

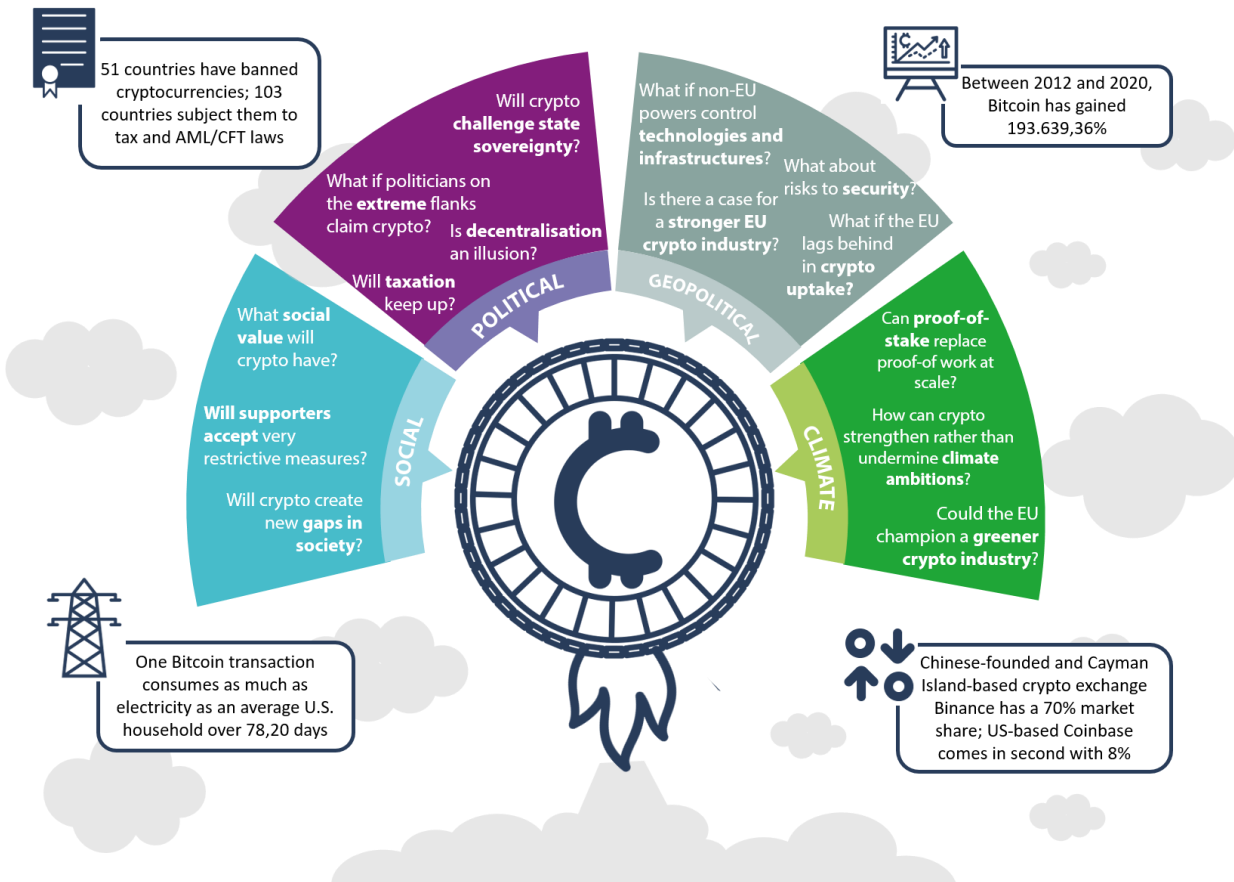


ART ANALYSIS AND RESEARCH TEAM

26 April 2022

The crypto assets ecosystem Suspicion, regulation, expansion?

Challenges and opportunities of a hybrid currency landscape



Source: ART

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EXECUTIVE SUMMARY

- **What is the problem that crypto assets are trying to solve? So far that is not clear. But private crypto assets and their ecosystem** - including crypto currencies, tokens, decentralised finance, and the enabling blockchain technology - **are booming.**
- Bitcoin still tends to be seen as synonymous with crypto assets (by both supporters and detractors), but its dominant role distracts attention from the very rapid expansion of the crypto sector as a whole. The growing adoption and active trading of crypto currencies by the financial sector has also generated only limited interest. Yet the **mainstreaming of crypto** into the financial system in Europe and beyond is accelerating, and this poses a series of challenges for governments. This is an innovation which is happening at unprecedented speed, and policy-makers need to **harness these developments to ensure they function in the wider interest.**
- To date, and for good reason, the political debate has focussed on how to reduce the potential risks to financial stability and monetary policy without stifling innovation. At the same time, preparations are underway on central bank digital currencies (CBDC), with the ECB working on the design of a digital euro. The aim of this paper is to look beyond the technical and financial stability aspects of crypto, and focus rather on the **(geo)political, social and environmental implications.**
- Although detailed information on both the crypto industry and its users is hard to come by, **Europeans seem to be attracted to the crypto market for various reasons:** the promise of quick profit at a time when savings are producing low yields and inflation is high, the lack of confidence in the traditional financial system in the wake of the financial crisis, the attraction of a system which removes the need for intermediaries, and a desire to avoid oversight by governments and corporates.
- Elsewhere in the world **crypto assets are being adopted more quickly and for rather different reasons, including by some governments.** In some developing economies they form an attractive alternative to weak state-backed currencies by offering greater price stability and making cross-border transactions much easier. They can also serve as a way of avoiding financial sanctions.
- **Both the US and China have taken a strategic approach to crypto-assets,** although their policies are very different. China has banned cryptocurrencies, whereas the US takes an open and rather positive view. **The EU is actively working on regulation, but has no overall strategy.**
- Crypto asset markets can bring increased political influence, wealth generation, a vibrant business environment, trade advantages and tax benefits for governments. **But they also bring significant challenges:**
 - **Politically,** an extensive crypto ecosystem, through its power to issue currency and impact on monetary policy risks undermining state sovereignty, pitting non-state actors against national governments. Some turn to crypto because they distrust centralised institutions. This may open the way to extremists at both ends of the political spectrum to exploit the domain of crypto.
 - **Socially,** there could well be a growing economic and social divide between users and non-users, not least along generational lines. The ideological element of crypto use also means that a clamp-down on its use could trigger a backlash, especially if it is seen by users as a legitimate alternative to traditional banking services.
 - **Geopolitically,** crypto can create risks for the EU, particularly if non-EU powers take control of crypto technology, standards and infrastructure. But a proactive approach by the EU could generate a thriving and competitive EU crypto industry offering the potential for economic growth and job creation.
 - **Environmentally,** crypto's heavy use of energy resources is a drag on the fight against climate change. But there is an opportunity for Europe to take the lead in developing a greener crypto industry.
- **Against this background, it is crucial to have a political debate on crypto that looks not only at the financial dimension, but also takes into account (geo)political, social and environmental aspects. That is the only way of understanding the challenges posed by crypto assets, but more importantly of harnessing their potential to ensure that they work for the benefit of society as a whole.**

I. INTRODUCTION

The public debate on crypto in general and Bitcoin in particular is polarised. Enthusiastic supporters face criticism from opponents, and there seems to be little room for nuance. For the moment, the benefits of crypto for society as a whole appear limited, and the environmental footprint of proof-of-work blockchains is very harmful. Nevertheless, **crypto use is booming**: the number of individual investors is growing, and ever more companies are getting into the business of crypto payments and non-fungible tokens (NFTs). But a combination of technical complexity and crypto slang creates a barrier for non-specialists. This paper aims at describing the current landscape

and sets out a number of social, (geo)political and environmental challenges for the future. It focuses on crypto assets and does not offer a detailed analysis of Central Bank Digital Currencies.

The paper begins by describing the wider crypto landscape (section II), whereas the following sections III and IV further delve into crypto-users and the crypto-industry. Section V focuses on the political, social, geopolitical and environmental dimensions of the crypto ecosystem.

A glossary in the Annex contains explanations of the terms that appear in **orange** when they first appear in the text.

II. THE CRYPTO ASSETS ECOSYSTEM

In a nutshell...

- The size and delimitation of the crypto assets market is difficult to measure given its continuous evolution and extreme volatility. Regulators are struggling to classify these new assets.
- Beyond the search for commonly agreed definitions, it is clear that – even though its size remains modest when compared to stock markets – the whole family of crypto assets is experiencing exponential growth, not only because of their popularity for speculation, but also thanks to their enabling function for other applications such as decentralised finance (DeFi).
- In terms of DeFi, Europe has a strong cryptocurrency economy. Nevertheless, as far as consumer adoption is concerned, other parts of the world take the lead.
- Worldwide, regulation is under discussion or being adopted. This focuses primarily on addressing the financial risks posed by crypto.

1. What is it? From cryptocurrencies to crypto assets.

Cryptocurrencies are a form of generally peer-to-peer, decentralised, digital cash. Encryption techniques are used to regulate the generation of units of a cryptocurrency and to verify transactions, which are registered with **Distributed Ledger Technology (DLT)** – a system of records that is maintained across several computers in a network, with each computer having a copy of the whole register (also known as a blockchain). In short, it constitutes a decentralised database of token statuses. All crypto transactions are recorded in the blockchain, so in theory they are traceable, albeit not effortlessly. **Cryptocurrencies can broadly be organised into three categories: bitcoin and altcoins, stablecoins, and Central Bank Digital Currencies (CBDCs).**

Cryptocurrencies really emerged with the Bitcoin as an alternative to existing currency or a store of value after the 2008 financial crisis (Nakamoto White Paper, October 2008). Bitcoin is both the name of the coin and of the automated protocol. Described by sci-fi authors (*Snow Crash*, 1992¹), early attempts at private electronic currencies based on cryptographic protocols appeared with Digicash (1989), HashCash (1997) and B-Money (1998). Bitcoin was first used to purchase a tangible asset back in 2010 (USD 25 worth of pizza for 10 000 BTC). The founders of the first cryptocurrencies, known as “cypherpunks”, considered that the privacy of everyone’s transactions should be guaranteed through encryption.

Altcoin” emerged as a generic term for all cryptocurrencies other than Bitcoin. It is either derived from Bitcoin blockchain (Litecoin, Dogecoin...) or is based on a native blockchain, in particular Ethereum, which uses the coin Ether as a token for validating transactions, as a platform for **Decentralised App (DApp)** and for automated transactions called **“Smart contract”**. “Privacy coins”, such as Monero (2014) or Z-Cash (2016), subsequently emerged with the promise of fully anonymous transactions.

As a second category, **“Stablecoin”**, backed by fiat currencies, (a basket of) commodities, or other cryptocurrencies, arose as a response to the volatility in the price of cryptocurrencies (the most important one, Tether or USDT, backed by the USD, was launched in 2014).

