b>154.5</b>	<b>306k</b>
<b>Feb</b>	<b>147</b>	<b>305k</b>	
<b>March</b>		<b>165.2</b>	<b>364k</b>
<b>April</b>	<b>202.6</b>	<b>509k</b>	
<b>May</b>		<b>283.5</b>	<b>585k</b>
<b>June</b>	<b>316.1</b>	<b>601k</b>	

## Major reasons for Cryptocurrency growth in Africa

### Economic Instability

Many African countries have unstable economies and some are undergoing high inflation. This means that their currencies can be unstable or weak. This is the reason why some of the continent's citizens have taken up the use of cryptocurrencies.

In Zimbabwe for example, due to the hyperinflation that happened in 2015 and their weak currency, many of its citizens turned to trade in Bitcoin and use crypto as a medium for trade.

### Used for Remittances from the Diaspora

According to the [World Bank](#), remittances to Sub-Saharan countries in 2019 were close to \$48 Billion, though these are expected to drop due to the high transaction fees charged by Banks and other money-transfer institutions. According to Nigerian-based tech-entrepreneur Emmanuel Darko, the fees can be as high as 20%, add that to the costs associated with converting currency.

Because of these, African citizens together with their diaspora counterparts have turned to the use of crypto and Bitcoin remittance companies such as BitPesa based in Nairobi, Kenya. These companies are a lot less cheap than banks and are not affected by inflation. BitPesa for example is established and reputed for use of Bitcoin as an international money transfer medium.

## Barriers of Cryptocurrency adoption in Africa

### Government policy

Although it is difficult to regulate the use of crypto because that is essentially the reason it was made in the first place. Several African governments have banned its use; these include Algeria, Morocco, Egypt, and Nigeria. The Central Bank of Nigeria has also cited Cryptocurrency as a means of money laundering and warned people against its use.

But because its popularity is increasing within the continent, governments are being forced back into the drawing board. With Nigeria, its Central Bank set up a committee to look at ways of adapting its use and its regulation.

### Cryptocurrency is not considered a value store

No Cryptocurrency is considered a legal tender in any country, and without government support and indecisiveness, it is difficult to convince the masses, especially the older people of its suitability for use. Couple that with the fact that you can't hold a value to it and so it becomes difficult to sell it as an idea to people.

### Fear of it being a Ponzi scheme

Just like anything that people do not understand or have enough information on, they fear that it may be a scam or consider it a bubble that will eventually burst. For the citizens in most of these countries, there is a reason to be concerned as there have been several fake crypto trading websites and situations where people invest in crypto then lose their money when the owners of the specific currency close shop.

Most of the people in Nigeria, South Africa, and Kenya, etc. invest in crypto because it is considered a lucrative investment with very high returns, this is according to [Trade Forex Kenya](#)

## Case Study

### *Cryptocurrency in Kenya*

Kenya is in a unique position when it comes to crypto. On one hand, its Central Bank does not support its use and even discourages citizens doing so. On the other hand, the National Government, although quiet on the matter, is thought to be in support, or rather not against its adoption. Its ICT Cabinet Secretary, Joe Mucheru, in charge of the government ministry under which Cryptocurrency matters would fall, is a known admirer and supporter of Cryptocurrency.

The ICT minister had a stake in BitPesa, a leading crypto remittance company, he is on record stating that the country's government was looking at ways of using blockchain (technology under which crypto operates) and digital currencies in some [government functions](#).

Kenya has been listed among the top 10 countries leading in Cryptocurrency adoption and second in Africa, ahead of countries such as South Africa. This is according to a report by Chainalysis. The most popular forms of crypto in the country at the moment are Bitcoin, Dash, Lisk, and Ethereum.

### *Crypto transactions in the country*

According to The [Blockchain Association of Kenya](#), Bitcoin transactions in the country stand at over \$1.5M. Some traders in the country have accepted Cryptocurrency modes of payment as legitimate payment options for their businesses.

