Blockchain Partner

by KPMG

Crypto outlook 2022

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ethereum

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2021 Wrap up

Innovation in the crypto ecosystem continued to be very intense in 2021. This report pinpoints the underlying trends and attempts to predict what lies ahead in 2022.

Bitcoin, first of all, exceeded its records several times over setting a new level of $69,044 on 10 November 2021, more than double its 2020 record. **Institutional investors** made a notable entrance on this market, with several large companies, including MicroStrategy, Tesla, Galaxy Digital and Voyager Digital[1], investing or adding to their investments in bitcoin to diversify their cash holdings[2], thus helping to lend credibility to the idea of this asset becoming a safe haven, among other things.

The listing of the exchange platform **Coinbase** on the US stock exchange in April was also a milestone. With a valuation of **$60 billion,** it was **the largest IPO since Facebook,** and ranks the company ahead of all European banks in terms of both valuation and number of verified customers (68 million). In addition, on 20 October, the ProShares **bitcoin ETF** (BITO)[3] was the first such fund accessible to the New York stock exchange, with investors able to gain indirect exposure to bitcoin futures contracts, i.e. without having to go through crypto exchanges[4]. The level of interest by investors in this exchange-traded fund was such that it boasted a record of more than $1 billion assets under management in just two days[5].

Traditional financial players, for their part, seem to have finally taken the measure of the subject, gradually shifting their attention from "blockchain", in particular closed and permissioned infrastructures, to all things crypto. With crypto services now in operation at major US banks like US Bank, Goldman Sachs and JP Morgan, all previously sceptical if not hostile towards bitcoin[6], crypto currencies are very unlikely to move out of the limelight. In France, after issuing **€100 million in security token bonds, Societe Generale** (Forge) also submitted a proposal in September to the holders of tokens of the MakerDAO protocol[7] that they accept the use of real world assets as collateral. Such hybrid initiatives involving traditional finance and decentralised finance would have been unthinkable just a year ago.

The payments sector, meanwhile, has also jumped on board: **Visa** purchased its first CryptoPunk 7610 NFT for $150,000, and is working with Anchorage to **use the USDC,** the Circle and Coinbase stablecoin[8], for clearing and settlements. Rival player Mastercard followed closely behind with the acquisition of CipherTrace, a provider of data analytics on cryptocurrencies. Both payment giants are now offering individual customers crypto credit cards. In France, things are evolving apace, with **Lydia** in particular having recently opened up the **possibility of exchanging cryptocurrencies** through a partnership with Austrian player BitPanda, which holds a licence in accordance with French regulation.

1. Bitcoin Treasuries: 59 Biggest Companies Holding (Public/Priv) (buybitcoinworldwide.com)
2. https://www.bloomberg.com/news/articles/2021-10-19/proshares-bitcoin-futures-etf-starts-trading-in-watershed-moment
3. ProShares Bitcoin Strategy ETF | BITO | Overview | ProShares ETFs
4. ProShares Bitcoin Futures ETF 'BITO' Hauls In $570M of Assets in Stock-Market Debut (coindesk.com)
5. Record absolu : Le premier ETF Bitcoin (BTC) reçoit plus de 1 milliard de dollars en 2 jours - Cointribune
6. https://www.cnbc.com/2019/12/20/jp-morgan-ceo-jamie-dimon-in-2017-calls-bitcoin-a-fraud.html
7. [Security Tokens Refinancing] MIP6 Application for OFH Tokens - Collateral Onboarding / Collateral Onboarding Applications (MIP6) - The Maker Forum (makerdao.com)
8. Visa now settles payments in USDC stablecoin on Ethereum blockchain (theblockcrypto.com)

El Salvador helped to make more history for bitcoin in 2021, adopting it as a legal tender currency[9] on 7 September, having abandoned its own currency in 2001 in favour of the US dollar. In section 1, we give an initial assessment four months into this massive experiment.

As the adoption of cryptocurrencies grows, more and more politicians and regulators are making their views known publicly.

Several states, such as Nigeria[10] and India[11], have attempted to ban cryptocurrencies; China banned bitcoin mining, which caused the hashrate (computing power) to plummet during the summer[12]. **Such bans, however, are difficult to implement.** Nigeria, for instance, has seen one of the highest levels of bitcoin adoption. After China's crackdown, the mining activity simply migrated to other regions, the US in particular, and the bitcoin network proved its resilience by reaching new hashrate records six months later.

Other states have also been sceptical about cryptocurrencies, with some attempting to appropriate the underlying technologies. Many central banks are launching projects[13] to create a **central bank digital currency (CBDC)** with two main objectives. Firstly, to ensure the competitiveness of fiat currencies in a world in which cash, the only payment instrument issued directly by public authorities, is used less and less. Secondly, to ensure more efficient oversight of exchanges to prevent illegal use of money, and potentially adopt an additional monetary policy instrument[14].

However, concerns are emerging, particularly among citizens, especially with regard to the protection of privacy, as the authorities would have full control over all transactions; but also from commercial banks, which see their role as intermediaries in the distribution of money potentially being bypassed.

The United States, for its part, has adopted a singular but unsurprising stance given its history of digital technologies, its appetite for innovation and, above all, the dollar's unique status worldwide as a reference currency. Having understood the benefits of promoting the development of dollar-backed stablecoins[15], it is developing **regulations around stable cryptocurrencies** and notably allowing banking institutions to issue them[16].

Concerning the crypto ecosystem, two main trends can be observed.

The first relates to **the growth of the content economy** and everything covered by Web3.

9. E75F3.PDF (jurisprudencia.gob.sv)
10. Au Nigeria, la banque centrale déclare la guerre aux cryptomonnaies (lemonde.fr)
11. India announces bill to ban cryptocurrencies (france24.com)
12. China Crypto Bans: A Complete History (coindesk.com)
13. https://www.atlanticcouncil.org/cbdctracker
14. This depends on the design and implementation models specific to each CBDC. In the ECB's studies of a digital euro for retail payments, it discusses the option of applying an interest rate to the currency in certain cases (e.g. above certain amounts) to increase the impact of the central bank's monetary policy choices.
15. Speech by Randal K Quarles on stablecoins
16. Report on Stablecoins (treasury.gov)

Web3 is seen as the internet owned by creators and users, orchestrated using tokens[17], as opposed to Web2, which is owned by a few hegemonic players such as GAFAM. Through decentralised web technologies, the user becomes the owner of their data as well as of the content they produce, which can be monetised if demand exists on the market. **NFTs have grown significantly** during the year, particularly in the fields of art and gaming, through exchange platforms such as OpenSea. The total value of NFTs is currently estimated at $21 billion[18], with the valuation of projects such as the CryptoPunks and the Bored Ape Yacht Club easily exceeding a billion dollars. These NFTs are part of a social and cultural phenomenon specific to the web, but also represent investment products and objects in the metaverse.

Although the concept pre-dates cryptocurrencies (see Second Life in particular), the use of metaverses brings a real change of dimension.

In the context of this report, we define a **metaverse,** such as Decentraland[19], as a **3D virtual world in which all industries that have achieved digitisation can converge:** not only finance through DeFi protocols but also art, gaming, advertising, fashion, not to mention social networks, etc. The auction house Sotheby's has notably reproduced its historic London headquarters in Decentraland[20]. Many Web2 companies are also taking the leap, such as Facebook, which was recently renamed "Meta", to announce future projects in a digital virtual world, albeit interoperability and openness are bound to be challenges. Twitter, for its part, is introducing the possibility of using a verified NFT as profile picture, and of sending tips via Bitcoin and Ethereum.

The second trend relates to the **growth of DeFi,** which since its inception during the "DeFi Summer" of 2020 has continued to rise, from 22 billion TVL (total value held by the applications) to more than $250 billion at present[21]. Among the use cases explored this year are notably **on-chain forex[22],** attempts to resolve issues related to **"mercenary capital"[23],** and **DeFi and NFT hybridisation,** such as collateralised loans.

Furthermore, **due to the sharp increase in activity on the Ethereum network,** a victim of its own success like bitcoin before it, **saturation problems emerged,** with growing delays and costs for on-chain transactions. Faced with these difficulties, a new wave of blockchains (known as Layer 1) has emerged in the ecosystem, leading to a dispersion of liquidity across several media, and issues around interoperability. We will come back to these issues, and the proposals for **"Layer 2" scalability solutions** on the Ethereum network.

2022 therefore is set to be another intense year, in which changes in the relationship between bitcoin and states will need to be monitored in particular, together with the growth in the content economy (Web3) and the issues of interoperability and scalability, particularly on the Ethereum blockchain.

17. Chris Dixon, a16z
18. DefiLlama - NFT Dashboard
19. Welcome to Decentraland
20. Sotheby's opens a virtual gallery in Decentraland | Decentraland
21. DefiLlama - DeFi Dashboard
22. Jarvis – DeFi For All
23. Olympus DAO | The Decentralized Reserve Currency


38,522.04
$38,522.04
Bitcoin
BTC
Price

Could countries move to adopt bitcoin?

El Salvador paves the way by adopting bitcoin

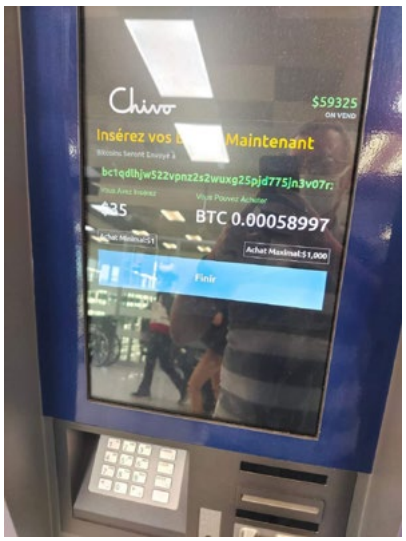
El Salvador's adoption of bitcoin as legal tender has been a new historical achievement for cryptocurrencies and provides a precedent for the use of cryptocurrency at a national level. Drawing on the various official announcements by President Nayib Bukele[24] as well as the observations of French experts who visited El Salvador in November 2021 during the Adopting Bitcoin conference, we attempt an initial assessment four months after the entry into force of the Bitcoin Law.

Significant adoption within a few months

Under El Salvador's **Bitcoin Law[25], which was enacted on 7 September 2021,** Salvadorans can use bitcoin like the dollar to purchase goods and services, pay wages and pay taxes.

In three months, the government has entered into partnerships with professionals in the sector (US company Strike), developed a **wallet (Chivo),** installed at least **200 bitcoin ATMs[26]** and launched a **national mining industry,** backed by its abundant geothermal resources.