In response to developments in blockchain technology and crypto-markets, governments worldwide are at different stages of developing a third category of cryptocurrencies: **Central Bank Digital Currency (CBDC)**. Aside from a few outliers – the digital renminbi or the sand dollar in the

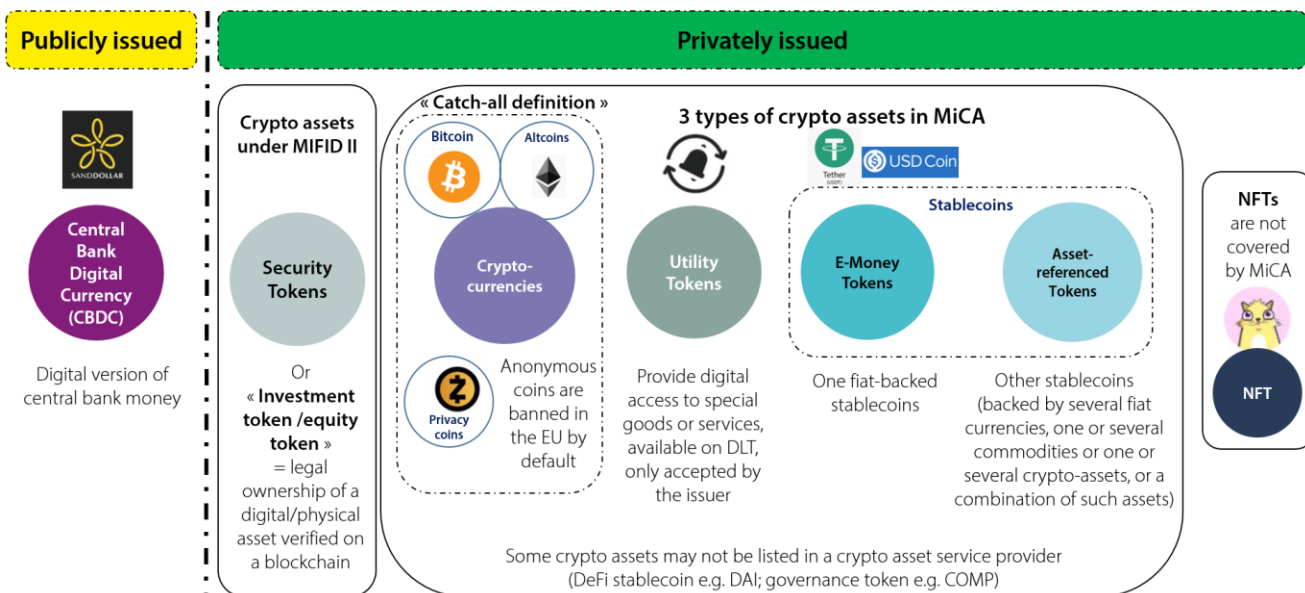
Bahamas – most CBDC projects (including the digital USD², rouble or euro³) are still under discussion, and a long way from being realised. Crypto assets are fundamentally different from CBDCs, not least because they are privately owned or decentralised, unlike fiat currencies of CBDCs, which have the backing of a central bank.

In parallel, digital tokens began to spread (payment tokens, utility tokens or security tokens), including **Non-fungible tokens (NFTs)**, which are paid with cryptocurrencies.

Whether or not cryptocurrencies qualify as a form of money is an ongoing debate, and different regulators classify cryptocurrencies differently⁴. The **EU legislative proposal for the Markets in Crypto-Assets regulation (‘MiCA proposal’)⁵ focuses on the comprehensive family of Crypto assets**, without mentioning cryptocurrencies⁶. Crypto assets all combine cryptographic and distributed ledger technologies (blockchains), which together provide a foundation for decentralised, peer-to-peer payments.

Figure 1: Crypto assets classification

“Crypto-asset” means a digital representation of value or rights which may be transferred and stored electronically, using distributed ledger technology or similar technology.” (Art 3(2) MiCA proposal)



Source: ART (inspired by ADAN⁷)

The **decentralised nature of crypto also entails the absence of a central governance system**. Different cryptocurrencies have different governance frameworks: on-chain governance (where decision-making takes place within the

blockchain system through code updates to the blockchain protocol which users accept or reject), off-chain governance (where decisions are discussed and taken outside the blockchain system), or hybrid models.

2. Where is it?

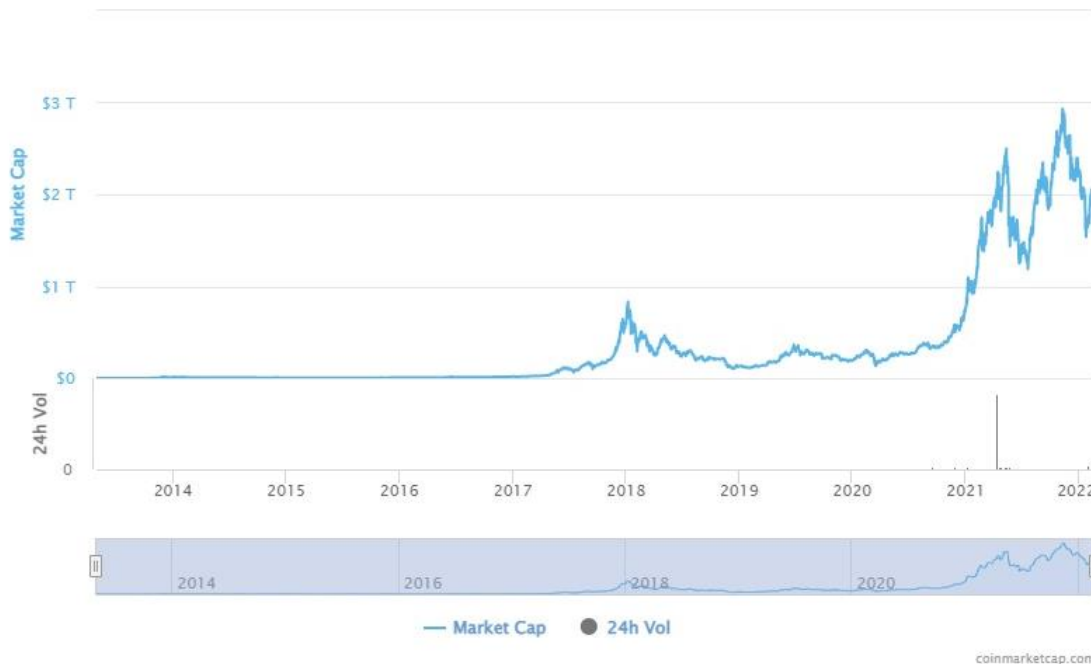
Any assumption that cryptocurrencies are no more than a digital replacement of a traditional currency would be to ignore the **dynamics of the wider crypto asset ecosystem**, which is hard to pin down. This ecosystem is enabled by blockchain technology and is the driving force behind disintermediated peer-to-peer transactions and **Decentralised Finance (DeFi)** applications. It is an enabler for the current transition to **Stablecoin**: a type of crypto asset that aims to maintain a stable value relative to a specified asset or a pool of assets.

Web 3.0⁸, and for the potential **Metaverse**⁹. It is regarded as contributing to the “gamification” of trading¹⁰, yet at the same time, institutional investors and banks are increasingly investing in crypto assets and blockchain-related companies¹¹. In fact, in Europe, institutional investors are now dominant in (active) trades. According to Coinbase Global data, institutional investments soared from USD 120 billion in 2020 to USD 1.14 trillion in 2021, compared to USD 535 billion by retail investors¹². Moreover, crypto transactions are no longer mostly spot transactions: derivatives have also become a dominant part of the market. Crypto derivatives accounted for over 60% of crypto trading in January 2022¹³.

Crypto is booming worldwide and, despite its volatility, has experienced exponential growth rates in recent years. The number of crypto users worldwide was estimated at around 130 million in 2020 (equivalent to the take-up rate of the Internet in 1997), **almost doubling in six months to 221 million in June 2021**¹⁴, and could reach 1 billion users by the end of 2030 if current limitations (technological, financial and political) are reduced. Bitcoin and crypto use is currently growing faster than the internet¹⁵.

Whereas around 1,600 cryptocurrencies were identified in 2018¹⁶, early March 2020, over 5,100 crypto-assets existed on coinmarketcap.com¹⁷. Two years later (10 March 2022), more than **18 130 crypto assets** were listed. In November 2021, the crypto market surpassed the **USD 3.0 trillion mark**¹⁸ for the first time, up from USD 14 billion only five years earlier. It amounted to around **USD 1.8 trillion on 10 March 2022**. This global market capitalisation represents the total value of cryptos in circulation, but does not include the value generated by the companies that produce services in this industry.

Figure 2: Total market capitalisation of all cryptoassets, including stablecoins and tokens



Source: Coinmarketcap.com¹⁹

At the same time, the size of the crypto market remains small in comparison to other, traditional, markets, as shown in Figure 3. In October 2021, the

equities market was more than 50 times larger than the cryptocurrencies market.

Figure 3: Crypto market size versus equities (October 2021)

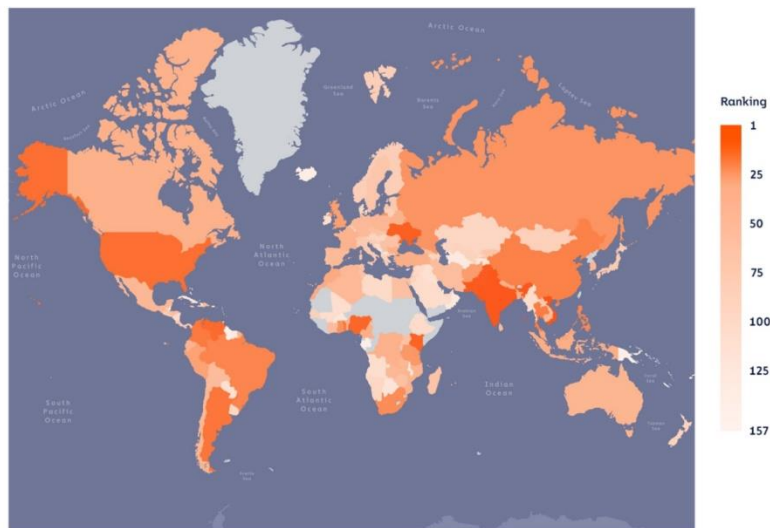


Source: NGRAVE²⁰

As shown in Figure 4, which reflects crypto adoption as a combined result of three different metrics²¹, **crypto adoption in the EU is significantly lower than in other parts of the world**. Several emerging economies – Kenya, Nigeria, Vietnam, Venezuela – rank particularly high because they have large transactions volumes on

peer-to-peer transactions²². Yet Chainalysis considers **Central, Northern and Western Europe, despite the relatively low levels of adoption, to be the biggest cryptocurrency economy in the world**, thanks largely to the growth of DeFi protocols²³. Europe is the biggest cryptocurrency trading partner for every other region²⁴.