Tony Mwongera, owner of a health spa in the country's capital of Nairobi started accepting Bitcoin payments in 2018 as a way of dealing with theft in his company. And his customers accepted this change and embraced it finding it convenient.

In Nyeri, a rural town of the country, there is a local hotel known as Betty's Place that allows its customers to pay for services using Bitcoin.

Cryptocurrency adoption in the country still has its challenges, and in a country of over 50 Million citizens only about 40, 000 people have ever used Bitcoin in a transaction.

### **Cryptocurrency-based remittance services in Africa:**

- Abra in Malawi and Morocco,
- GeoPay in South Africa,
- BitMari in Zimbabwe,
- Kobocoin throughout Africa.
- M-Pesa (mobile banking)

## General Statistics on Cryptocurrencies and the blockchain

- Number of wallet users (more than 70 million in 2021)
- Cryptocurrencies have over \$1 trillion in value as of 8 May, 2021.
- There are more than 4000 cryptocurrencies
- Around 1000 cryptocurrencies have failed
- There are currently more than 17699 bitcoin ATMs in the U.S.
- VC funding into blockchain startups was \$2.3B in 2020
- There are 72.9 million blockchain wallet users worldwide
- Bitcoin's market share in the cryptocurrency industry is 66%
- The financial sector in 2020 accounted for more than 60% of blockchain's worldwide market value. (Statista)
- The average cost of transactions using Bitcoin is 18.25\$, Ethereum – 59.57\$, Dogecoin – 1.23\$. (Bitinfocharts.com)
- Blockchain can help investment banks to reduce infrastructure costs by 30%. (Accenture Consulting)
- “The global market value of blockchain in food and agriculture markets is estimated to reach \$1.4 billion by 2028.” (BIS Research, Fortunly.com)
- IBM has more than 500 blockchain projects in the works. About 1,500 employees are working with it. (CNN, IBM)
- U.S. spend on blockchain is expected to reach \$41 billion by 2025. (Globenews.com)
- Blockchain-based projects possibly can add more than \$176 billion of value to businesses by 2025 and can exceed \$3.1 trillion by 2030. (Gartner.com)
- World's largest banks are going to invest around \$50 million to build a blockchain-based digital cash settlement system. (Reuters)
- 15% of all investments in cryptocurrencies are made by women. (Markets.businessinsider.com)
- Around 20% of the current Bitcoin supply might be permanently lost. (Decrypt.co)
- 15,174 businesses worldwide accept bitcoin. <sup>16</sup>
- Around 2,300 US businesses accept bitcoin.
- California has 440 businesses that accept bitcoin—the most of any US state.
- South Dakota only has one business that accepts bitcoin—the least of any US state.
- 328,370 bitcoin transactions go through every day.
- And an average of 13,682 bitcoin transactions go through per hour.
- There are 5,041 bitcoin ATMs around the world.
- Around 13 major national companies accept bitcoin payments.
- Most mining takes place in China. China also is home to mining pools (collaborations between different partners on mining). It also provides mining equipment.
- Tether, which issues a “stablecoin” widely used to facilitate bitcoin trading, said that just 2.9% of its \$58bn-worth of coins is backed by cash reserves<sup>17</sup>
- Several major American banks are now offering their institutional clients access to Crypto investments. Some crypto ETFs are under review in the US.