24. French Bitcoin experts: Big Block Data, Stackin Sat, Découvrir Bitcoin, LN market
25. E75F3.PDF (jurisprudencia.gob.sv)
26. Bitcoin ATM El Salvador – find bitcoin machine locations (coinatmradar.com)



Chivo ATM at San Salvador Airport[27]

In his latest communications, President Nayib Bukele stated that **five million Salvadorans[28] had opened a bitcoin wallet, while the number of people with a bank account was 1.7 million[29].** Bitcoin has achieved financial inclusion for nearly three times more people than the banking sector, and is allowing people to exchange value other than with the dollar, in a context in which the country abandoned its local currency in favour of the US dollar in 2001, making it dependent on US monetary policy.

However, these high figures should be seen in relative terms: the average monthly income in El Salvador is $240, and to boost adoption, the government offered every resident that opened a Chivo wallet $30. Based on the observations made locally, **a significant proportion of the population only downloaded the Chivo wallet to obtain this free money.**

With bitcoin, the local population now has a means of receiving remittances from relatives living abroad at a lower cost and almost instantaneously. Remittances represented 24% of the country's GDP in 2020[30], a considerable windfall for the country, on which financial intermediaries like Western Union charge high fees. The resulting shortfall for these players could be up to $400 million[31].

Because of this alternative access to the financial system, the daily lives of millions of people are being disrupted. For Salvadorans still without access to the banking system, the use of cash and the related disadvantages (need to physically go to the place of payment, risks around holding it, etc.) could be challenged by the adoption of bitcoin. The latter offers an advantage over banknotes by facilitating the management of savings and cash and benefits in the transfer of funds (e.g. payment of a supplier). However, this is a trend that needs to be monitored, particularly in the medium to long term.

As for retailers, according to the feedback onsite, **most medium-sized and large retailers[32]** (McDonald's, Starbucks, Pizza Hut) **already accept bitcoin payments.** Some service stations even offer advantages to bitcoin users (see photo below: "you can save $0.20 per litre by paying with your Chivo wallet"[33]). **On the other hand, informal shops, such as market «tiendas», still make very little use of cryptocurrency.**

27. Le Bitcoin au Salvador - Le Terrier du Bitcoin (decouvrebitcoin.com)
28. This information needs to be qualified as no verifiable data has been disclosed, other than the official information of President Nayib Bukele
29. Bitcoin City - El Salvador President LIVE at #FeelTheBit - YouTube
30. Personal remittances, received (% of GDP) - El Salvador | Data (worldbank.org)
31. El Salvador bitcoin move could cost money providers $400 million a year (cnbc.com)
32. McDonald's Starts Accepting Bitcoin In El Salvador (forbes.com)
33. https://twitter.com/nayibbukele/status/1443414254498066434?s=20

The adoption of bitcoin in El Salvador, which has a large informal economy[34], could be an important lever for development by helping to structure accounts or to save securely without access to a bank account. However, contrary to widespread opinion that bitcoin is a convenient tool for the grey economy, the public in the informal economy seems to be adopting bitcoin less quickly (used by an estimated 10-20% to date)[35].

In addition to this disparity among economic players, **significant differences have also been observed around the country. Tourist areas** such as El Zonte show a high level of use, **serving as a showcase for the adoption** of bitcoin. But **since large swathes of the country comprise rural areas, some regions are not equipped with a suitable internet connection for the use of bitcoin.**

It has also been observed that the introduction of this new monetary unit has encouraged citizens at all levels of society to educate themselves financially, particularly in terms of investment, to protect themselves from dollar inflation and bitcoin volatility, but also in terms of technology, for instance in relation to the methods of holding their assets. The next step for the state could be to organise education on these subjects, disseminate best practices and train specialists.

According to testimonies gathered by the bitcoin community, **adherence to this societal project could depend more on political affiliation and whether or not a person supports President Nayib Bukele.** We are sceptical that all Salvadorans have a strong desire not to be dependent on US monetary policy and to protect users' personal data by eschewing intermediary networks.

However, and although this decision was taken at state institution level without consulting or informing citizens beforehand (as evidenced by various demonstrations, contested numbers), the adoption of bitcoin in El Salvador seems to be going very well after only four months. Nevertheless, real adoption will be a long process, and some technical and infrastructure weaknesses seem to be slowing it down.

34. The International Labour Organization (ILO) estimates that six out of ten Salvadorans struggle to make a living in the country's informal economy
35. Onsite observations by a group of French experts

Bitcoin as a payment infrastructure: Lightning Network good news, Chivo bad news

The Lightning Network is a bitcoin scalability solution that allows certain transactions to be moved outside the main chain (L1) to limit network congestion. It is a way of freeing up space in bitcoin blocks, making transactions faster[36] and reducing transaction costs.

There are several solutions for using Lightning Network, ranging from a completely decentralised and independent system where the individual has their own Lightning Network node in addition to a non-custodial wallet like Breez, to the use of a third-party-owned, centralised and opaque wallet, such as the application promoted by Nayib Bukele.

In fact, the Chivo wallet, which was made available in record time, has shown several defects that need to be corrected if El Salvador's[37] bitcoin project is to be a success.

- The Chivo wallet operates on a private network and has been developed by a private company that is a government subsidiary. It is therefore a black box on which little information is disclosed, which is in stark contrast to the cypherpunk philosophy of transparency around exchanges.
- The main interface is designed such that the user can intuitively carry out Chivo-to-Chivo transactions while the option to make payments on the public bitcoin network is not very visible and an additional operation is required to switch to the Lightning Network (L2).
- Fund transfers occasionally fail, in cases where a payment is made from a non-custodial wallet[38] to the Chivo wallet.
- The KYC process contains flaws[39]

This solution is limited but does not at all discredit the Lightning Network[40] since everyone is free to choose their payment infrastructure service (from decentralised to centralised), which is not the case with a fiduciary currency such as the dollar or the euro.

Furthermore, thanks to its developer community, Bitcoin continues to evolve, with various updates like Segwit in 2017 and more recently Taproot[41] in 2021. The Lightning Network technology deployed in 2018 is still gradually maturing to create a more user-friendly experience, spearheaded in particular by French company Acinq.

36. A Bitcoin transaction can take ten minutes, which is the time needed to verify a block.
37. Investigation sur le Chivo Wallet - Le Terrier du Bitcoin (decouvrebitcoin.com)
38. Breez, Bitcoin Lightning Wallet, Éclair Mobile, Zap
39. Identity Thieves Exploit El Salvador's Chivo Bitcoin Wallet's Setup Process (coindesk.com)
40. Discover Bitcoin on Twitter: «A short story on how bad the chivo wallet is: Yesterday with @Breez_Tech CEO Roy we tried paying with LN at some local meat restaurant. In 2021 paying in LN is pretty well understood; they create the invoice, we scan the QR code and voila Well not w/@chivowallet #FixChivo https://t.co/10ZJZ7lkmN» / Twitter
41. Activation of Taproot - bitcoin.fr

How could the use of bitcoin pan out in El Salvador?

President Bukele took international institutions by surprise when he took his state Bitcoin project a step further by announcing the **issue of a $1 billion dollar bitcoin bond,** tokenised by Blockstream on the Liquid Network blockchain. This unprecedented funding strategy provides a direct path to investors by avoiding traditional bond markets and the restrictive lending conditions imposed by the IMF, as experienced by Greece.

Half of the proceeds from the bond will be used to finance **the construction of a Bitcoin City** and mining infrastructure powered using energy from the Conchagua volcano. This city will feature zero taxes except for a 10% VAT, and is intended to attract investors, entrepreneurs and talents from all over the world. Wagering on a rise in the value of bitcoin, the other half of the proceeds will be used **to purchase bitcoins** and store them for five years, to reimburse investors in the future. However bold such a decision, there is still a **potential risk of default by the country** in the event of a bear market. Moreover, we have very little information on the impact of past bond contracts underwritten by El Salvador on the issue of this bond[42].

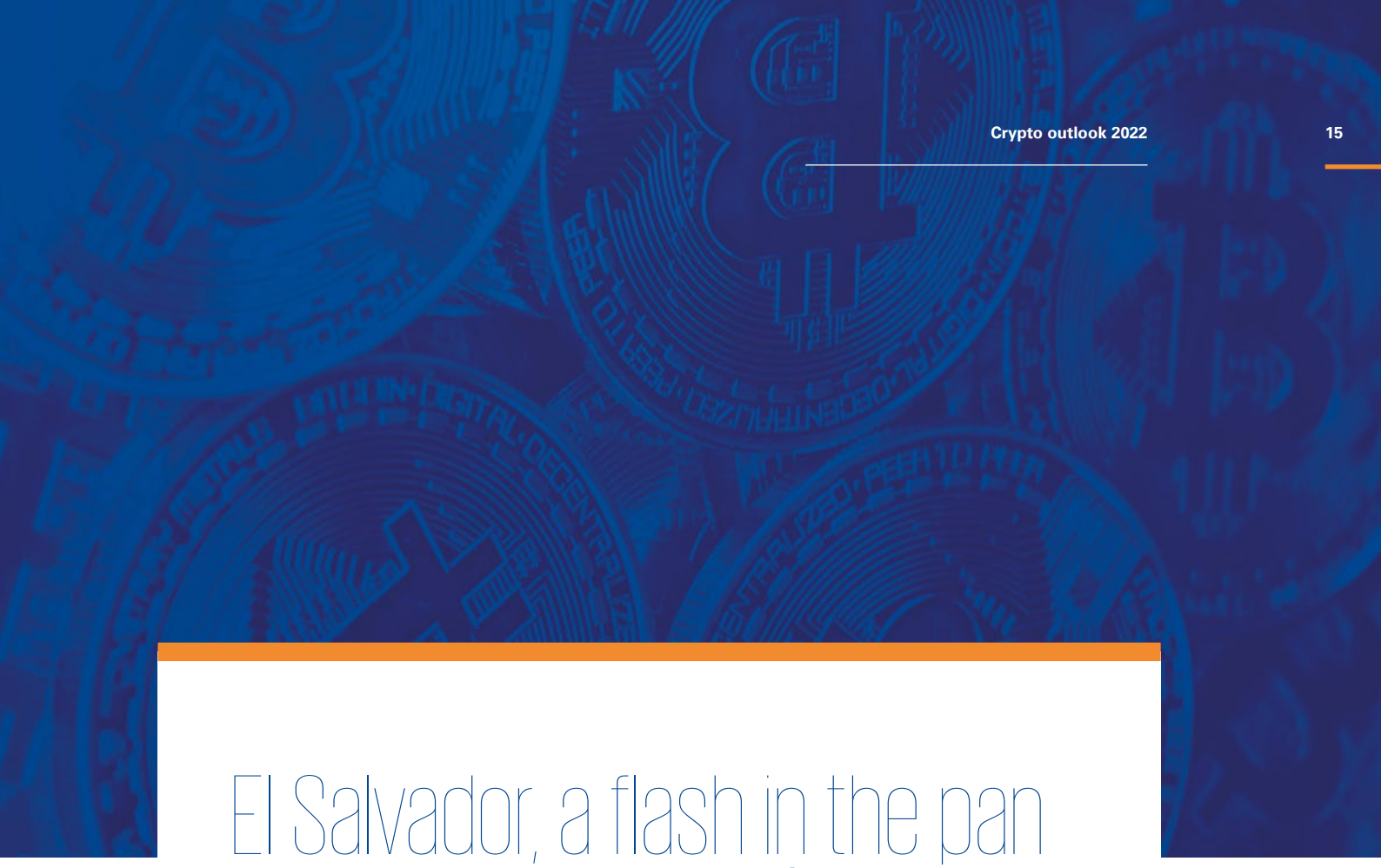
What we could imagine in the near future is that **the country will encourage economic players to understand the value of having a disintermediated digital currency.** Two scenarios can be envisaged if Salvadoran companies start to receive and accumulate bitcoins, which they do not necessarily want to keep in cash:

- They can exchange **their bitcoins for dollar stablecoins to avoid volatility,** with the following benefits:
  - A reduction of transaction costs
  - Faster transactions (no interruption of service)
  - Easy access to decentralised financial services (DeFi)
- They can **exchange bitcoins directly** with business partners, should they wish to **avoid the dollar,** with the following benefits:
  - Enjoy the same benefits as in the first scenario
  - Protect against dollar and euro inflation
  - Avoid stablecoins which are pegged to the dollar and thus potentially ultimately **subject to US law.**

Naturally, companies are exposed in this case to a major currency risk on their bitcoin holdings.