Figure 4: Global cryptocurrency adoption index (July 2020-June 2021)

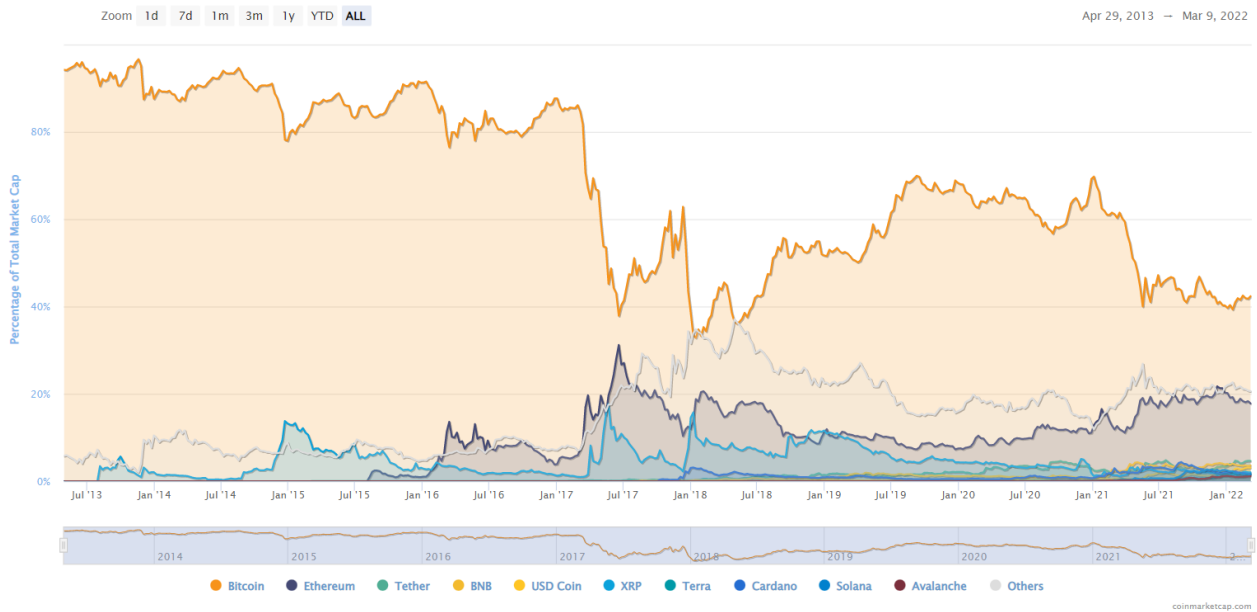


Source: Chainalysis²⁵

Concerning the **types of cryptocurrencies** used in Central, Northern and Western Europe, stablecoin accounts for between 25% and 30% of all transaction volume, and altcoin usage for between 8% and 11%. Bitcoin remains the leading crypto currency, dominating the market with a total

capitalisation in excess of 63% (USD 159 billion) in 2020²⁶. On 7 March 2022, Bitcoin's share in total crypto market capitalization was 42.3%, ahead of Ether (17.7%) and Tether (4.6%), the latter being the main 'stablecoin'.

Figure 5: Ten largest crypto assets by percentage of total market capitalisation of crypto assets ('Bitcoin Dominance Chart')

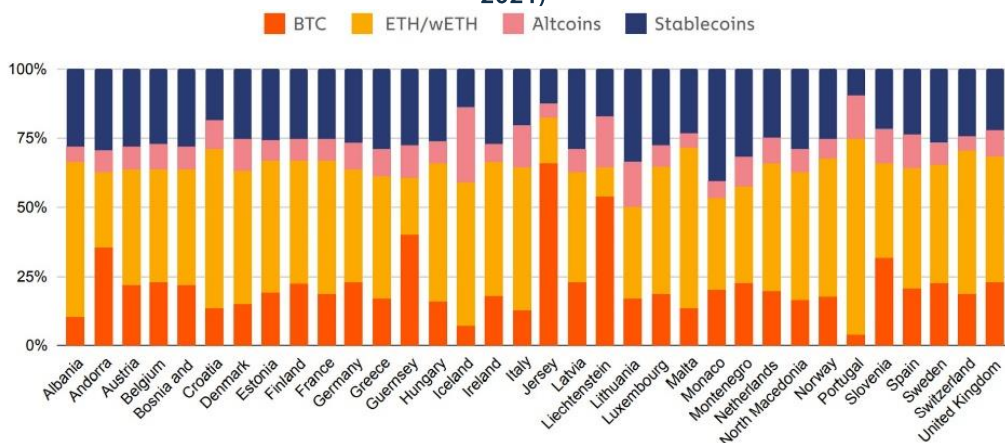


Source: Coinmarketcap.com (9 March 2022)

The breakdown between Bitcoin and Ethereum or Wrapped Ethereum (wETH²⁷) shows more variability. Combined, Ethereum and wETH are the most popular cryptocurrency in nearly every country (linked to the fact that they are the most commonly used on DeFi platforms). It is worth noting that some coins and tokens are designed to fulfil a specific purpose (a reason to use it, for example for payments – like Bitcoin, Ether, Solana, Polygon),

while others have no underlying reason for existing except as a tool of speculation (Dogecoin, Shiba Inu, \$wool) and are highly volatile. Shiba Inu gained 777% over only 30 days in October 2021 before plunging again. Interestingly, **instead of prioritising a single cryptocurrency, users seem to use several for different purposes**²⁸.

Figure 6: Central, Northern & Western European country transaction volume by currency type (July 2020-June 2021)



Source: Chainalysis²⁹

The average holding period of crypto assets is much shorter than that of traditional stocks: whereas the latter are held for 5.5 months on average³⁰, the

median holding period for the 21 largest cryptocurrencies on Coinbase is between 4 days (Wrapped Bitcoin) and 93 days (Litecoin)³¹.

3. Regulation

Worldwide, regulation of crypto assets either already exists or is under discussion. In 2018, the US Library of Congress identified 8 jurisdictions with an absolute ban and 15 jurisdictions with an implicit ban of cryptocurrencies. An update in November 2021 showed there were 9 jurisdictions with an absolute ban and 42 with an implicit ban (bringing the total to **51 countries**). During this same time period, the application of tax laws, anti-money laundering and counterterrorist financing legislation to cryptocurrencies also increased exponentially. The number of jurisdictions applying one or other of these laws to cryptocurrencies **rose from 33 in 2018 to 103 in 2021**, with the majority applying both³².

At EU level, crypto asset activity is already regulated (for example in anti-money laundering legislation). Current legislative proposals (such as the Markets in Crypto-Asset Regulation - MiCA) are set to **further extend the regulatory reach into crypto-markets**. These pieces of regulation focus primarily on the financial and security risks posed by crypto assets, while trying to ensure that crypto asset markets can play a role as a legitimate alternative where traditional financial systems may not be available or operational.

On 9 March 2022, **US President Biden signed an executive order ensuring responsible innovation in digital assets**. The order takes, for the first time, **a whole-of-government approach to addressing the risks and harnessing the potential benefits of digital assets and their underlying technology**. In terms of regulation, it calls, amongst others, for measures to protect US consumers, investors and businesses, protect US and global financial stability, and mitigate both systemic risk and the risk to national security posed

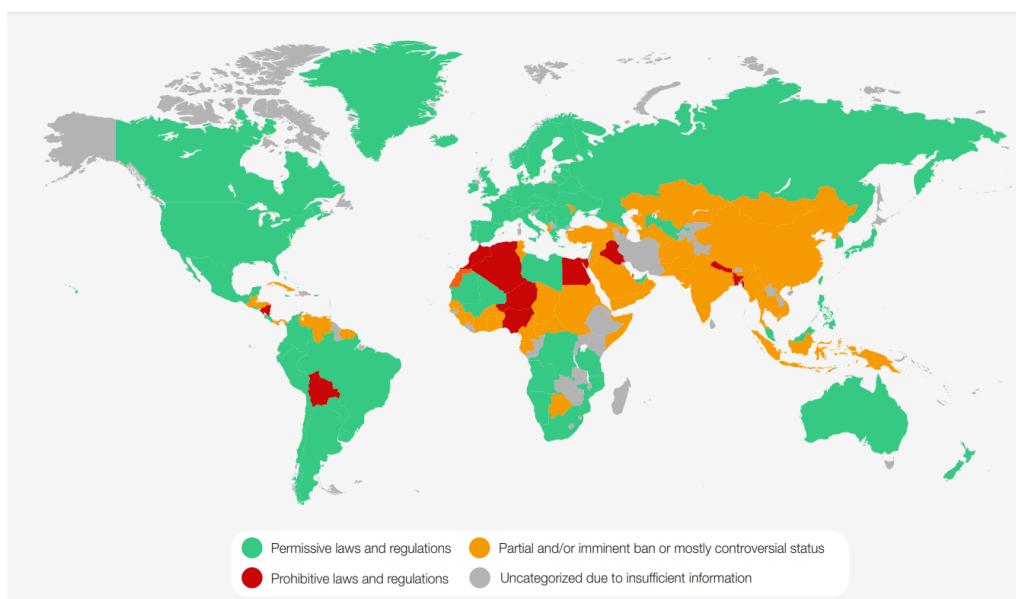
by digital assets³³. At the same time, it aims at promoting US leadership in the sector. It encourages fair access to safe and affordable financial services, and supports technological advances while ensuring responsible development and use.

China was one of the first countries to embrace cryptocurrencies. However in September 2021, the **People's Bank of China banned all cryptocurrency transactions**, citing as a reason their role in facilitating crime and the risk they pose to China's financial system. Observers think that with this ban, the PBOC also tried to combat capital flight from China³⁴ and exert social control over its population.

In **Russia**, cryptocurrencies have legal status but cannot be used to pay for goods and services. In February 2022 the Russian Ministry of Finance put forward **new cryptocurrency regulation**, which the Finance Minister hopes will be approved by the end of 2022. The draft proposes to uphold the ban on crypto payments for goods and services, and introduces a limit on cryptocurrency investments as well as regulation on mining. This does not go as far as the initial suggestion from the Bank of Russia a month earlier when it proposed a blanket ban on cryptocurrencies³⁵.

In **India**, according to Chainalysis, the crypto market grew 641% between July 2020 and June 2021. India banned crypto transactions in 2018, but this was annulled by the Supreme Court in March 2020. In February 2022, **crypto trading was formally recognised but a high levy (30% - which means that crypto is treated in the same way as gambling and speculation) was introduced on income from transactions as a discouragement**³⁶.

Figure 7: Legal status of cryptocurrencies



III. THE USERS' PERSPECTIVE: WHY (NOT) USE CRYPTO ASSETS?

In a nutshell...

- While incomplete data and a differing picture across EU countries make it difficult to describe the average crypto user, it is clear that crypto use has become more mainstream in recent years and is expected to grow.
- The appetite for crypto, notwithstanding well-known risks, is not only financially driven but also socially and politically driven.