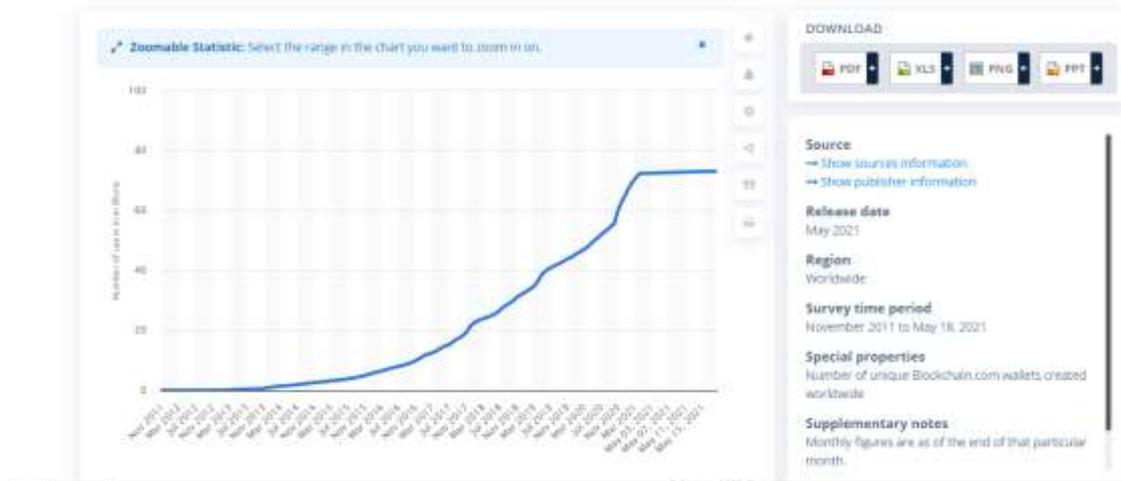
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<sup>16</sup> <https://www.fundera.com/resources/how-many-businesses-accept-bitcoin>

<sup>17</sup> <https://www.economist.com/finance-and-economics/2021/05/20/as-bitcoin-lurches-wall-street-plots-its-way-into-cryptoland>

- Santander, a bank, has said that adopting blockchains could save the finance industry \$20bn a year in back-office costs.
- The number of wallet users in the US is increasing.

Number of Blockchain wallet users worldwide from November 2011 to May 18, 2021  
(in millions)



## Understanding bitcoin Mining: How Bitcoin volatility affects miners' earnings

- There are around 500 transactions in one Bitcoin block.
- Today miners get rewarded 6,25 BTC for mining one block.
- With average transaction fee 16\$ miner gets 8000\$(they get it in BTC) + 6,25 BTC reward for mining one block.
- With average fee 64\$ miner gets 32000\$ + 6,25 BTC.
- The transaction senders are paying the transaction fee.
- Miners can choose which transaction to mine first.
- When there are more transactions waiting in line, transaction senders have to offer higher fees for their transaction to get into the block.
- The fee doesn't depend on the size of transaction (in bytes) and the amount of money you send doesn't affect the size.
- With the average transaction fee of 16\$, Bitcoin can't be used for small transactions as creator envisioned it to be.
- In times of high transaction demand fees spike up to 60\$.
- Another effect of high transaction demand is unreasonably long waiting time. Sometimes it can take days.
- The transaction demand usually spikes when the price of bitcoin falls dramatically.
- In this case although miners get higher numbers in fees, the drop of BTC price reduces profits.

- Miners benefit the most when transaction demand is high and the price of BTC goes up.