© Renaud Lifchitz, cybersecurity expert, during the conference Adopting Bitcoin in El Salvador.

42. https://twitter.com/M_PaulMcNamara/status/1468586429043429378?t=n7TmhVhj_6MKccQS1oBQsA&s=19



El Salvador, a flash in the pan or the first of many?

There are several reasons why other states could also adopt bitcoin as legal tender

The adoption of bitcoin as legal tender in El Salvador raises many practical questions: among others, how many digital wallets will be opened in the medium term? Will the volume of transactions increase as anticipated? Will the level of acceptance among merchants be high enough to allow bitcoin to be used on a daily basis? Will investors be interested in "bitcoin" bonds designed to finance the purchase of digital currency and the construction of Bitcoin City?

Depending on how the initiative fares in overcoming these multiple challenges, the precedent set by El Salvador could inspire other states to follow suit and give legal tender to bitcoin (BTC), potentially in addition to rather than as a substitute for their national currency.

As for El Salvador (see in particular points a, b and c below), there are several factors underpinning a state's potential decision to adopt bitcoin.

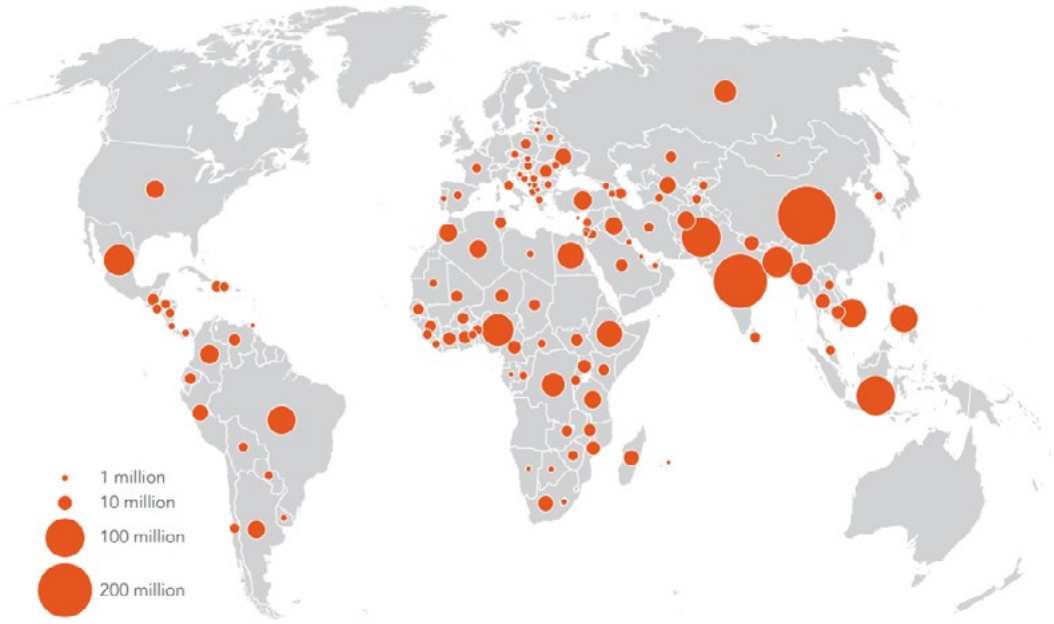
a. Facilitation of international remittances

International remittances (money transfers) constitute a substantial proportion of the GDP of many states. Yet, international transfers, particularly via traditional players such as Western Union, are still very slow and expensive. On average, Oliver Wyman estimates that a cross-border transaction today takes between two and three days and costs $27 (excluding FX) between direct and indirect fees, since intermediaries also pay each other by offering lower exchange rates[43].

b. Promote financial inclusion

As illustrated by the latest World Bank report on this subject (see chart below), **a significant share of the population in many countries still does not have access to a bank account.**

Globally, 1.7 billion adults lack an account
Adults without an account, 2017



Source: Global Findex database.
Note: Data are not displayed for economies where the share of adults without an account is 5 percent or less.

On the other hand, even in the poorest/least developed areas, access to smartphones (and the internet more generally) is now widespread, leading to greater dissemination of mobile payment solutions in countries that still have low banking penetration rates, one such example being M-Pesa in Kenya.

43. unlocking-120-billion-value-in-cross-border-payments.pdf (oliverwyman.com)

c. Strengthen national sovereignty

To control inflation and volatility, many countries still peg their currency to the dollar or, more rarely, to the euro[44], through various mechanisms, such as the fixed peg or the exchange rate anchor[45]. **While such measures enable a fixed exchange rate with the fiat currency that is deemed stable, they greatly limit states' sovereignty.** Furthermore, they can indirectly cause asymmetries between the nominal value and the real value of the national currency, resulting in the emergence of a black market for the currency[46].

If the BTC's volatility were to decline over time, its adoption as a legal currency could serve as a defence against inflation, bitcoin being by design a finite and scarce asset. Monetary policy measures would be difficult if not impossible to implement; nevertheless, such a strategy would at least not involve a delegation of sovereignty to a third state.

d. Optimise energy production and profitability in this sector

Some countries produce surplus energy that can hardly be stored, particularly of hydroelectric origin. Tajikistan, for example, whose energy mix is based on hydropower, produces a surplus of 3-5 billion kWh[47] during the summer. This surplus could be optimised by creating BTC state mining centres, allowing the state to gain cryptocurrencies and join the decentralised network of bitcoin nodes. Such initiatives appear to be complementary, if not necessary, in adopting the BTC as legal currency.

Additional factors could encourage states or put them off

Other factors must also be taken into account in trying to pinpoint which countries could follow El Salvador's example in the coming years:

Level of adoption of cryptos

Some developing countries feature at the top of the Chainalysis ranking[48] of crypto adoption: e.g. Vietnam (first), Philippines (fifteenth), Morocco (twenty-fourth). It should be noted, however, that the Chainalysis methodology only takes into account the quantity of on-chain exchanges, both in value and volume terms, thus tending to underestimate the penetration of cryptos in states such as the USA, for two main reasons.

First, in countries with high-performing payment infrastructures and stable official currencies, cryptocurrencies are often used as a store of value, the BTC in particular[49]. Second, because in these same countries the majority of transactions are purchases or sales of off-chain cryptocurrencies (not accounted for by Chainalysis since the data are not public) via exchange platforms such as Coinbase.

44. This applies in particular to West African countries that use the CFA franc. A new currency, the Eco, is expected to eventually replace the CFA franc, but its introduction has been postponed several times. For further information, see: L'Eco : une monnaie commune ouest-africaine d'ici 2027, est-ce réaliste ? - BBC News Africa
45. For more details on the different mechanisms for linking the price of a fiat currency to that of the dollar or euro, see Classification of Exchange Rate Arrangements and Monetary Policy Frameworks -- as of June 30, 2004 (imf.org)
46. For a summary of the advantages and disadvantages of a currency peg, see Advantages and Disadvantages of Currency Pegs (managementstudyguide.com)
47. The energy sector of the Republic of Tajikistan | Ministry of foreign affairs of the Republic of Tajikistan (mfa.tj)
48. Chainalysis Blog | The 2021 Global Crypto Adoption Index: Worldwide Adoption Jumps Over 880% With P2P Platforms Driving Cryptocurrency Usage in Emerging Markets
49. In November 2021, the Pew Research Center estimated that 16% of US citizens already held cryptocurrencies: 16% of Americans say they have invested in, traded or used cryptocurrency | Pew Research Center. In December 2021, the President and COO of Coinbase, Emilie Choi, said that 12% of Americans use cryptos: Coinbase President: Crypto on Pace for 1 Billion Users Within 5 Years - Blockworks

Nevertheless, the Chainalysis report clearly shows that **the adoption of cryptocurrencies is far from limited to the most advanced economies.**

Sovereign debt status

When a state has a high level of public debt, in particular debt to be repaid in foreign currency (USD), it is less likely, in theory, to give legal tender to the BTC. In fact, as it would allow citizens to pay their taxes in cryptocurrency, **the country would be exposed to currency risk and such a decision would constitute a wager on a rise in the price of the BTC.** If the BTC price were to fall before the debt maturity date, any repayment or renegotiation could prove complicated (see case of El Salvador).

Sanctions

If a country is the subject of sanctions/embargoes, the adoption of the BTC could facilitate international trade.

Balance of trade

As the BTC is set to show variable volatility as an asset in the short to medium term, if a country's import/export trade balance showed a deficit, then it would be exposed to foreign exchange risk if it adopted the BTC as a legal currency. Two scenarios must be taken into account:

- **Imbalance in favour of exports + rising BTC market:** losses are possible if the initial investment is in BTC while the products are purchased in a third currency (e.g. USD).
- **Imbalance in favour of imports + falling BTC market:** losses are possible if a country is dependent on imports while the BTC price is falling.

This criterion could be extended to factor in the current account balance.

The risks mentioned above could be mitigated by adopting the BTC as a complement to and not as a substitute for a national fiat currency.

That said, the coexistence of BTC and a national fiat currency could also lead to other difficulties, such as the level of exposure of the banking sector to one or both of those currencies. This report takes just a fleeting look at these matters and does not aim to address all the scenarios, risks and opportunities entailed in an exhaustive manner.