It is very clear that in many aspects, crypto assets overpromise and underdeliver – a common feature of new technologies³⁸. This section is not aimed at discussing what crypto assets can and cannot do –

which would in any case be a difficult task in view of evolving technical developments – but rather focuses on why they are attractive to European users.

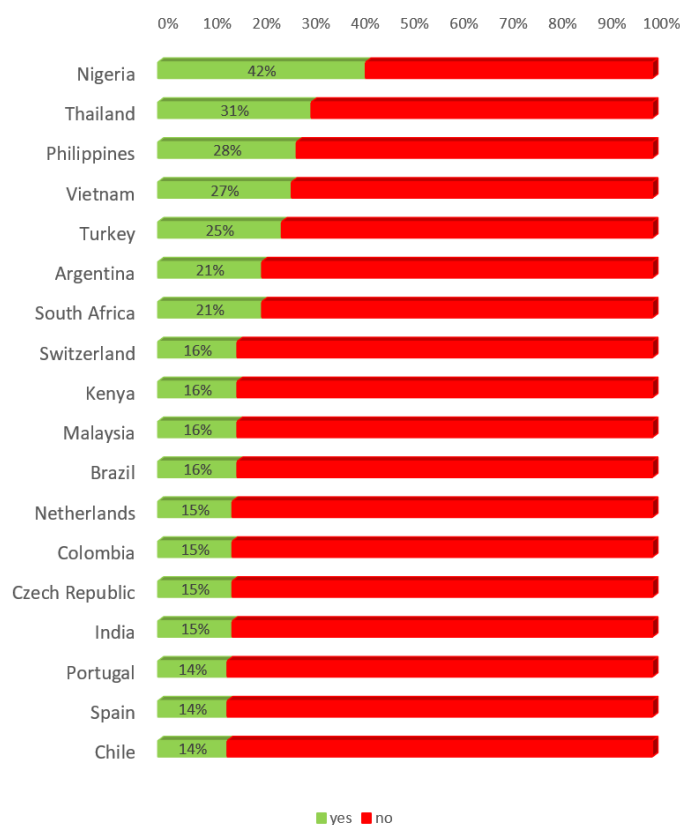
1. Who are crypto-users?

It is not an easy task to describe the profile of European crypto-users or the way they use crypto. Paradoxically, 'although the transparent nature of the blockchain would allow an examination of transaction data, the frequencies of using the individual applications are rarely tracked due to the vast amount of data. Another problem of blockchain-level data analysis is that individuals can have multiple wallets for different uses – a multitude of wallets oftentimes cannot be associated with individuals³⁹. Therefore, most studies so far are based on surveys, which focus on only one country, rely on a limited user sample and

often do not look at all user characteristics that could be of interest.

Despite the lack of clear and coherent data, changes over time suggest that crypto holdings are moving from a niche market to more mainstream activity. That said, **ownership and the use of cryptocurrencies in the EU currently remains relatively low in comparison to some other parts of the world.** This conclusion is the result of combining 55 different surveys from the Statista Global Consumer Survey conducted in 56 countries (of which 18 are EU Member States).

Figure 8: How many consumers own or use cryptocurrencies?



Source: ART based on Statista data⁴⁰

Some broad socio-economic characteristics of individual **EU crypto users** can be identified. The average German crypto owner is young (39.02 years), male (74%) and more likely than non-owners to have a university degree (33% versus 23%) or PhD (3% versus 1%), and tends to have an above average household income⁴¹. In 2021, 8% of French people own cryptos, with a similar profile (35 years old - male), and 30% of them likely to consider it as a first investment⁴². There are no comprehensive figures comparing crypto adoption and user profile across all EU Member States, but there seem to be large differences in terms of volumes, users and transactions.

In the US, around 16% of adult Americans – approximately 40 million people – have invested in, traded, or used cryptocurrencies. Investors in crypto seem to be different from investors in other risky assets, like stocks, who consist disproportionately of affluent, college-educated whites. According to a survey, 44% of crypto investors are non-white. For the general US active investor population, this share stands at 36%⁴³. There is anecdotal evidence that crypto investing has become remarkably popular among minority groups and the working class⁴⁴.

It is worth mentioning that **financial literacy and risk awareness of crypto users are often not at**

the level which the risk profile of the assets would suggest is required. Regulators blame “gamification” of trade at least partly for the fact that it can encourage investors to carry out more frequent or higher-risk trading than would have been the case without so-called ‘digital engagement practices’⁴⁵. In the US, the lack of financial knowledge and risk awareness in many US crypto investors has led to warnings of a repetition of the subprime crisis⁴⁶. Social media influencers and celebrities such as Lionel Messi who promote crypto assets as well as crypto companies with large-scale marketing campaigns target a very broad and not necessarily financially literate audience with slogans such as ‘Fortune favours the brave’ (Crypto.com), suggesting that investing in crypto assets is an easy way to make money.

As well as individuals, **businesses** also increasingly use crypto for a range of investment, operational and transactional purposes⁴⁷. In the US, most of the major banks such as JP Morgan, BNY Mellon or US Bank have opened crypto buy-sell or custody services in recent years for their customers. Engagement by banks in the EU seems to be less developed.

2. Motivations for use of crypto

Not all users have the same reasons for using cryptocurrencies, but there are several clusters of users with **similar financial, social and ideological motivations, which are often interconnected**. In line with cryptocurrencies’

tendency to overpromise, some of the financial and social motivations are either speculative, meaning they are theoretically possible but have not been widely realised, or based on misconceptions around the functioning of cryptocurrencies.

Figure 9: Motivations for crypto use

MOTIVATIONS FOR CRYPTO USE

FINANCIAL, POLITICAL AND IDEOLOGICAL, AND SOCIAL MOTIVATIONS ARE OFTEN INTERCONNECTED

FINANCIAL

Users turn to crypto as an investment, or (less frequently) they use it as a means of payment. Crypto is also used for start-up funding, accessing services or voting in governance decisions of blockchain-based projects.

POLITICAL AND IDEOLOGICAL

The decentralised nature of crypto assets attracts those who do not trust the centralised structures and public institutions that control the traditional financial system.

SOCIAL

The social identity around the crypto community is shaped by users and attracts newcomers. Technological curiosity and the desire to contribute to technical progress also drive crypto use.

1

2

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Source: ART

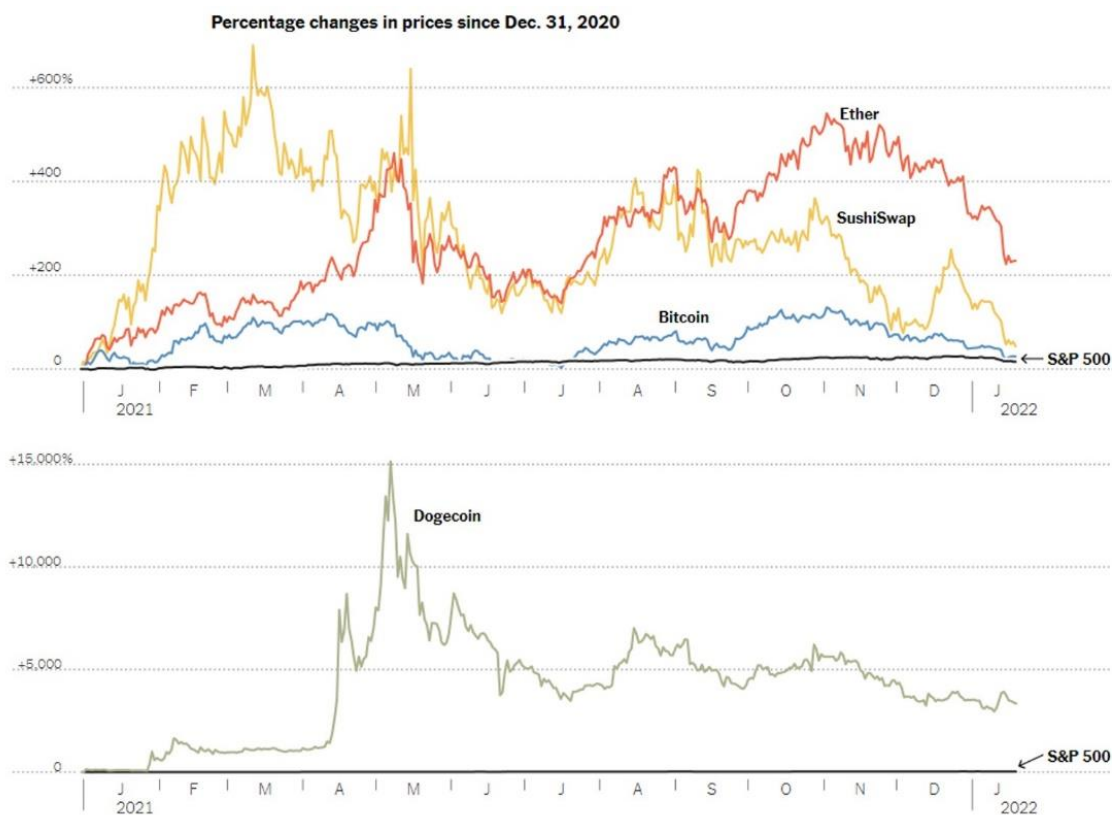


Unsurprisingly, **financial motivation** is at the heart of crypto use. In Europe, the most popular practical uses of crypto are **investment**, speculation and payment. As shown in

Figure 10, despite their extreme volatility, crypto earning and savings have in recent years outperformed traditional investments. While cryptocurrency is very popular as an investment, there are differences in terms of motives. While

some see it as a long-term investment or a means to diversify their portfolio, others are attracted by potential quick gains – an attitude encouraged by marketing campaigns that promise easy money – and are therefore active in managing their investments⁴⁸. The high volatility of crypto assets attracts those who see investment as a game and who are willing to take risks. Although high volatility does not make crypto assets a good hedge against inflation, this is exactly what some investors are using it for⁴⁹.

Figure 10: Crypto prices vs. the stock market



Source: New York Times⁵⁰

Some see wealth inequality as a key driver for the appeal of blockchain and crypto, arguing that blockchain-enabled technologies have become 'parking lots for venture capitalists'. This increased their value at a time of accelerating wealth inequality which, together with economic precarity, helps to drive the attractiveness of blockchain and crypto for those willing to take the risk⁵¹.

Crypto-assets are also used as a means of **payment**. Within an internal business ecosystem they can grant access to certain products or services, such as a game or an e-commerce platform⁵². They are also used for peer-to-peer transactions.

But uses other than investment and payment also exist. These include start-up funding, accessing services (for example decentralised storage networks via DApps) or voting in governance decisions of blockchain-based projects⁵³. The existence of many other types of use have led scholars to conclude that **cryptocurrencies more**

closely resemble a technology-based product rather than a currency or a security⁵⁴.