**Average crypto transaction fees:**



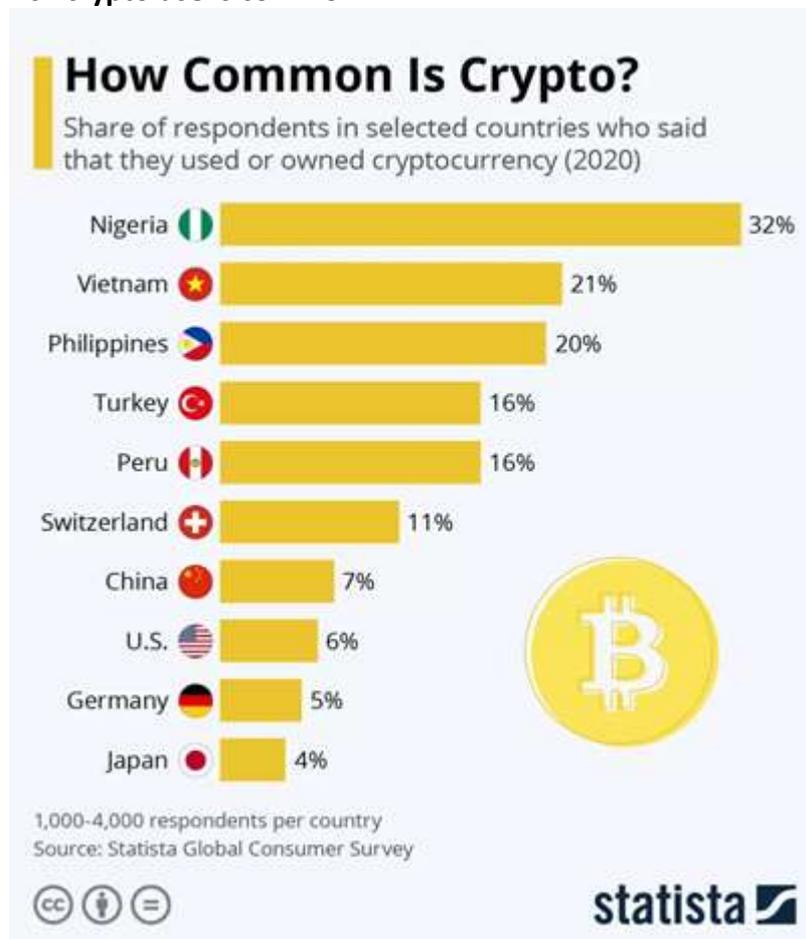
Average crypto transaction fees, Bitinfocharts.com

**Bitcoin transactions per day**



Bitcoin transactions per day, Ycharts.com

## Countries in which crypto use is common



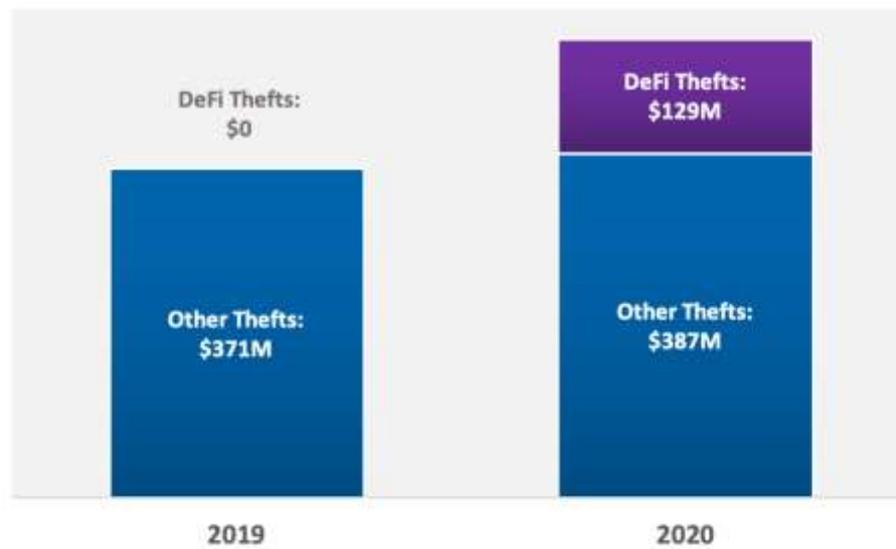
**The cost of crypto theft: risk of blockchain fraud is quite high, usually higher than the risk of hacks and thefts**