Political context

Given that this is somewhat a divisive subject, we could, paradoxically, assume that it would be **easier to give legal tender to the BTC, in the short term, for countries in which decision-making powers are highly centralised and institutions are strong.**

Indeed, the adoption of the BTC could be seen as a bold and differentiating move befitting certain authoritarian regimes.

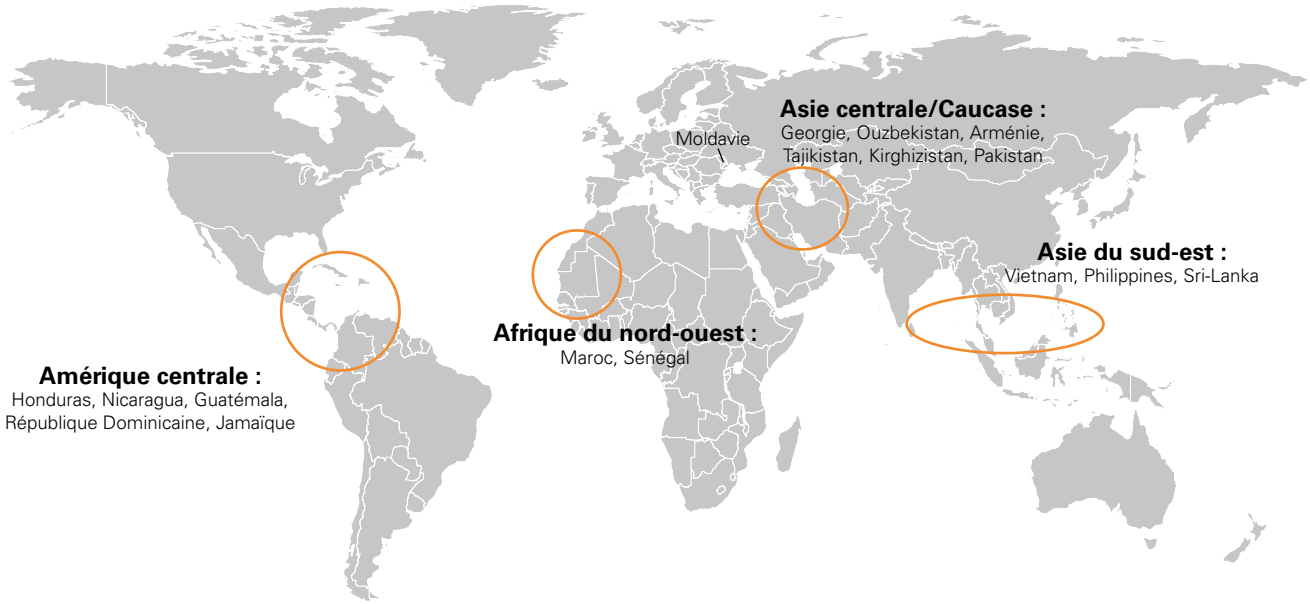
In parallel, an official adoption of the BTC could be seen as difficult or even impossible for countries currently experiencing serious political and economic crises. In a situation like that of Lebanon, for instance[50], it is unlikely that a measure of such scale would be included in the government's already saturated agenda. However, unofficial adoption could be possible due to the increase in cryptocurrency trading amid the banking sector collapse and distrust of institutions and institutional forms of currency.

Finally, countries have an alternative, with a more limited potential but also involving less risk, to the adoption of the BTC as legal currency. That is the creation of a stablecoin backed by their national fiat currency, which could be used on blockchain payment infrastructures such as Ethereum or, eventually, Bitcoin Lightning. Such a scenario would at least favour bank penetration rates and facilitate international remittances.

50. The case of Lebanon is worth looking at as, in theory, the country meets several conditions for a potential and useful adoption of the BTC: very high inflation, structural dependency on international remittances, etc.

Concrete examples of countries that could adopt bitcoin and areas to watch

Using a combination of the criteria illustrated above and a cross-referencing of the available data[51], we can identify countries that seem to have a higher probability of adopting the BTC as legal currency.



51. The World Bank is the source for the percentages of remittances/GDP (2020), inflation rates (2020), bank penetration rates (2017) and the trade balance/GDP (2019) percentages. The reference for political regimes is the Democracy Index 2020 published by The Economist (Intelligence Unit); the reference concerning energy production is the IEA website (2019); and the reference for the level of adoption of cryptoassets is the stated Chainalysis report.

Points to watch by country

Key: in red, the criteria that could make the adoption of bitcoin as a legal currency more difficult; in green, the criteria that would make it more relevant.

Area	Country	Remittances/ GDP (2020)	Inflation (2020)	Unbanked (2017)	Position in the crypto adoption ranking	Political/ institutional regime	Solar or hydro energy sources	Peg?	Trade balance/ GDP (2019)
Central America	Honduras	23,5%	3,5%	54,7%	58	Hybrid		Crawling peg	-15%
	Nicaragua	15,3%	3,7%	69,1%	110	Authoritarian		Crawling peg	-4,8%
	Guatemala	14,8%	3,2%	55,9%	83	Hybrid			-8,1%
	Dominican Republic	10,6%	3,8%	43,8%	51	Democracy			-7,7%
	Jamaïca	21,2%	5,2%	X	81	Democracy			-14%
North/ West Africa	Morocco	6,5%	0,7%	71,4%	24	Hybrid			-7,7%
	Senegal	10,5%	2,5%	57,7%	93	Hybrid		Exchange rate anchor (EUR)	-14,5%
Eastern Europe	Moldova	16,3%	3,8%	56,2%	50	Hybrid			-22%
Central Asia / Caucasus	Armenia	10,8%	1,2%	52,2%	107	Hybrid			-8,6%
	Georgia	13,4%	5,2%	38,8%	56	Hybrid	Hydro-electric		-18,6%
	Uzbekistan	12,1%	X	62,9%	95	Authoritarian			-10%
	Tadjikistan	27,3%	6% (2016)	53%	133	Authoritarian	Hydro-electric		-21%
	Kirghizistan	29,4%	6,3%	60%	70	Hybrid	Potential for hydroelectric power		-20%
	Pakistan	9,9%	9,7%	78,7%	3	Hybrid			-7,1%
Southeast Asia	Vietnam	5%	3,2%	69,2%	1	Authoritarian			3,19%
	Philippines	9,6%	2,6%	65,5%	15	Democracy			-7,8%
	Sri Lanka	8,8%	6,2%	26,4%	53	Democracy		Pegged to USD (challenged)	-6,4%

In summary:

- Since the introduction of El Salvador's Bitcoin Law, **bitcoin has been adopted more as a political choice linked to support for President Nayib Bukele than as support from an ideological perspective for a decentralised currency.** There has been a high level of adoption in the short period since introduction, although informal shops and rural areas remain on the fringes for now.
- Bitcoin has helped to optimise international transfers and bring financial inclusion for a large section of the Salvadoran population, although **efforts to promote acculturation in this area remain necessary.** Regarding the bitcoin payment infrastructure, **the Chivo wallet solution shows technical flaws and opacity levels that need to be resolved rapidly.**
- The country therefore has made a bold wager on bitcoin, structuring its **mining industry around its geothermal resources,** constructing a **Bitcoin City** financed by the issue of a **bitcoin bond** and carrying out massive purchases of bitcoins. **El Salvador has become a bitcoin showpiece for all to observe.**
- If the El Salvador example is a success, the task of pinpointing **which other states could make bitcoin legal tender** (potentially in addition to their national currency) would require consideration of several criteria, in particular but not exhaustively, the weight of cash **remittances** in GDP, the **inflation** rate, and the share of the population still without **a bank account.**
- By cross-referencing the available data and the various criteria taken into account, the **countries likely to adopt bitcoin (eventually) seem to be located in Central America** (Honduras, Nicaragua, Guatemala, etc.), **Central Asia / Caucasus** (Tajikistan, Uzbekistan, Georgia, Kyrgyzstan, etc.) and **Southeast Asia** (Vietnam, Philippines, Sri Lanka).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The rise of Web3: the content economy

Web3: a new phase of the internet's development is emerging

In light of the opportunities offered by tokenisation, we are now seeing a form of financialisation of certain industries - with play-to-earn probably the most obvious illustration for the entertainment industry - or even the re-financialisation of certain markets which, due to the growth of Web2[52], no longer generate revenues comparable to those of the pre-internet era. For example, cryptoassets and blockchain could enable the journalism market to return to a level of profitability that was compromised for certain types of content by the extractive dynamics of Web2. Indeed, while social media has now largely taken the place of mass media, the users behind social media content hold no rights to their "creations". More generally, **the staggering rise of non-fungible assets (non-fungible tokens or NFTs) stems from a desire by internet users to regain ownership of the products of their online activity.**

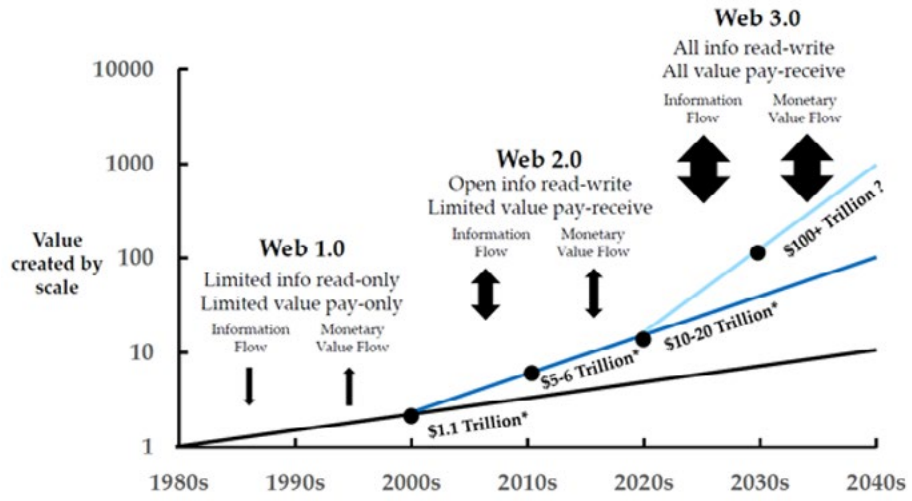
Thanks to NFTs, any object, whether material (a painting, a real estate asset, etc.) or non-material (a right of access, a financial security, a video, a weapon in a combat game, etc.), can be represented uniquely and thus acquire a value (if there is demand for the asset), and be owned, sold, used, loaned, exchanged, etc. in an open digital space, on more decentralised networks. In this respect, **NFTs are the gateway to Web3 and the (virtual) content economy:** a new dimension that is on the verge of eruption.

52. Web2, the current structure of the internet, was itself established in the early 2000s as a further development of the decentralised early internet ecosystem (Web1) comprised of static web pages. For UX purposes, Web2 saw the growth of centralised models enabling the creation of dynamic content. However, the content created by users does not belong to them but rather to the platforms offering access to their services in exchange for full control over the data generated by the online activity.