What explains the popularity of crypto in some countries in Africa and Asia (see also Figure 4)⁵⁵? There may be financial reasons which whilst not so relevant in Europe are nevertheless more important in emerging economies. These include the use of crypto to reduce reliance on a volatile fiat currency and an unstable financial system and as a way of overcoming obstacles to accessing traditional financial products. Crypto can increase **financial inclusion** in countries where much of the population is unbanked given that a smartphone is all that is required to buy or sell cryptocurrencies. It could also make it easier and cheaper to transact smaller purchases or send remittances across borders, although to date, there is no evidence that this is the case⁵⁶. Any increase in the use of crypto for remittances from the EU would deserve further analysis.



Even more difficult to quantify, but equally interesting, are the **political, ideological and social motivations** that drive crypto use. Some critical observers even say that the

successful narratives of crypto – technological, social and ideological – are what drives crypto’s success, since they see little practical use for cryptocurrencies other than as a speculative tool⁵⁷.

Political and ideological considerations play a role for crypto users. These are primarily concerned with issues of privacy and anonymity, often cited as a key motive by users of crypto⁵⁸. Although jurisdictions around the world – including in Europe – are working to impose anti-money laundering and counterterrorist financing measures on all cryptocurrencies, for well-informed users, crypto still offers privacy and security⁵⁹. The very existence of ‘privacy coins’ such as Monero is based on the argument that they are effective in concealing transactions and are the most confidential and undetectable of cryptocurrencies⁶⁰.

Across all user types there seems to be some degree of ideological belief in the crypto ecosystem, although this varies depending on the degree of personal investment: frequent users who manage cryptocurrencies for a range of purposes tend to be more ideologically involved than those who regard it simply as an investment opportunity⁶¹. Some – opponents and supporters



Many studies have also highlighted a **social component in the adoption of crypto assets**. Crypto currencies are, for example, the means of payment on certain

game platforms and to purchase NFTs. The social identity around crypto is shaped by users and attracts newcomers. Members of the community are often actively involved in extending the reach of cryptocurrencies and convincing others to use crypto⁷⁰. To a certain extent, therefore, crypto platforms can be considered as social platforms, and crypto asset ownership starts to become part of one’s (online) social identity. Its game-like features referred to earlier may well also contribute to this phenomenon. A further non-financial motivation driving crypto use seems to include technological curiosity and the desire to contribute to technical progress⁷¹. Fear of missing out (‘FOMO’) - on the

alike – have gone as far as comparing Bitcoin to a religion⁶². In the US in particular, libertarians see state money as a type of oppression⁶³, as opposed to cryptocurrencies which represent the ‘democratisation of money’. This link between a lack of trust in centralised structures and public institutions and the popularity of crypto explains the embrace of Bitcoin by US right-wing politicians (‘Ohio must be a pro-God, pro-family, pro-Bitcoin state’ tweeted a former Ohio State Treasurer⁶⁴). US far-right extremists, having been banned from traditional platforms, have also turned to cryptocurrencies for fundraising; the promise of a decentralised future and independence from mainstream structures is grist to their mill⁶⁵. Even in Europe, independence from centralised institutions is cited as a motive by crypto-users⁶⁶, and politicians on the far-right of the political spectrum have shown interest in the crypto industry⁶⁷.

Blockchain and DLT do not rely on trust in authorities, but on an “artificial consensus”, i.e. cooperation among users around automated protocols: ‘coordination and agreement of permissible behaviour plays center stage when it comes to successfully employing blockchain technology’⁶⁸. In the US, where cryptocurrency traders have a remarkably diverse profile in terms of age, education, race and gender, it is suggested that the absence of any intermediaries is part of the attraction to ‘groups of people whose right to ownership has been encoded in legal precedent and cultural norms for generations’⁶⁹.

mystique around crypto in general and on the prospect of large profits in particular - has contributed to a hype around crypto in certain socioeconomic groups, and marketing (traditional advertisements⁷² as well as endorsements by social media influencers⁷³) plays into this. One example of a crypto coin based on a combination of identity and cause is the Gypsycoin, launched in June 2021 by the Romanian Roma community with the promise to connect its worldwide community with ‘*technology, charity actions, education and development solutions*’⁷⁴.

Finally, while all these motivations largely concern individual users, **crypto assets are also increasingly popular with businesses**. Some companies hold crypto on their balance sheet, others facilitate crypto-enabled payments. Like individual users, their reasons are both financial and social: to enable access to new capital and liquidity

pools as well as new asset classes, but also to attract customers from new demographic groups as part of positioning the company to be able to take full advantage of future developments (think of gamification and web 3.0)⁷⁵. Crypto assets in business are used for cross-border or SME financing,

smart contracts, e-commerce and crypto-backed loans. A growing number of (retail) companies, such as Mastercard, Pavilion Hotels & Resorts, Microsoft and Starbucks, are offering the possibility for consumers to – directly or indirectly – pay with cryptocurrencies.

IV. THE SUPPLY SIDE: INDUSTRY'S CRYPTO-ECOSYSTEM DYNAMICS

In a nutshell...

- The crypto industry is a dynamic ecosystem that consists of a range of different actors.
- A comparison between the industry in Europe and competition in US, China and other third countries is difficult in the absence of complete and objective data, but suggests that Europe is not in the lead.

1. A dynamic ecosystem

The **crypto ecosystem** involves a wide range of actors: from crypto-asset issuers or sponsors, miners and (centralised or decentralised) trading platforms to exchange platforms and wallet providers⁷⁶. These

actors provide one or often more services related to crypto assets. Seven types of services are covered by the proposal for an EU Markets in crypto assets regulation (MiCA).

Figure 11: Crypto asset services



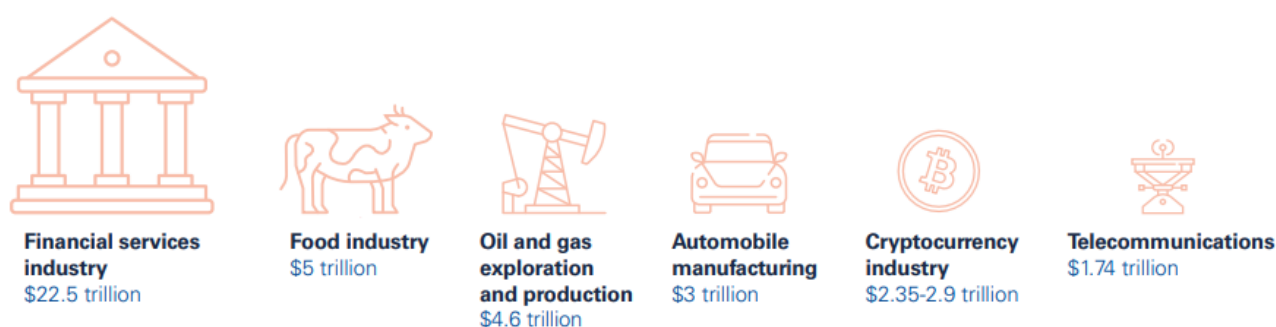
Source: ART based on the MiCA proposal⁷⁷

In 2018, there were around 200 to 500 trading platforms and exchanges operating in the world, with trading being highly concentrated⁷⁸. At global level, the **crypto industry remains small in comparison to the overall financial services industry**. However, **it is growing at remarkable**

speed. In only a few years it has become larger than the telecom industry and equivalent to the automobile manufacturing sector. In Germany, a crypto player announced its intention to acquire a 268-year-old bank – which would be a first⁷⁹.

Figure 12: The comparative size of the crypto industry (global)

Global Industries



Source : Too Big to Fail? Crypto Market Size vs Traditional Assets | by NGRAVE | NGRAVE | Jan, 2022 | Medium

Source: ADAN-KMPG⁸⁰

Investments in companies involved in the crypto ecosystem have also increased significantly. By 2021, a total of €30 billion had been raised from venture capital (VC) funds, compared to €5 billion in 2020, even though it remains a small part of total VC

global investment (around 5%)⁸¹. For newly minted unicorns (startups valued at more than USD 1 billion), 2021 was a record-breaking year for crypto companies⁸².

2. Where is the EU industry in the picture?

Accurate statistics about the EU crypto industry, as well as non-EU actors offering services within the EU and sources of funding are hard to come by. The Commission's impact assessment for the MiCA proposal therefore relies in part on out-dated figures or anecdotal evidence. Despite the absence of a consolidated view across the EU, crypto ecosystems in different Member States are clearly expanding. According to some studies, **Europe is a world leader in DeFi, with France, Germany and the Netherlands as the EU's top contributors**⁸³. By way of example, the French crypto ecosystem is growing to the extent that the 29 largest French crypto companies employ a total of more than 1,130 people, 85% of whom are in France, and have together raised €1.2 billion. These same companies expect their workforce to grow by a further 120% by January 2023. The French crypto industry is expected to account for 2,500 jobs by 2022⁸⁴.

However, the lack of an overall picture of the EU crypto industry – in terms of size, dominant players, taxation base, funding, competitiveness, strengths and weaknesses – is problematic for regulatory purposes, but also in terms of assessing the EU's competitive position globally. Crypto industries outside the EU appear to be more powerful, and although there is a lack of clear evidence, it seems likely that the relatively lower levels of crypto adoption in the EU are a factor.

According to the European Commission, the largest crypto exchange platforms by volume and value of transactions are located in **Asia and in the US**⁸⁵. Worldwide, Binance exchange platform claims to have 70% of the crypto market, compared to 8% for the US company Coinbase⁸⁶. But in 2021 Coinbase, which was founded 10 years ago, completed the largest IPO since Facebook (valued at USD 60 billion), and has outperformed almost all European banks with nearly 80 million verified customers. It is unclear how many European customers these platforms have (the Commission's impact assessment suggests that in 2017 around a third of crypto exchanges may have been in the EU, ahead of the Asia-Pacific and North America). Some studies suggest that non-EU venture capital firms are aggressive in the financing of European crypto companies⁸⁷.

Big Tech giants are also betting on cryptocurrencies and crypto assets, because they form a key building block of the web 3.0 or the potential Metaverse. Although Meta (ex-Facebook) has been forced by the US regulator to give up its stablecoin project Diem, the company maintains a significant interest in crypto assets. Google-owner Alphabet's CEO Sundar Pichai confirmed on 1 February 2022 that the company is exploring crypto and blockchain potential⁸⁸. But they are experiencing difficulties in recruiting, particularly for technical profiles, but also for support or non-

technical functions. In 2021, crypto-related job postings on LinkedIn grew by 395% in the US⁸⁹.

Several **US mayors** (New York and Miami for example) have opted to receive part of their salary in Bitcoin, in an attempt to lure crypto companies to their cities⁹⁰. Anecdotal data on crypto startups with **unicorn** status suggests that the US is by far the largest single market for crypto unicorn creation⁹¹, despite the fact that there are also EU crypto unicorns (such as Austrian-based Bitpanda, Germany's Trade Republic, French Sorare and Ledger).