## Blockchain Fraud Continues to Vastly Exceed Hacks and Thefts in 2020



Source: CipherTrace Cryptocurrency Intelligence

## \$516 Million in 2020 Thefts DeFi Adds \$129 Million to Crypto Thefts

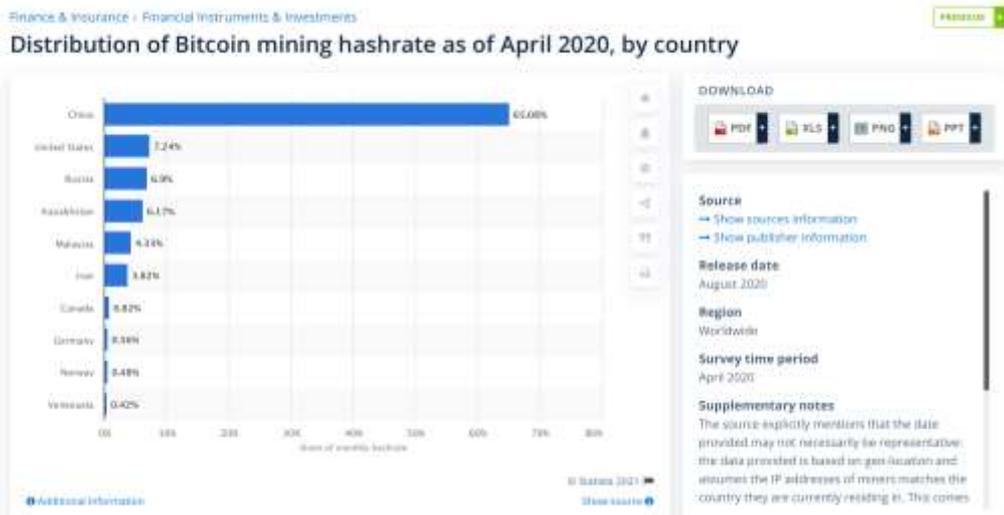


Source: CipherTrace Cryptocurrency Intelligence

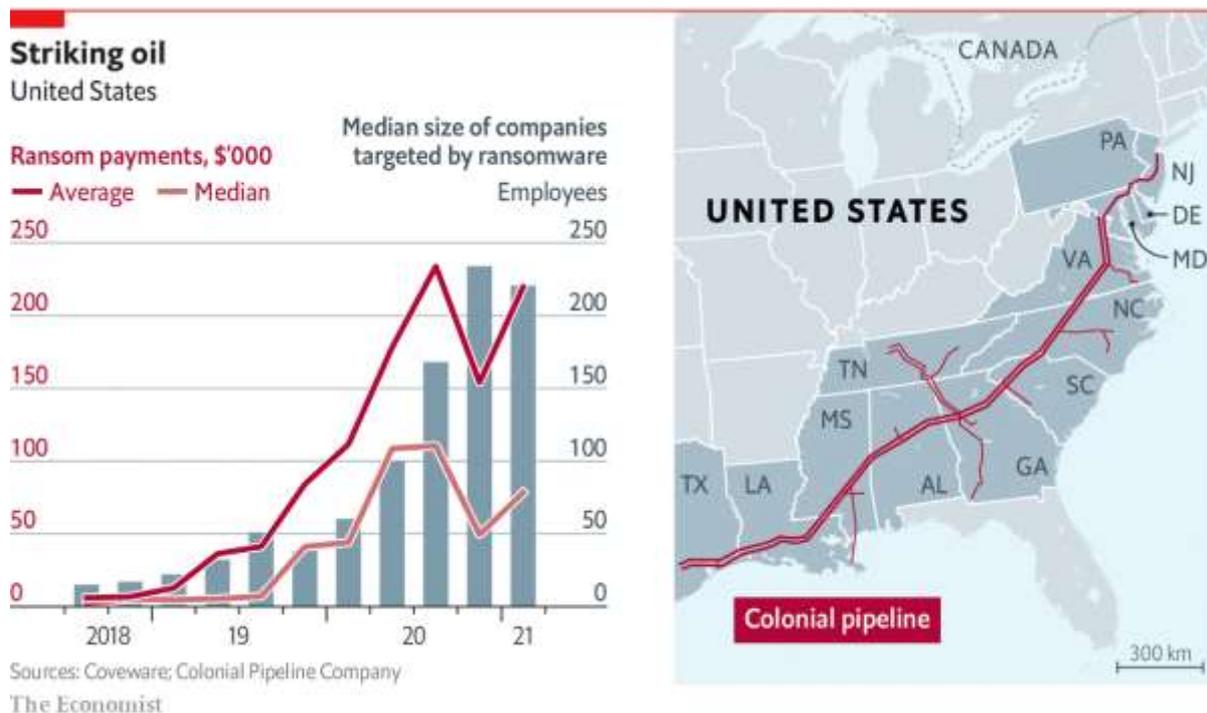
The cost of **global cryptocurrency theft** has increased by **142.3 million** in a one-year period.