Comparison of Web1, Web2 and Web3 characteristics. Source: Grayscale

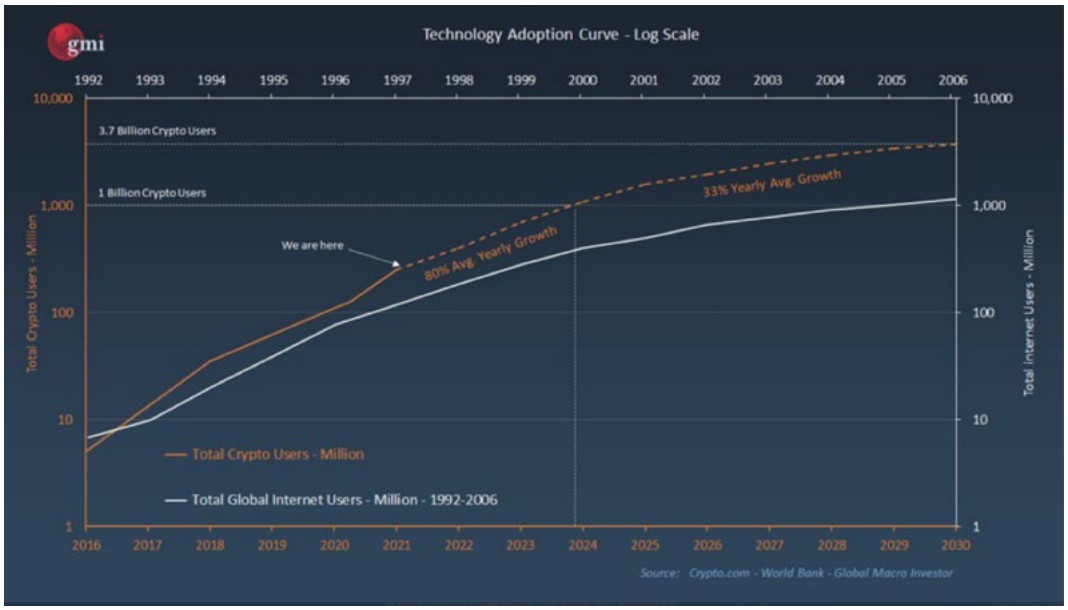
	Web 1.0	Web 2.0	Web 3.0
Interact	Read	Read-Write	Read-Write-Own
Medium	Static Text	Interactive Content	Virtual Economies
Organization	Companies	Platforms	Networks
Infrastructure	Personal Computers	Cloud & Mobile	Blockchain Cloud
Control	Decentralized	Centralized	Decentralized

Historical snapshot of the three phases of the Web's development. Source: MapleLeaf



Comparison between the growth of Web1 ("internet users") and the crypto industry ("crypto users") and projection of future growth.

Source: Global Macro Investor (July 2021)



With Web3, cryptoassets can almost be given "physical" characteristics from the perspective that anything that we completely own is essentially seen in the collective imagination as a "physical" thing. Grayscale offers a striking everyday example[53] when it says that just as you would never imagine a footwear brand would deprive someone of their shoes once they have been purchased, OpenSea has no power over NFTs owned by internet users[54]. If individual X buys a right to a virtual representation of a t-shirt in the form of NFT on OpenSea, the item purchased only exists in his or her wallet: Only X can wear it on the internet, wherever and whenever they wish.

These notions of "wherever" and "whenever" will feature prominently in the challenges for 2022. Because the inherent composability of the crypto ecosystem can but lead to a new, virtual worlds in which all industries come together: the metaverses, unique spaces combining DeFi, digital art, digital fashion, advertising, gaming, social interactions, etc.

The term **"metaverse"** was formed by combining the Greek preposition (and adverb) μετά (meta) and the English word "universe" to depict the complex reality it represents. The term μετά or meta is usually translated into English as "beyond". In reality, however, its significance is much broader, midway between "with", "apart from", "in addition to", "behind", "after" and "beside". Below are two definitions of "metaverse":

> A persistent, live digital universe that affords individuals a sense of agency, social presence, and shared spatial awareness, along with the ability to participate in an extensive virtual economy with profound societal impact[55].

> A set of interconnected, experiential, 3D virtual worlds where people located anywhere can socialize in real-time to form a persistent, user-owned, internet economy spanning the digital and physical worlds[56].

The forerunners of crypto metaverses are the imaginary worlds of video games (Fortnite, Roblox, SecondLife, etc.), some of which have developed not only sophisticated virtual spaces, but also an internal market for the purchase and sale of all kinds of assets.

Cryptoassets and blockchain have introduced two fundamental concepts into these dimensions: digital scarcity, enabling real asset ownership without going through a trusted third party, and interoperability, together with the obvious benefit of a global scale payment infrastructure.

53. Grayscale_Metaverse_Report_Nov2021.pdf
54. OpenSea may decide to stop listing a NFT, which can still be displayed and sold on other platforms.
55. Into The Void: Where Crypto Meets The Metaverse (metaversed.net)
56. Grayscale, ibid

The crypto metaverses to watch in 2022 will be **Decentraland**[57] and **The Sandbox**[58]. These players fall into two distinct categories, namely generalist or holistic metaverses (Decentraland) and game-oriented metaverses (The Sandbox and Axie Infinity).

Up until now, game-oriented projects have attracted more users through the appeal of games. However, in the medium to long term, the potential of holistic metaverses like Decentraland could be higher if they can generate enough interaction to trigger network effects[59].

Both Decentraland and The Sandbox are already attracting a high number of investments and initiatives. For example, in November 2021, Adidas launched on The Sandbox[60] and Nike acquired the digital shoe studio RTFKT[61] (combining NFT and 3D models for metaverse) while the **first official metaverse embassy was created on Decentraland** by the State of Barbados[62]. In addition, **Sotheby's has been auctioning works of art at its headquarters on Decentraland**[63] since June 2021 (see image below)[64].

Meanwhile, plot prices have risen dramatically and millions of dollars[65] are being invested to get hold of the best land for constructing virtual buildings. In the academic world, researchers like Fabian Schär are already publishing papers on "the Economics of Blockchain-Based Virtual Worlds[66]. Of particular note is the fact that **the growth of crypto-metaverses and Web3 more generally is increasingly less correlated to the performance of bitcoin.** As such, we can expect Web3 to continue expanding rapidly in 2022, independently of whether bitcoin's current bull trend continues.

It should be emphasised also that an alternative model is starting to emerge, as seen for example with Nifty Island[67], with NFT as a "content" brick but without land registries and plot sales (limited in number) as a basic structure.

57. Welcome to Decentraland
58. The Sandbox Game — User-Generated Crypto & Blockchain Games
59. In October 2021, only 848 people interacted with Decentraland's smart contracts, according to DappRadar. Although this does not include users present on the metaverse who have not carried out actions such as purchases, such a small number illustrates the embryonic stage of this project.
60. (20) adidas Originals on Twitter: «adiVerse anyone? What should we build, together in @TheSandboxGame? » / Twitter and (20) Wu Blockchain on Twitter: «adidas Originals said it will build the meta-universe on the Sandbox. Affected by this, although the market is sluggish, SAND rose by 36%, and meta-universe concepts such as MANA ENJ also rose.» / Twitter
61. See Nike's announcement: https://news.nike.com/news/nike-acquires-rtfkt
62. Barbados to Become First Sovereign Nation With an Embassy in the Metaverse (coindesk.com)
63. Sotheby's opens a virtual gallery in Decentraland | Decentraland
64. Screenshot during a connection in Decentraland
65. Virtual real estate plot sells for record $2.4 million | Reuters
66. The Economics of Blockchain-Based Virtual Worlds: A Hedonic Regression Model for Virtual Land by Mitchell Goldberg, Peter Kugler, Fabian Schär :: SSRN
67. Nifty Island | An Open, Player Owned, Virtual World Powered by NFTs

Play-to-earn: when tokenisation disrupts an industry's very business model[68]

Play-to-earn is emerging as a likely new standard in the gaming world. Following the transition of part of this industry from a traditional paid model to the Fortnite-style freemium model, **play-to-earn (P2E) opens up a new vista for players to derive real income from their online activity** by capitalising on the growth of NFT. But what is the future of the online gaming industry? Will there still be room for play-for-fun in the years to come?

In 2022, the P2E model will probably continue to conquer the market for three main reasons:

1. The ability to earn revenue from the game is rapidly attracting a large number of users;
2. Competing with the element of money added in can be very exciting, although potentially addictive, adding to the "fun" of the game;
3. Investors are also attracted by the potential of P2E games generating quick profits.

However, the financialisation of games as a result of the rise of play-to-earn models will probably not do away with more traditional games, which require no investment to participate. Firstly, because not all players are driven by a desire to compete for or win money. Secondly, because in some cases, **financialisation can have the effect of discouraging players.**

Several precedents point to this, such as the drop in the number of players on Blizzard's Diablo 3 after the introduction of an auction system that financialised the game[69], before the explosion of the NFT market. Furthermore, the player community seems keen on ensuring that games do not turn into a pay-to-win format, which has been much criticised by players as a paradigm in which the winner is always the one prepared to pay the most.

Play-to-earn games could evolve over time to ensure their continuity and win bigger audiences. In the case of Sorare[70], for example, we could see the emergence of private leagues with less competition and less at stake, designed simply to play with friends in small groups. There seems to be a real demand for this type of feature, for example in Italy, where players of "Fantacalcio" are estimated to be more numerous (six million) than players of real football (four million)[71]. In Italy, many fantasy-footballers will probably not be motivated enough to devote the time and energy needed to obtain good results on Sorare.

68. The main reference for this insert is: The Financialization of Fun: Crypto Gaming Thesis – Mechanism Capital
69. Diablo 3 Failed Because Of The Real Money Auction House (thegamer.com)
70. Sorare is a digital NFT-based fantasy football game like Mon Petit Gazon: Sorare • Global fantasy football
71. Fantacalcio, giocatori da prendere a 1 | L'Ultimo Uomo

Applications based on a pure play-to-earn model[72], which try to win audiences with the sole promise of being able to earn income, may not have the most solid foundations. **Whether virtual or real, no economy can grow perpetually** or guarantee that winners will exist without losers. The profits on Axie Infinity[73], for example, have already started to decline, which will ultimately lead to the departure of some players interested solely in earning opportunities. If newcomers cannot hope to generate income because of barriers to entry in terms of price, a recession could be triggered. In 2022, we can expect P2E game launches with big ambitions in terms of gameplay, at least in their beta version (see Illuvium, EmberSword, Star Atlas, etc.).