The UK is the undisputed market leader of European cryptocurrency activity, largely driven by DeFi⁹². The UK also has a strong cryptocurrency industry and is said to come in second to the US both in terms of funding for crypto companies (followed by France and Canada) and in terms of number of cryptocurrency firms (followed by Singapore, Canada and India)⁹³. On 4 April 2022, the UK Treasury announced plans to make the UK a 'global hub for cryptoasset technology and investment'⁹⁴. Those plans include recognising stablecoins recognised as a valid form of payment, as well as legislating for a 'financial market

infrastructure sandbox' to help firms innovate, an Financial Conduct Authority-led 'CryptoSprint', working with the Royal Mint on an NFT, and an engagement group to work more closely with industry. In **Switzerland**, the city of Zug has a strong presence, with many Foundations based there (e.g. Ethereum, Cardano or Tezos), and is looking to become the global leader of cryptocurrencies.

Although it has banned cryptocurrencies, China is investing heavily in blockchain technology and its applications for both government and commerce. Furthermore, its digital renminbi is at an advanced stage of development and being rolled out to the broader population.

When it comes to the relative position of the EU industry in the global crypto landscape, there is a number of relatively basic questions that would benefit from **further research based on comprehensive data**. For example: which firms and countries are leading in crypto-development, and which ones in crypto-mining? Do European users trade on European or international platforms? And what is the number of EU-based projects or EU-backed coins?

V. A HYBRID FUTURE: CHALLENGES AND OPPORTUNITIES FOR THE EU AND MEMBER STATES/MEMBER STATE GOVERNMENTS

In a nutshell...

- **Politically**, a hybrid currency system raises questions of sovereignty, security and taxation. It will change the balance of power between governments, private companies and individuals. In the public debate, there is a risk that political parties at the extremes of the spectrum take ownership of the crypto assets domain.
- Although its overall **social** added value is not clear yet, by some users, crypto assets are seen as offering an alternative to the traditional financial system. This perspective should be addressed in political and regulatory debates.
- Power in the crypto ecosystem - in setting standards, hosting industry, enabling future innovations, but also in evading financial sanctions - can translate into **geopolitical** power. If Europe sees merit in a competitive crypto industry, a strategic approach is needed.
- As regards the **environmental** dimension, cryptocurrencies' carbon footprint, electrical energy consumption and electronic waste pose a serious challenge for its future growth.

The future currency landscape is likely to be hybrid. Fiat currencies and digital currencies, publicly issued and privately developed currencies will co-exist. Political and regulatory interest at EU level for crypto currently focuses on financial stability, monetary sovereignty (in particular potential 'global stablecoins'), anti-money laundering and counter-terrorist financing and, to a certain extent, investor protection. **That relatively**

narrow focus neglects the political, social, geopolitical and environmental dimension of the crypto ecosystem, the importance of which will grow as the presence of cryptocurrencies and crypto assets in society and in the financial system increases. Further growth will also exacerbate the existing downsides, critics and limitations of crypto-assets in general, and Bitcoin and Ethereum, as their most visible examples, in particular.

1. The political dimension

A growing crypto ecosystem should first and foremost be considered from a political perspective, as it could raise issues related to **sovereignty**. Cryptocurrencies – whether privately-owned or decentralised – have the potential to undermine the sovereignty of states and their monetary policy. This is why the US regulator pressured Meta (ex-Facebook) to reshore its stablecoin project Diem (ex-Libra) from Switzerland to the US, and then to abandon it entirely (Meta sold it to a bank). It is why China has banned cryptocurrencies altogether.

The issue of trust is key to the political dimension. Even if the crypto ecosystem is based on a rejection of trust in centralised institutions, trust, both at the social level and in technology, is a prerequisite in blockchain⁹⁵. And to some extent, crypto's **decentralisation is an illusion**⁹⁶. In DeFi, for example, governance tokens representing voting power together form **Decentralised Autonomous Organisations (DAOs)**. Those DAOs can oversee multiple DeFi projects and therefore, despite their name, constitute an element of centralisation. Aside from DAOs, crypto whales, which are groups of individuals or organisations with crypto holdings that are so large that they can manipulate its valuation (3.7% of which is estimated to be criminal⁹⁷), can exercise significant power over the crypto ecosystem. Others consider that Web3 will simply shift power from existing incumbents like tech giants to new venture capital funds⁹⁸. The fact that **decision-making power can be concentrated** in the hands of a couple of large coin-holders not only undermines the whole philosophy of the system, but also potentially poses challenges to financial stability as spillovers between DeFi and the traditional finance system grow⁹⁹.

In so far as crypto use is driven by the sense that the traditional financial system is not equally accessible to all citizens and is unfairly controlled by centralised institutions, adequate measures to address those concerns should be considered. At the moment this dynamic seems to be less relevant in the EU than in other jurisdictions. Nonetheless, **mainstream politicians should remain attentive**, to avoid that those at the extremes of the political spectrum appropriate the crypto domain for themselves and for their own political ends.

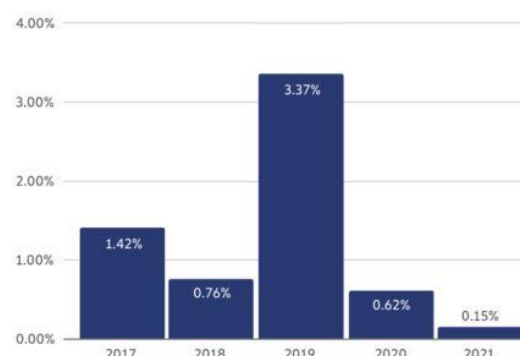
Another area to consider within the political spectrum is how cryptocurrencies **facilitate illicit activities**, from tax avoidance to outright criminality. While steps have been taken to ensure that cryptocurrencies are covered by anti-money laundering legislation, privacy coins – like Monero – are deliberately designed to guarantee maximum anonymity. As shown in Figure 13, cryptocurrency-based crime hit a new record in 2021. At the same time, according to Chainalysis (Figure 14) the use of crypto for fraudulent activities is only a very small proportion of total crypto transactions. Nonetheless, some studies assess that illegal activity linked to Bitcoin could amount to USD 76 billion a year, equivalent to 46% of all Bitcoin transactions and coming very close to the size of the US and EU illegal drug markets (2018)¹⁰⁰. In any case, cryptocurrency remains the most common pay-out method for cyberthreat actions, with ransomware attacks the key threat and Monero the cryptocurrency of choice¹⁰¹. If crypto continues to become more mainstream, curbing illicit use will remain a key challenge for policymakers and law enforcement.

Figure 13: Total cryptocurrency value received by illicit addresses



Source: Chainalysis¹⁰²

Figure 14: Illicit share of all cryptocurrency transaction volume



Source: Chainalysis¹⁰³

Blockchain technologies may eliminate the downsides associated with intermediaries, but they also create **new kinds of risks**. In 2021, scams led to USD 7.8 billion worth of cryptocurrency stolen, and theft added another USD 3.2 billion to that number¹⁰⁴. Risks also arise from investors' limited understanding of cryptocurrencies. Misconceptions about basic market mechanisms, the functioning of crypto trading, fee structures, security and privacy of transactions all create risks for consumers¹⁰⁵. This has led some observers to warn against a "crypto bubble" leading to a gigantic Ponzi scheme which could threaten investors of limited means¹⁰⁶. The **cybersecurity of crypto ecosystems** is also a key concern, both for safeguarding of users' crypto-assets from theft by criminal groups or state proxies, and for fighting against the monetising of ransomware attacks.

2. The social dimension

A central argument against cryptocurrencies and assets is their limited added value to society. Limits in size and frequency of records in decentralised blockchains constrain the number of transactions (7 transactions per second for Bitcoin¹⁰⁹ and 15 transactions per second for Ethereum). By comparison Visa handles 1,700 transactions per second on average (and claims to have a maximum capacity of 65,000 transactions), with considerably lower energy consumption. The lack of scalability of cryptocurrencies that run on decentralised blockchains limits their practical use. Their extreme volatility in any case limits their usefulness for everyday expenses. A basic question in the face of the growth in the crypto ecosystem is therefore: **will it bring benefits for society as a whole?**

An expanding crypto ecosystem could create different kinds of **social challenges**. Entry barriers due to difficulties over user interfaces, the nature of services offered and general lack of understanding of crypto¹¹⁰ could increase the gap between crypto users and non-users. This is likely to reflect the generation gap. Studies on the profile of crypto users and trends such as gamification suggest that the level of crypto uptake in society varies considerably from generation to generation. This is very likely to lead to a much higher degree of interest in crypto amongst Millennials and Generation Z than older generations.

Another political issue for consideration is that of **taxation**. The increasingly prominent place of privately developed currencies will constitute a major challenge for governments. Ironically, the move towards more 'democratic' forms of money could end up hollowing out the welfare state if issues of taxation are not addressed. Furthermore, fiscal competition over the taxation of crypto assets gains which already exists both worldwide and within the EU, could become more pronounced. An OECD report shows that to date, there is a lack of harmonisation and concrete guidance on the place of cryptocurrencies within the existing tax framework¹⁰⁷. For example, even the definition of taxable events differs substantially across Member States. Empirical estimates suggest that applying national tax rules on capital gains from shares to total estimated Bitcoin capital gains in the EU would have amounted to around €850 million in tax revenues in 2020¹⁰⁸.

Crypto mining, too, can have a **negative social impact on local communities**. Researchers claim that 'the unsustainable trajectory of some cryptocurrencies disproportionately impacts poor and vulnerable communities where cryptocurrency producers and other actors take advantage of economic instabilities, weak regulations, and access to cheap energy and other resources'¹¹¹. While mining can bring a certain degree of prosperity, this usually benefits individuals, while the community as a whole suffers from the the negative impacts of mining.

The level of urgency of these social considerations is directly linked to the level of uptake of crypto. It is therefore important to consider when and under which conditions there might be a significant increase in the level of adoption.

The main concern at the moment for policy-makers is the impact of crypto currencies and assets on **financial and economic stability**. What would a crypto crisis look like? Who would take responsibility if the real economy is hit and society is disrupted because of large-scale losses of private crypto users? Any regulatory response to mitigate such financial risks also has a social dimension.

As seen in section III, crypto users are driven by more than mere financial considerations. Whether justified or not, crypto currencies and assets are regarded as decentralised and operating outside

traditional political structures. Their attractiveness increases during in periods of high inflation and booming property markets, particularly within a wider context of increasing inequality and uneven access to the job market. Some crypto asset users even see them as offering an **affordable alternative to the traditional financial system**.

In addition, the ideological component of crypto use means that the imposition of constraints on the

3. The geopolitical dimension

There is also a clear geopolitical dimension to the expansion of the crypto universe. The crypto system needs to be considered in its global context.