The majority of bitcoin mining operations take place in China



Cryptocurrency gave a boost to cybercrime



Cybercrime has become proliferate in recent years, and **ransom-as-a-service** has emerged as a business model. Many cyberattack groups are believed to be located in Russia.

Some recent ransomware attacks

Date	Victim	Attacker	Ransom payment
May 2021	Colonial pipelines	The Dark side	75 bitcoins (USD4.4 million) although US authorities have managed to recover a big portion of that money.
June 2020	University of California at San Francisco	Netwalker is believed to be responsible	The initial ransom demand is thought to have been \$3 million, with the university countering with an offer of \$780,000. Reports say the University eventually paid USD1.14 million <sup>18</sup> in partial payment.
Dec 2019	Travelex		\$2.3 million, or about 285 bitcoins

<sup>18</sup> <https://www.zdnet.com/article/university-of-california-sf-pays-ransomware-hackers-1-14-million-to-salvage-research/>

May 2021	Brenntag	The Darkside	\$4.4 million in bitcoin
July 2020	CWT Global	Ranger Locker	\$4.5 million in bitcoin <sup>19</sup>
May 2021	Ireland healthcare system	Conti ransomware group	Criminals reported asked the health service for \$20m (£14m) to restore services. However, the criminals have handed over the software tool (decryption key) for free.

#### Tools that help cyber criminals

- Tor
- Cryptocurrencies
- Spoofing software
- Encrypted phone networks
- VPN
- The Dark Web

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<sup>19</sup> <https://www.itgovernance.co.uk/blog/the-5-biggest-ransomware-pay-outs-of-all-time>

## The impact on financial stability

Prices of popular cryptocurrencies are highly volatile. This has given them a speculative appeal, but also made them unsuitable for daily transactions. The slow speed and high costs of transactions further impede the adoption of those currencies as mainstream currencies. Yet, the appearance of stable coins may offer a remedy to this volatility. Some of those coins are pegged to real assets like agricultural produce which helps stabilize their prices.

This is not enough, however, to make those stable coins a replacement for fiat currency. They still have to overcome several significant hurdles and improve their value proposition considerably. A scrutiny of crypto currencies and the blockchain reveals several flaws. The blockchain is not entirely immutable as previously thought, nor are its transactions 100% anonymous. Moreover, and more importantly, the blockchain and the crypto assets remain highly inefficient. They are used in places like Africa only for lack of better alternatives.

Financial services companies must do better. They should offer more inclusive services (nearly half of the world's population remains unbanked), and they should become more efficient (the cost of cross-border remittances remains high and transactions are slow). Established financial services providers must raise the bar so that people do not need to rely on crypto assets to carry out day to day transactions and send and receive remittances. They should offer more convenient mobile financing and payment solutions especially to young people in emerging markets. Otherwise, cryptos remain better substitutes.

**Back in 2018, the financial stability board has concluded that crypto assets did not pose a substantial risk to financial stability at the time, but it warned that this might change in the future. The pace of development matters.<sup>20</sup> So far, barriers to adoption and scalability of crypto assets are keeping their proliferation at bay. Yet, this can change faster than expected.**

Central banks in various countries, including Norway, are now working on developing their own digital currencies (central bank digital currencies, or CBDCs). This is a good step, but demanding one. Central banks must step up their programming capabilities and also work on preventing those CBDCs from having a negative impact on credit markets and the credit cycle. One key strength that central banks have is centralization. Scalability (and efficiency) cannot happen without a somewhat high degree of centralization (something that the blockchain and crypto assets lack). For this reason, central banks are in a good position to offer good alternatives, but a lot of CBDC initiatives are in the rich world and not in the developing world, where they are most needed.