In conclusion, **play-to-earn games that keep a fun dimension and moderate the risks in their model will have a better chance of success in the medium to long term,** compared to applications that offer significant gains in the short term but without any real added value in terms of gaming enjoyment, and which resemble DeFi protocols that obtain liquidity solely through inflationary token economics and high interest rates. These issues will take on more importance when the VC funds that finance the play-to-earn models become less abundant, probably within a few years.

72. Meaning applications that do not offer a real gaming for fun element according to the views of the gaming community. For Axie Infinity, see Does anyone play this game for fun?: AxieInfinity (reddit.com)
73. Daily Earnings of Typical Axie Infinity Player 'Fall Below the Philippines' Minimum Wage Line:' Report – Featured Bitcoin News

Unlikely that Web2 could integrate Web3?

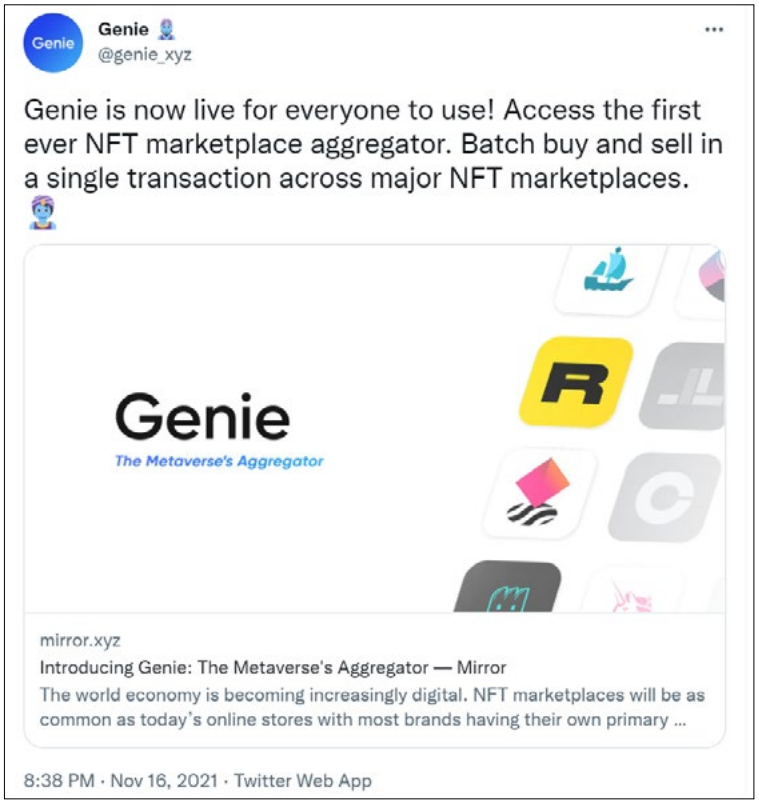
The Facebook group has been renamed Meta and has completely pivoted to a new strategy, both ambitious and risky, illustrating clearly the scale of the metaverse issue. Meta is looking to anticipate its competitors by focusing on the definitive growth of Web3 and the transition from mobile internet to internet based on virtual/augmented reality (VR/AR). The question on everyone's lips is whether this objective is achievable for Mark Zuckerberg, given the apparent incompatibility between Meta's values and those of the crypto metaverse and by extension of Web3.

In crypto-metaverses, any developer can create an application on a public blockchain and any user can acquire assets and interact with other bricks of the ecosystem. Socialisation is free and uncensored, interoperability is the bedrock of the system and an agnostic approach is maintained in relation to hardware.

Facebook, on the other hand, is a platform that has made of content capture (vs. a content economy) the core of its lucrative strategy. Meta is clearly aiming to promote the sale of its own connected products, such as AR/VR headsets and glasses (see image below). Finally, let alone the issue of censorship, it is hard to imagine Facebook transitioning to a disintermediated and interoperable system, where the content created on one of the group's platforms can be transferred outside at no additional cost, without obstacles.

We are sceptical that Web2 giants could integrate Web3 without profound changes in their DNA, although some platforms in a category lower than GAFAM, such as Discord[74] or Pinterest[75], are outlining a hybridisation process that involves leaving internet users the ownership of and rights to the content they generate.

Could Meta also adopt a hybrid approach to make its digital environment interoperable with other metaverses? It would certainly benefit in some ways from doing so. **The future of Web3 is the interoperability, if not the fusion, of crypto-metaverses[76],** and if Decentraland and The Sandbox have not yet connected, it is only because demand for virtual content has not yet reached sufficient critical mass. However, **when the bridges between each dimension are established, UX and UI will play a crucial role in determining the entry point into the Web3 galaxy.** Moreover, the aggregation of exchange platforms and protocols is already under way, including but also beyond DeFi (see image below).



74. Your Content Clause Explained – Discord
75. Content rights management | Pinterest help
76. Imagine a room with several doors, each leading to a metaverse such as Decentraland or The Sandbox. This would preserve the integrity of each space while ensuring an interconnection between the different dimensions

Meta could draw on an open model to become the main gateway to tomorrow's metaverse. But it is unlikely the Menlo Park group will take this path. The cryptocurrency Diem, for example, which is expected to play a central role in the future Meta ecosystem, circulates on a private infrastructure with the association that manages its operation governed by a limited number of multinationals.

Unless it can create an all-in-one dimension built entirely on its products and services, **Meta will probably opt to collaborate with other Web2 champions, as in the case of the Libra/Diem project.** Indeed, interoperability with the solutions of other tech or financial players will enable Meta to add more value to its virtual environment (and reduce the risks of it being dismantled), despite remaining closed and private. This will involve understanding which companies will be allies and which will be competitors. It is likely, for example, that Meta will be open to partnerships with Microsoft, which has already shown an interest in metaverse opportunities[77]. On the other hand, Apple could be a natural enemy of Meta as both companies are already positioned in the market for VR/AR hardware solutions (headsets, glasses, etc.)[78].

In conclusion, **it is worth noting that the hybridisation of the metaverse could also occur in the opposite direction: open metaverses could evolve towards centralised models, particularly for UX/UI purposes.** For example, in the short term, identity management may be used by players like Coinbase, with millions of customers and custodial and non-custodial solutions, to enter this market. While it would not in this case be a Web2 giant but rather a new crypto champion, such as Kraken, Binance, etc., it would somehow replicate the GAFAM model in terms of centralisation. Better suited to public blockchain infrastructures, such players would have nothing to fear but the growth of a decentralised alternative to their key management model, such as the Argent wallet which incorporates scalability solutions (see part 3). In this regard, **the development of decentralised identity solutions should be monitored, as they are intended to play a leading role in Web3[79].** Their mass adoption will depend on the ability to create digital "passports" that ensure not only very low costs and ownership rights over personal data, but also high standards in terms of UX/UI and security.

77. Microsoft muscles into the metaverse with Teams updates and Xbox upgrades (cointelegraph.com)
78. Apple AR glasses are nearly ready for your eyes, says key investment group | TechRadar et New Apple Mixed-Reality Headset Details: Swappable Headbands, Eye-Tracking - The Information
79. Decentralized Identity: Passport to Web3 | by Amber Group | Amber Group | Nov, 2021 | Medium

In summary:

- **Tokenisation has led to the emergence of the content economy (Web3), a new internet model enabling users to retain ownership of the content they generate through their online activity.**
- By virtue of the possibility of representing any asset in token form, **metaverses offer virtual spaces where all online activities can converge,** from gaming to cultural events and from e-commerce to social interactions.
- Although tokenisation favours the financialisation of a large number of industries, demand for non-financialised activities and services will not cease to exist (e. g. the future of the gaming industry facing the growth of the play-to-earn model).
- Web2 giants such as Meta (formerly Facebook) are interested in metaverses and the opportunities offered by Web3. So far, however, their centralised models seem incompatible with the core features of Web3, namely open networks and interoperability.

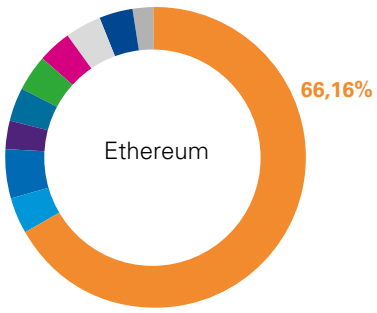

ETH
Ethereum
LTC
Litecoin
XRP
Ripple

Emergence of technical solutions for the scaling of crypto products

Emergence of technical solutions for the scaling of crypto products

A multi-chain world in which the Ethereum standard looms large

In 2021, the market confirmed **Ethereum** as the favoured **smart contracts** blockchain by number of users (20 million active addresses via the Metamask wallet[80]), developers and applications. The Ethereum ecosystem also outperformed its competitors in terms of liquidity, with $163 billion[81] of value locked in the smart contracts, representing 66% of the value across all blockchains (see chart below)

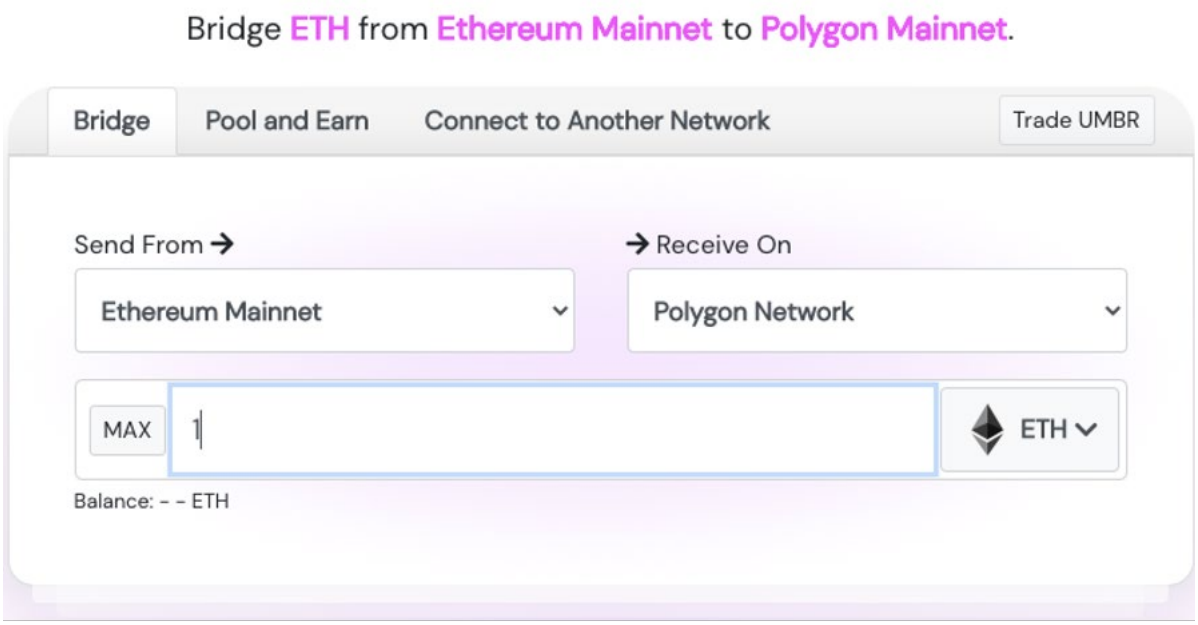


Source : DefiLlama - DeFi Dashboard

However, a victim of its own success, **the Ethereum blockchain now has to deal with an increasing number of transactions, which has led to an increase in the fees paid by users to ensure a quick processing of transactions.** This network congestion poses **an obstacle for products looking to conquer a market with several million users.** The issue of scalability is thus crucial, bearing in mind that Ethereum's theoretical capacity is 15 transactions per second (TPS) compared with 65,000 TPS for the Visa network, for example[82].