Europe is not at the forefront in terms of crypto use or crypto industry. The European ecosystem of crypto and related technologies is not as developed as its American and Chinese counterparts. As for almost all emerging technologies, China is investing heavily in more centralised blockchain norms and applications, in parallel to the launch of a digital renminbi, to promote a universal digital payment network along its digital silk roads¹¹³. Further crypto uptake in other regions (such as Africa or Asia) could be much more extensive and faster than in Europe. Third country governments, as well as powerful non-state actors, might seek to use crypto as a geopolitical instrument of power.

If crypto gains popularity with European citizens and makes its way into different aspects of society, **there could be a case for strengthening the European crypto assets ecosystem as a way of countering Europe's vulnerability to systems developed and controlled by third countries.** Creating a 'Brussels effect' in new global crypto standards will not be possible without a European crypto industry. One could argue that banning cryptocurrencies entirely and focusing on a sovereign European CBDC – as the Chinese are doing with the digital renminbi – would be a better way of strengthening the EU's digital sovereignty. But such a drastic move would also come with downsides and difficulties. For a start, it would raise questions about technology neutrality, the risks of damaging the blockchain industry and the impact on the rising crypto uptake in society.

As already said, the crypto ecosystem is not fully decentralised. The service providers enabling the crypto system (exchanges, mining farms, wallet providers) are private companies - often non-European (as, for example, the most popular

crypto ecosystem (for example an outright ban or tax disincentives) could **trigger a social backlash**. Distrust in central institutions, which is a motivation for some crypto users, could mean that any governmental control of the crypto ecosystem is regarded as unwarranted intrusion¹¹².

centralised exchanges in Central, Northern and Western Europe: Binance and Coinbase¹¹⁴). DAOs and crypto whales also exercise some form of control. It is therefore important to look at the effects on Europe of a crypto ecosystem that is **controlled by third parties, whether public or private**. This gives rise to a wide range of questions on issues such as data collection and protection¹¹⁵. A useful analogy is the development of 5G technology for decentralised cellular networks. As is well-known, discussions over 5G standards and architecture reflect political struggles over the development and deployment of future technology¹¹⁶; the same is true for blockchain technologies and crypto assets.

The same argument could be made as regards stablecoins, which can be a risk but also a channel of influence for the fiat currencies to which they are pegged. Currently, the popularity of euro-pegged stablecoins remains modest¹¹⁷, not least because of their limited visibility on non-EU exchange platforms. There could be a case for more and stronger euro-linked stablecoins – provided of course these came with the appropriate risk assessments.

A strong EU crypto industry could contribute to the **economic power** of its Member States and create jobs in the EU. This is particularly important if crypto-assets and digital wallets become key components of the digital economy¹¹⁸. Whilst the EU is pushing for blockchain technologies in general and for regulation, the recent US President Executive Order on digital assets seeks not only to mitigate risks, but also to promote US leadership in technology and economic competitiveness as part of strengthening US leadership in the global financial system¹¹⁹. When President Putin in January 2022 backed the Russian Ministry of Finance's stance that cryptocurrencies should be taxed and regulated, but not completely banned as proposed by the central bank, he acknowledged the risks

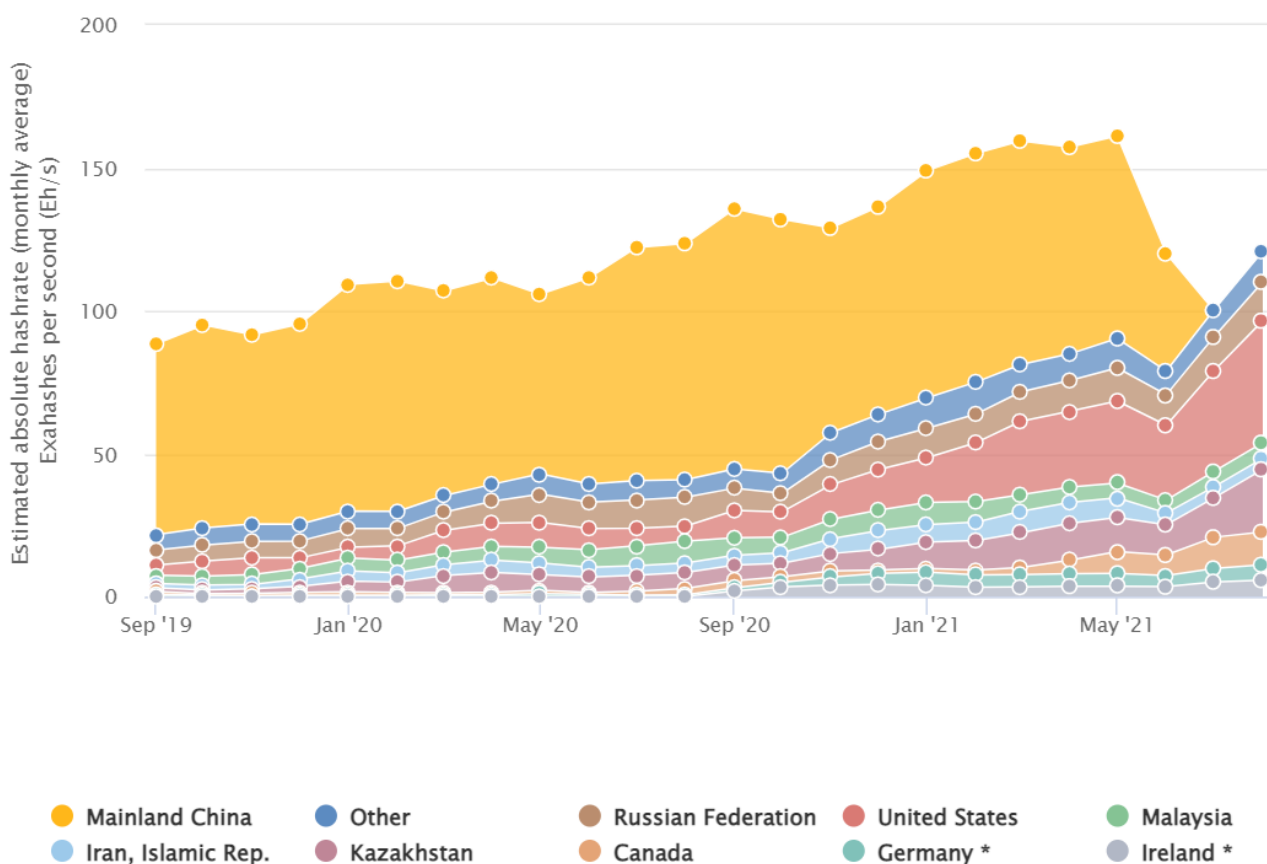
associated with cryptocurrencies, but also recognised Russia's competitive advantages in crypto mining in terms of 'surplus of electricity and well-trained personnel'¹²⁰.

Within the geopolitical domain, another issue to consider is the use of crypto by "rogue states" to evade **economic and financial sanctions**. 'Cryptocurrency presents a troubling new opportunity for individuals and rogue states to avoid international sanctions and to undermine traditional financial markets', according to the US Department of Justice's Cyber Digital Task Force Cryptocurrency Enforcement Framework report (October 2020)¹²¹, which highlights the risk that adversaries will turn to cryptocurrency to blunt the impact of US and international sanctions. Venezuela, for example, (unsuccessfully) tried to launch a national cryptocurrency to circumvent US sanctions, and Russia and Iran are suspected of using existing cryptocurrencies to escape sanctions

(through mining, licensing/taxation of mining, hacking) or to develop their own cryptocurrencies specifically to avoid international oversight. While publicly available details remain scarce, North Korea too is believed to exploit cryptocurrency technology and sponsor hackers to offset sanctions.

Likewise, the **geography of crypto mining also has geopolitical consequences**. According to research work, after the drop by China (less than 40% after a peak of 90% in September 2020), the US (around 43%) and Kazakhstan (around 22%) remain the dominant location for Bitcoin mining – showing that here also the decentralised nature of crypto is relative. Apart from Russia (12%) and Iran (4%), the other main actors are located in Asia or North America (Canada 12%). The revenues from mining can be a source of income for countries that experience difficulties accessing the traditional international financial systems.

Figure 15: Evolution of network hashrate in Bitcoin by country (September 2019 - August 2021)



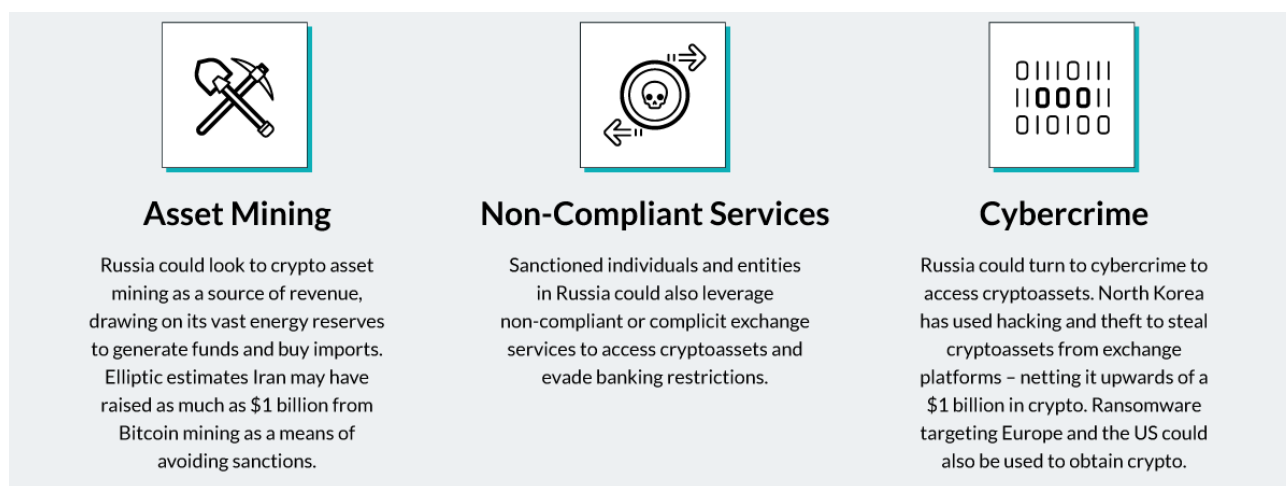
Note: The share of Germany or Ireland is likely inflated due to redirected IP addresses via the use of VPN or proxy services significantly (no evidence for large mining activity).