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<sup>20</sup> <https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural-change/crypto-assets-and-global-stablecoins/>

## Conclusion and future outlook

An ecosystem of decentralized finance is growing. It includes payment tokens (or cryptocurrencies), other forms of tokens, various types of blockchain technologies with varying protocols, and different forms of services built on those blockchain technologies. The services built around decentralized finance are becoming more advanced. Lending with the use of cryptocurrency as collateral is becoming possible, and peer to peer lending is also becoming possible with smart contracts. Decentralized apps are enabling people to earn money by using the spare capacity of their computers, and miners can earn bitcoin as they create new blocks in the blockchain. All of this means that new business models have become possible with these technologies. In addition, crypto assets are enabling people to remit money to their families abroad and hedge the risk of inflation, especially in Africa. The use cases for cryptocurrencies are increasing by the day.

Central banks' attitude towards cryptocurrencies has varied, but most are skeptical and restrict transactions in those currencies. Even more so, authorities in several countries such as China (where the majority of mining takes place) and Iran are cracking down on mining activities. All of those measures by central banks and authorities are unsurprising, but for the most part, their effectiveness can be questioned. Central banks have little oversight over bitcoin and other crypto transactions unless they go through the regulated banks. Peer to peer transactions are designed to prevent snooping and meddling from third parties, including, or especially, governments.

Despite the benefits of cryptocurrencies, there are still shortcomings. Exchanges can get hacked, and crypto assets can be used to launder money or demand ransom payments. Indeed, for criminals and law breakers, crypto tokens offer a good solution, enabling them to purchase or sell items on the dark web, which can in turn make drug trafficking and other offences much easier. Arguably, these disadvantages are a result of extreme decentralization rather than decentralization itself.

### Outlook

- We expect that **crypto tokens will continue to evolve**, and their value proposition will continue to be refined. This is mainly because of the growing flow of funds, and the development of new concepts such as *proof of stake*<sup>21</sup>, among others.
- As **centralized business models become obsolete**, more and more businesses will have to reinvent their business models on a more decentralized basis. This will require business transformation based on the cloud, much like the digital transformation that took place earlier.
- **Governments will have to adapt, swiftly**. Some governments like that of Dubai have a blockchain strategy and have requested from their banks to move in that direction. It is better for governments to take charge early as the costs of adapting later will be much higher.

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<sup>21</sup> <https://www.investopedia.com/terms/p/proof-stake-pos.asp>

- **Central Banks are not going to be redundant any time soon.** However, central banks must be flexible, especially those with a pegged exchange rate regime and rigid frameworks in countries where hyperinflation is rampant. Demand for powerful machines will increase but regulation by competent people will still be needed. MIT posits that the best outcome is achieved when humans and machines work together. This applies also in the finance sector. Central banks will rely more on advanced AI to regulate markets.
- **Lending via crypto assets may flourish more in countries where capital markets are not mature enough to provide credit.**
- **Securitization of crypto-based loans may encourage people to lend more** as more instruments become available in the market.
- **Crypto can play a role in banking the unbanked** – the less privileged people who have no access to banking services, or it is too costly for them to obtain such services.
- In the new digital age, **data may be used as collateral.** The behavior of loan seekers can be analyzed to assess their credit worthiness. This can lead to the emergence of new forms of lending, and may in fact help provide needed financing to people who are credit worthy but do not have a good credit score. This service may prove vital in developing countries, where the needs for finance at easy terms is quite high, and can serve development goals.
- In Bitcoin and Ethereum, incentives are aligned. Miners expand the blockchain by adding more blocks, and thus expanding the network, and they earn money. Alignment in governance is a positive factor for crypto. Imagine if every time you picked up litter from the street, you earn a reward. Yet, a missing ingredient is the punishment for bad behavior. **Governance tokens can solve this issue.**
- Competition in the future will be over talent in cryptography and processing power. **Quantum computers may accelerate the advent of cryptocurrencies and their use in daily transactions.**

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