It is therefore difficult to base applications such as DeFi protocols, NFT platforms, decentralised games, or social networks on Ethereum, on which usage costs to obtain (almost) immediate processing of a transaction are very high (several tens of dollars for a swap at the time of writing this report). For example, French unicorn Sorare was forced to adapt its infrastructure as its business model involved covering the costs of creating and transferring Sorare cards (NFTs, $30 to $40 for a transfer).

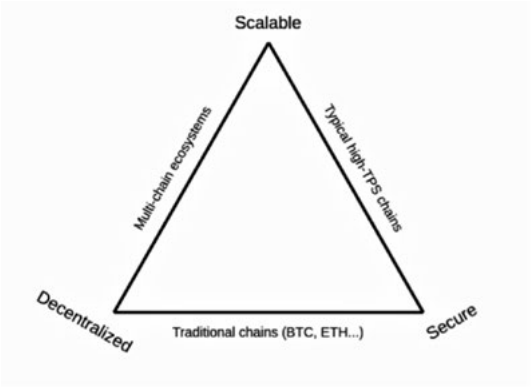
Alternative blockchains have emerged on foot of the saturation of the Ethereum network: independent first-layer (L1) infrastructures, **sidechains** (that use the Ethereum programming language) and **plasma chains** (anchored sidechains[83]). Some are compatible with the Ethereum Virtual Machine (EVM), i.e. they share the same structure and computer language as Ethereum (Polygon PoS, BSC, Avalanche), while others are not (Terra, Solana). In both cases, to transfer funds or call smart contracts from different chains, so-called "bridges" that link these different infrastructures are needed. The image below shows a bridge from the Ethereum network to the Polygon network for the transfer of 1 ETH.



Source : Bridge Ethereum (ETH) from Ethereum Mainnet to Polygon Mainnet. (umbria.network)

80. MetaMask - A crypto wallet & gateway to blockchain apps
81. Ethereum TVL - DefiLlama
82. IGFX_Inside-Visa_v09082017_abridged_digital This, however, should be seen in relative terms insofar as we are comparing an exhaustive autonomous network, which includes its own unit of account, transaction payment and final settlement system (Ethereum) with a network such as Visa which is only one part or scheme in a bigger system.
83. Understanding: Plasma Chains vs. Sidechains - @pigi documentation

These alternative blockchains promise a higher level of scalability, and therefore lower costs. However, **such a choice often comes at the expense of the other two features of the "decentralisation, scalability, security"** trilemma.



The scalability trilemma, illustrated. Credits: Vitalik Buterin

In concrete terms, if the consensus of an Ethereum sidechain, such as Polygon, fails, it is possible that the user will not find their funds on the Ethereum chain. What's more, the Polygon consensus is weaker than that of Ethereum.

These alternative blockchains have their own validation methods which are not always as decentralised as that of Ethereum (Proof of Work at present but set to change to Proof of Stake with Ethereum 2.0). Some centralise transaction validation in the hands of a few players, making the network less secure, resilient and censorship resistant.

For example, the Solana blockchain experienced 17 hours of interruption in October 2021[84] and security flaws were detected[85]. Other blockchains have secure or comparable validation methods in theory, but in practice they struggle to achieve critical decentralisation to validate this security; for instance, the Binance Smart Chain (BSC) which has 21 validators on the main net[86].

The multiplication of layer 1 blockchains has brought with it the issue of **liquidity dispersion.** When a DeFi protocol is deployed on several blockchains, this disperses liquidity across different media and **slows down the composability of applications,** i.e. the interaction of several applications between each other and the possibility of arranging them simply to build complex services.

In addition, **the use of a bridge** to transfer funds from one blockchain to another hinders **the user experience,** a crucial point that has already been broadly raised in this ecosystem.

However, these layer 1 blockchains, which are competitors of Ethereum, benefit from a window of opportunity as Ethereum reaches record transaction costs, caused in particular by the growing use of NFTs and DeFi protocols (450% increase in TVL between January and December 2021). In this regard, Polygon PoS stands out on the market: a large number of applications such as Aave, Curve and Balancer have already partially or totally migrated to Polygon. On the RampDefi application (see image below), it is possible to choose between three (and soon five) networks.

84. Solana Network Outage and Proof of Stake Blockchains (beincrypto.com)
85. Un bug lié à la blockchain Solana (SOL) aurait pu causer la perte de centaines de millions de dollars (cryptoast.fr)
86. https://academy.binance.com/en/articles/a-quick-guide-to-bnb-staking-on-binance-smart-chain-bsc

Jarvis Network, for example, launched the first **decentralised on-chain forex** market on Polygon in partnership with Swiss company Mt Pelerin, to create a bridge between traditional finance and decentralised finance. It is now possible to access DeFi using euros, the pound sterling, the Polish zloty or other local currencies, **free of charge,** and to exchange them **without slippage** (1:1) for the USDC, the preferred stablecoin for accessing DeFi protocols.

To cite another example,Sky Mavis, the company behind the Axie Infinity, game, has migrated its activity to the Ronin sidechain, created on an ad hoc basis with the sole aim of increasing scalability and enabling greater use of the game. A bridge is also possible to trade tokens won in the game on other L1 infrastructures.

The interoperability of these layer 1 blockchains is becoming an increasingly important factor in allowing liquidity to move and applications to be composable. However, the security of bridges, which are governed by smart contracts, also needs to be monitored to avoid the risk of hacks.

To try and resolve the interoperability issue, a few blockchains were created to serve as **"decentralised hubs"** on which several sub-blockchains are directly interconnected and can thus communicate more easily with each other (transfers, cross-chain smart contract calls, etc.). The most developed examples are the Cosmos and Polkadot[87] blockchains.

Furthermore, sidechains are starting to experience the same scalability issues: Polygon's costs have recently increased[88] as a result of spam made possible by almost zero transaction fees[89] and, more broadly, because of the increasing activity on the network. We therefore find it **difficult to imagine a layer 1 blockchain capable of absorbing a large number of transactions while also offering network security and decentralisation.** For this reason, the layer 2 scalability solutions currently being developed on Ethereum offer the best prospects.

We feel the **multiplication of layer 1 blockchain protocols may be a pipe dream: it frequently happens that as soon as they become more successful, they meet the same problems as Ethereum or Bitcoin before them, or simply compromise the very purpose of cryptos,** i.e. to allow uncensored peer-to-peer exchange of value on a decentralised and secure network.

87. Cosmos vs. Polkadot. A comparison of two multi-chain… | by Gaurav Agrawal | QuikNode | Medium
88. Polygon PoS Chain Average Gas Price Chart | PolygonScan
89. Polygon to Raise Network Fees as a Measure Against Spam Transactions (yahoo.com)

Layer 2 solutions for more efficient applications

The Ethereum community, the most active in the ecosystem, regularly proposes improvements to the main protocol and is today discussing the transition from Proof of Work to Proof of Stake[90]. This update is also expected to introduce "data sharding" which would significantly increase the number of transactions per second (100k per second at the end of the decade[91]) and thus reduce costs. However, this update, often referred to as "The Merge", has yet to be achieved and urgent scalability solutions, such as a **layer 2 rollup solution,** are needed to reduce transaction costs at the same time.

By way of illustration, the image below shows the cost of exchanging one token for another on the Ethereum network ($19.77) versus an L2 scalability solution ($0.48 for ZKSync), bearing in mind that L2 costs are likely to fall much further in the months and years to come.

Source : L2Fees.info

90. Ethereum Proof of Stake - EthHub
91. Hence, rollups that use eth2 sharded data can collectively process as much as ~100k TPS, and even more in the future. An Incomplete Guide to Rollups (vitalik.ca)

To date, Ethereum is "monolithic", meaning that consensus, execution and data storage functions must be integrated in layer 1, which causes the network to congest. **L2 solutions move execution and data storage outside the chain, making Ethereum modular.**

- Rollups are layer 2 technologies that inherit the security of the network to which they correspond, while increasing the transactions validated per second and reducing transaction costs. They seem to be the best compromise[92] to meet the requirements of the trilemma Scalability-Security-Decentralisation.
- In short, rollups execute transactions outside the main Ethereum chain (off-chain) and compress the results of these transactions, recording them on the Ethereum layer 1 for verification. **This significantly reduces the number of data stored on layer 1, and therefore transaction fees.**
- Ultimately, the migration of L1 applications to L2 rollups combined with the updating of the Ethereum protocol (to PoS + data sharding) could increase scalability to the point of reaching the VISA transaction rate (65k TPS[93]), according to Vitalik Buterin[94], Ethereum's founder.

A word of caution, however, because, like other blockchains, Ethereum may promise a lot but actual implementation might be subject to delays on its roadmap.

In the meantime, **two types of rollup** can be observed, which differ in terms of the location of data storage (on-/off-chain) and the transaction verification mechanism.

Optimistic rollups have been more widespread to date given their maturity as a solution. However, their main disadvantage is the time needed to withdraw funds (cross-layer transactions).

The leading optimistic rollup is **Arbitrum,** developed by Off Chain Labs, with **2.5 billion TVL** and deployed on **60 applications,** including:

- **decentralised exchanges** (DEXs) such as Curve, a stablecoin trading platform, and AnySwap, a cross-chain exchange platform (e.g. exchange of 100 USDC from Ethereum L1 to Arbitrum)
- **decentralised investment platforms,** such as Badger DAO, a protocol that offers returns on Bitcoin in DeFi
- **Web2 companies** such as Reddit, which encourages contributions from users: active users receive Community Points (tokens) that allow them to vote in surveys, send tips to content creators and moderate[95] posts.

On the other hand, **zero-knowledge rollups (zkrollups)** seem to be the most promising solution for the scalability of Ethereum and any L1 chain in general. However, they are difficult to implement due to the technical skills required.