Source: Cambridge Bitcoin Electricity Consumption Index¹²²

The role of crypto in Russia's attack on Ukraine

Ukraine and Russia have both embraced crypto assets, ranking 4th and 18th respectively in Chainalysis' global crypto adoption index for 2021¹²³. After the Russian invasion of Ukraine, those have become a **variable in the conflict in different ways**. First, there are fears that the **Russian government and individuals sanctioned could use crypto assets to keep access to finance** – to escape the Western sanctions as well as the Russian capital controls imposed as a counter-reaction.. At the same time, the infrastructure, adoption and volume of the Russian crypto ecosystem are not as mature as would be necessary to circumvent sanctions at scale¹²⁴ (Russia's total banking sector assets are USD 1.4 trillion, nearly the size of the entire crypto market¹²⁵). The current financial sanctions also apply to crypto-assets (both directly and through anti-circumvention clauses)¹²⁶. Moreover, the fact that, contrary to popular belief, crypto-asset transactions are traceable on blockchains discourages crypto trade with sanctioned persons and entities. Still, the risk that cryptocurrencies are being used to evade sanctions continues to exist, and on 7 March 2022 the US Treasury's Financial Crimes Enforcement Network issued an alert on that¹²⁷.

Figure 16: How crypto might aid Russian sanctions evasion



Source: Elliptic¹²⁸

On the side of Ukraine – whose Parliament adopted a law to legalise and regulate cryptocurrencies on 18 February 2022 – **crypto fundraising campaigns** have been set up to support the Ukrainian people and army – in fact, government Twitter accounts listed wallet addresses for Bitcoin, Ether and Tether¹²⁹. Even though the donations (worth more than USD 100 million) are minuscule compared to those received from conventional sources, they show the benefits of cryptocurrencies' easy, fast and secure moving across borders in extraordinary situations¹³⁰. Furthermore, anecdotal evidence suggests that some refugees have used cryptocurrencies to escape cash machine payout limits and ban on international bank transfers imposed by emergency laws¹³¹.

Initially the value of Bitcoin and other cryptocurrencies dropped in reaction to the Russian invasion, but it recovered significantly. While its volatility is around 5 times as high as that of the stock index, Bitcoin is down less than half the roughly 10% decline of the S&P 500 (1 January – 2 March 2022)¹³². Analysts link recent spikes less to rising demands of Russians and Ukrainians, but more to the narrative surrounding crypto as apolitical, borderless and safe from the reach of governments¹³³. At the other hand, it is also clear that crypto in general and Bitcoin in particular **have not proved to be the 'digital gold'** that some supporters had expected it to become in times of crisis. Its underperformance in that respect can perhaps be explained by technical limitations, such as limited Internet access in Ukraine, but also by its volatility and the fact that its use for payments is still limited¹³⁴.

It is too early to say what impact the conflict will have on the geography of crypto mining.

4. The environmental dimension

Finally, but importantly, the significant growth of crypto and its high value over recent years come with a significant cost in terms of **carbon footprint, electrical energy consumption and electronic waste**. This is frequently used, including by some national financial regulators in the EU¹³⁵, as one of the main arguments for curbing the crypto industry or banning cryptocurrencies altogether. Despite the virtual nature of crypto assets, physical natural resources are fundamental to their existence. Further growth of the crypto ecosystem will come with significant environmental consequences, which looks to be very problematic in view of the green transition and the EU's ambitious climate goals.

At present, the ecological footprint of cryptocurrency mining for Bitcoin and Ethereum is enormous, due to the way transactions are verified (**Proof-of-Work**¹³⁶), which requires significant computing power. At the moment, the carbon footprint of one single Bitcoin transaction is equivalent to 2,371,061 VISA transactions, its electrical energy use is equivalent to the power consumption of an average US household over 77.20 days¹³⁷. The electronic waste created annually by the Bitcoin network is comparable to the total waste of small IT equipment in the Netherlands¹³⁸.

Miners tend to congregate in locations with cheap energy. In some cases, this means that they soak up local overcapacities in renewable energy. Before China's ban on crypto mining, miners in China moved around using coal in the dry season and excess hydro-energy in the wet season. This led to 41,6% of total energy used for Bitcoin mining worldwide coming from renewable sources in 2020¹³⁹. But in many other cases, cheap energy means natural gas (US) or even hard coal (Kazakhstan). In the US, already defunct coalmines have been restarted to service the crypto mining industry¹⁴⁰. After China banned crypto mining in June 2021, the share of renewable energy in Bitcoin mining dropped to 25.1% in August 2021¹⁴¹. The private-sector Crypto Climate Accord's objective of powering crypto with 100% renewables in 2030 seems far off¹⁴². According to experts, using excess

renewable energy will become attractive only when mining at short intervals becomes profitable – which is not the case with proof-of-work.

The industry, if asked about crypto's environmental footprint, will point at the future replacement of energy-intensive proof-of-work validation by less consuming **Proof-of-Stake** methods. Ethereum plans to transition to the system in 2022, expecting to cut energy use by 99.95%¹⁴³. At the same time, there are legitimate uses of proof-of-work – which is said to be more secure – that cannot easily be replaced by proof-of-stake. Furthermore, the decentralised governance of cryptocurrencies makes a protocol switch extremely complicated and the miners, who would lose their source of income, are unlikely to agree to a switch. **Policy intervention and regulation could be the only option to push for a switch to proof-of-stake on a larger scale and in the shorter term.**

Moreover, despite its better energy performance, proof-of-stake has downsides too. Proof-of-stake is less efficient in putting new currency into circulation and it encourages hoarding, which is bad for a currency's availability and liquidity, thus limiting its usefulness and increasing its volatility¹⁴⁴. Furthermore, with proof-of-stake, there is a bigger risk of power concentration, which runs up against the dogma of decentralisation.

Given that crypto mining takes place largely outside Europe, the question has not yet caused European lawmakers much concern, although it is gaining traction. Looking ahead, we could see tension between a desire to promote a **domestic crypto industry and the will to achieve the objective of climate neutrality**. As big players like China and possibly Russia move to ban or regulate crypto mining, the EU will be faced with the same question. Will it discourage a potential move of mining activity to Europe, or will it embrace it and take the opportunity to champion a greener crypto industry, whilst acknowledging that renewable energy used for crypto might be required for other purposes as part of the green transition?



WHAT NEXT?

In an economy that is ever more digitalised, it is important to have an overarching **strategy at the highest political level** that takes into account all the different dimensions of continued crypto growth. Others such as the US and China are already doing just that, although their responses are very different. It is not too late for Europe to take a view on an approach which reflects its own interests and concerns. **But time is not on the side of policy-makers.** The development of the crypto ecosystem is moving ahead at a speed which can render issues obsolete within months and rapidly leave public bodies struggling to keep ahead of the game.

ANNEX: GLOSSARY

Altcoin: any cryptocurrency other than Bitcoin (and, depending on the context, Ethereum).

Central Bank Digital Currency (CBDC): central bank liability offered in digital form for use by citizens and businesses for their retail payments (ECB).

Crypto assets: a type of assets that depend primarily on cryptography and DLT¹⁴⁵.

Decentralised App (DApp): a decentralised app that runs on a blockchain or peer-to-peer network (typically Ethereum).

Decentralised Autonomous Organisations (DAOs): an entity with no central leadership, governed by a community organised around a specific set of rules enforced on a blockchain¹⁴⁶.

Decentralised Finance (DeFi): a class of decentralised cryptocurrency platforms that can run autonomously without the support of a central company, group, or person. DeFi platforms, also known as protocols, are built on top of smart contract-enriched blockchains — primarily the Ethereum network — and can fulfill specific financial functions determined by the smart contracts' underlying code. Popular types of DeFi protocols include decentralised exchanges and lending platforms¹⁴⁷.

Distributed Ledger Technology (DLT): records, or ledgers, of electronic transactions, very similar to accounting ledgers. Their uniqueness lies in the fact that they are maintained by a shared or 'distributed' network of participants ('nodes') and not by a centralised entity. Permission-based DLTs are closed systems where only identified participants can propose and validate ledger updates. In permissionless DLTs, any entity can access the database and, depending on the specific validation method used, may be able to contribute to updating the ledger¹⁴⁸.

Metaverse: the Metaverse is best described as an immersive and constant virtual 3D world where people interact through an avatar to enjoy entertainment, make purchases and carry out transactions with cryptocurrencies, or work without leaving their seat¹⁴⁹.

Non-fungible tokens (NFTs): a unique unit of data (= the only one existing of its type) that links to a particular piece of digital art, music, video, etc. and that can be bought and sold¹⁵⁰. NFTs are recorded in a blockchain.

Proof-of-Stake: a type of consensus mechanism to validate cryptocurrency transactions. In a proof-of-stake mechanism, owners of cryptocurrency can stake their coins to become a validator in the network. That gives them the right to create new blocks of transactions and add them to the blockchain.

Proof-of-Work: a type of consensus mechanism to validate cryptocurrency transactions. In proof-of-work mining, transactions are validated by so-called miners, who have to solve computational puzzles to this purpose. All the miners working on a block are in fact racing to solve the same puzzle. Once a solution has been found, the block will be confirmed and added to the blockchain. The miner that finds the solution will be rewarded with new coins and/or transaction fees paid by the users, before all the miners continue to work on the next block¹⁵¹.

Smart contract: a piece of software that runs directly on DLT and can replicate a given contract's terms. It effectively implements the terms of an agreement (e.g. payment terms and conditions) into computational material to automate the execution of contractual obligations¹⁵².

Stablecoin: a type of crypto asset that aims to maintain a stable value relative to a specified asset or a pool of assets¹⁵³.

Web 3.0: the idea for a new version of the internet based on the blockchain.

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- ² 'Money and Payments: The U.S. Dollar in the Age of Digital Transformation', US Federal Reserve System, <https://www.federalreserve.gov/publications/files/money-and-payments-20220120.pdf>.
- ³ The ECB is currently in the investigation phase of the digital euro project, which will be completed by October 2023. The Governing Council will then decide whether to move to the next phase: the development of integrated services and testing and possible live experimentation of a digital euro. This phase could take around three years. See https://www.ecb.europa.eu/paym/digital_euro/faqs/html/ecb.fag_digital_euro.en.html (visited on 3 February 2022).
- ⁴ Cryptocurrencies are a subset of digital currencies (which include centralised in-game virtual currencies, as well as tokens which encompass local or community currencies like the Bristol Pound). In general, the term digital currency is preferred over virtual currency, which relates to "unreal". Digital means non tangible. See David Lee Kuo Chuen (ed.), *Handbook of digital currency: Bitcoin, innovation, financial instruments, and big data*, Academic Press, 2015. The MiCA proposal has aligned the definition of crypto assets with that of "virtual assets" used in AML/CFT framework by AMLD5 and FATF.
- ⁵ *Proposal for a regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937 ('MiCA proposal')*, COM/2020/593, European Commission, 24 September 2020.
- ⁶ Whilst the MiCA proposal only talks about three categories (utility tokens, asset referenced tokens and e-money tokens), the Council's mandate stipulates: asset referenced token, e-money tokens and *other crypto assets, including utility tokens*.
- ⁷ 'Taxonomie des crypto-actifs sur blockchain', Association pour le développement des actifs numériques, <https://adan.eu/pedagogie/classification-crypto-actifs>.
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