Of note among the ZK rollups already widely used is **Starkware** and its **StarkEx** (and recently StarkNet) solution, which has $1.2 billion of TVL[96] and is used for:

- **Minting and trading NFTs:**
  - Sorare and its NFT cards linked to football players and their actual performances migrated from Ethereum L1 to StarkEx[97] (L2), as the application pays for all network costs for the users, which could be higher than the price of the card on L1. The saturation of Ethereum thus weakened its business model.

92. Addressing common rollup misconceptions | by Polynya | Medium
93. IGFX_Inside-Visa_v09082017_abridged_digital
94. Why rollups + data shards are the only sustainable solution for high scalability - r/ethtrader (libredd.it)
95. Reddit Plans To Onboard 500 Million Users To Web3 Via Ethereum's Arbitrum - CryptoTicker
96. L2BEAT – The state of the layer two ecosystem
97. Scaling Sorare on Ethereum with StarkWare | by Pierre Duperrin | Sorare | Medium

- Immutable raised $83 million last September[98] to develop the implementation of a scalability solution. Its product, Immutable X, is an application for minting and trading NFTs on Ethereum at zero cost (supported by Immutable), without compromising the security of the NFTs. Immutable X offers a decentralised alternative to the centralised colossus OpenSea[99].
- The social network TikTok (Web2) also uses Immutable X to tokenise Top Moments, as well as to enable artists to monetise their work on the platform (traffic of 1 billion per month[100]).

- **Derivatives trading:** DYdX, a derivatives trading platform, has a volume of five million transactions per week[101] and $880m of TVL[102]. The Ethereum network is theoretically capable of absorbing nine million transactions per week, while the dYdX platform already "consumes" more than half of this capacity.

However, zkrollups have a specific programming language that is not really compatible with Ethereum's smart contracts (Solidity). The community is therefore looking very closely at two solutions that could solve this interoperability issue.

On the one hand, StarkWare is developing **StarkNet, whose value proposition aims** at **improving composability,** i.e. the interaction between applications, while Matter Labs is developing **ZkSync,** which is compatible with the Ethereum language.

ZkSync offers more flexibility for very low transaction fees on any asset, such as DAI or USDC. A transfer currently costs $0.20 but costs will decrease as adoption of the solution increases. The integration of ZkSync into the Argent smart-contract wallet also facilitates the user experience; for instance, users can exchange fiat currency directly for cryptos via the Argent wallet[103].

The **relevance of these technologies** and the highly-skilled **specialist teams** (including cryptography coders[104]) associated with the StarkWare and Matter Labs projects confirm the robustness of the zkrollups they are developing. Debates[105] within the community and initial trends on this market suggest that **these solutions will be increasingly adopted as their level of maturity grows.**

The chart below shows that the companies developing these solutions have raised significant funds since 2019 (600 million) to optimise their layer 2 products.

98. NFT trading: Immutable raises $82 million for creating and selling non-fungible tokens (afr.com)
99. NFT trader OpenSea bans insider trading after employee rakes in profit | Non-fungible tokens (NFTs) | The Guardian
100. TikTok attracts 1 billion users each month - Forbes France
101. dYdX
102. dYdX – L2BEAT
103. Argent + zkSync: A Peer-to-Peer Electronic Cash System dream comes to life | by Polynya | Medium
104. https://twitter.com/dareal_sisyphe/status/1469242568982642690?s=20
105. Supercycled on Twitter : «1/ Saying that zk rollups will be huge is an understatement Two beasts have been working on this tech in the background for YEARS. Their time to shine is imminent. What opportunities? What differences? Wen token? A on @zksync vs @StarkWareLtd https://t.co/zEbTHMMWej» / Twitter

Funding amounts have been summed since 2019

It would also appear that the aforementioned alternative blockchains are turning to zkrollups to increase their scalability over time (e.g. Polygon PoS[106], Tezos). We are therefore entering an ecosystem which is fragmented between several chains and several layers within these chains.

In summary:

- **A multi-chain world has emerged to deal with Ethereum saturation. However, in the long term, all L1 blockchains will have scalability issues unless they compromise significantly in the area of security.** This is hindering the entry of new players and the development of applications.
- **Ethereum has proven itself as a robust infrastructure, but needs to move some functions to layer 2.** We believe that scalability solutions, in particular zkrollups, will help to decongest the network without compromising too much in terms of decentralisation and security.
- Application creators and users will have to deal with a cross-chain and cross-layer ecosystem. The challenge over the coming months will therefore be to improve interoperability.

106. Polygon Takes A Major Lead In ZK Rollups; Welcomes Mir, A Groundbreaking ZK Startup In A $400M Deal — Polygon | Blog

Focus: Cryptocurrencies and the financial sector

Although the disintermediation of financial transactions is one of the core features of the bitcoin and cryptocurrency philosophy, traditional financial players stand to benefit from understanding the objectives of this decentralised economy so that they can position themselves in the value chain.

After numerous market confirmations, 2021 has demonstrated to historic institutions, even those most hostile to cryptoassets, that the nature of the challenge has changed: **it is now riskier not to be part of this crypto universe than to join it.** For companies, it is not a question of identifying use cases but rather of becoming informed as soon as possible to be able to determine a strategy around a subject that goes far beyond the technical debates.

The following section illustrates, in a concise and non-exhaustive manner, the major challenges posed by the rise of cryptocurrencies and tokenisation in each of the main financial service business lines.

Payments

Everywhere in the world, **it is becoming increasingly easy for individuals to pay for their purchases in cryptocurrencies.** The payment giants are positioning themselves: not just PayPal[107] but Worldline[108], Visa[109], Mastercard[110], and many others.

Scalability solutions such as Lightning Network for Bitcoin (adopted in El Salvador) and zkrollups for Ethereum (see Part 3 of the report) **were launched to enable blockchain networks to process a very large number of transactions almost instantaneously and at minimal costs.** We can expect these solutions to be successfully implemented on a large scale in 2022.

In view of this, the payments sector will soon be permanently affected by the crypto revolution. The first segment to be targeted, and which has already been heavily impacted, is international remittances and money transfers, in which cryptocurrencies offer considerable advantages (processing times, transaction costs, etc.). For payment players, **the first gateway to the crypto world are stablecoins,** which offer the advantages of cryptocurrencies without their volatility.

Investment (including asset management, wealth management, etc.)

Two major trends are impacting investment businesses in particular. Firstly, more and **more individuals and companies are buying bitcoin and ether** (as well as other cryptocurrencies) **to diversify their investments and bet on an increase in their prices.** Bitcoin, in particular, seems to be increasingly used as a safe haven, like gold: between 12% and 16% of Americans are estimated to own cryptocurrencies in December 2021[111]. In France, regulated players such as Coinhouse already offer crypto savings plans at 6.5% per year[112].

Secondly, **decentralised finance (DeFi) is growing rapidly** and offers an alternative to the financial services of traditional players. At 13 December 2021, DeFi[113] protocols managed more than $246 billion. In this ecosystem, **very attractive investment opportunities can easily be found, with high interest rates** made possible not only by the inflationary strategy of certain protocols, but also by the considerable savings (in terms of costs) which a decentralised and automated model enables. More and more retail and corporate investors are turning to DeFi, including through regulated third-party players such as Coinbase, which now offer access to the DeFi Compound Treasury service.

Credit

DeFi also provides access to loans using cryptocurrencies or NFTs as collateral. In an experiment with the MakerDAO protocol, Societe Generale (Forge) borrowed $20 million in DeFi[114], using traditional financial securities in token format as collateral.

In addition, DeFi protocols such as Aave or Compound are in the process of creating **liquidity pools that only players who have passed through KYC/KYB controls can access.** Through these pools, it is possible to borrow money securely, in cryptocurrency or traditional fiat currency, as a service provider such as Fireblocks provides conversion and matchmaking.

107. PayPal will let US users pay with Bitcoin, Ethereum, and Litecoin starting today - The Verge
108. Worldline and Bitcoin Suisse launch WL Crypto Payments in Switzerland - IBS Intelligence
109. Visa Adds Cryptocurrency to Its Settlement Platform (investopedia.com), Visa Adds Cryptocurrency to Its Settlement Platform (investopedia.com) and Crypto | Money is evolving | Visa
110. Mastercard Partners with Leading Digital Currency Companies Across Asia Pacific to Launch the Region's First Crypto-Linked Payment Cards, Mastercard Teams Up With Three Asian Crypto Companies To Launch Bitcoin Payment Cards (forbes.com) and Why Mastercard is bringing crypto onto its network
111. See footnote number 49
112. Crypto Coinhouse savings passbook | Coinhouse
113. DefiLlama - DeFi Dashboard
114. See Forge experiment (Societe Generale) with MakerDAO DeFi protocol Societe Generale Applies for $20M MakerDAO Loan Using Bond Token Collateral (coindesk.com)

Real Estate

Tokenisation allows real estate assets to be represented on blockchain. **In the form of tokens, real estate assets acquire the characteristics of cryptocurrencies, with major advantages in terms of liquidity, transferability (including via automatic exchanges using smart contracts), fractionability and traceability**, all on a secure, stable and global infrastructure. Many such projects are currently emerging[115].

Real estate is also expanding in the blockchain technology-based 3D virtual worlds known as "metaverses" (see Part 2 of this report). **Crypto-metaverses such as Decentraland have created land registry systems and sell plots** on which it is possible to construct any type of building, from an embassy (see Barbados State Project)[116] to the headquarters of a company (Consensys[117], among others), a casino (such as that of Atari[118]) and an art gallery (Sotheby's gallery in particular[120]). The price of these plots is currently soaring and **millions[119] are already being invested in virtual real estate.**

Custody/account keeping

The growth of the crypto industry has brought with it a multiplication of wallet solutions to securely store amounts in cryptocurrency. This in turn has created a new market segment for capture by account-keeping specialists. While it may be true that traditional players know less about the crypto ecosystem than pure players like exchange platforms (Coinbase, etc.), **traditional institutions like banks have recognised expertise in regulations, which could be a real advantage** as the crypto industry undergoes the process of institutionalisation. These challenges are all the more obvious in France, where custody players must obtain a PSAN license[121] to provide crypto account-keeping services.

Insurance

New industries inevitably bring with them new risks. The crypto industry is no exception, and major opportunities are opening up for historic insurance players. For example, DeFi protocols are exposed to significant cybersecurity risks, as they are often targeted by hackers. Similarly, cryptocurrency storage services, both in hardware (Ledger) and via dematerialised portfolios (Coinbase, Kraken, etc.), need to protect the amounts they store.

115. Codefi Case Study Download: Mata Capital (consensys.net)
116. Why Barbados' Metaverse Embassy Matters (coindesk.com)
117. ConsenSys Opens Headquarters in Decentraland - NFT Plazas
118. Lancement du Casino Atari avec une fête sur Decentraland - BeinCrypto France
119. Sotheby's opens a virtual gallery in Decentraland | Decentraland
120. Virtual real estate plot sells for record $2.4 million | Reuters

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