CRYPTO ASSET LAB REPORT 2025

Market trends, regulation, and technology

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EXECUTIVE SUMMARY

In 2024 the market in crypto-assets, and cryptocurrencies in particular, was boosted by a dynamic combination of innovation, political developments and positive investor sentiment, both institutional and retail.

The launch of cryptocurrency ETFs and Bitcoin's achievement of new price milestones have characterised the growth of the crypto-asset industry; at the same time, volatility, large volumes of derivatives and price correlation trends have shown that the sector has reached a certain degree of maturity. Looking ahead, these developments position crypto-assets as **a promising, though challenging, asset class worldwide.** The evolving regulatory landscape for crypto-assets must address the key issue of the **absence of a unified taxonomy to define digital assets**, which hinders regulatory consistency across jurisdictions. In this context, the European Union's **MiCAR (*Markets in Crypto-Assets Regulation*)** stands out as a key regulatory framework to harmonise rules and protect investors.

MiCAR introduces specific regulations for *stablecoins*, e-money *tokens* and *asset-linked tokens*, as well as compliance requirements for **crypto asset service providers (CASPs)**. However, challenges persist with **decentralised finance (DeFi)**, as it is excluded from the current regulations due its decentralised nature. Further important initiatives for the industry include the ***Digital Operational Resilience Act* (DORA)** regulation, aimed at improving digital resilience in the financial sector, and global efforts such as the Financial Action Task Force's (FATF) *travel rule* to fight against money laundering. Despite these advancements, **significant doubts remain about the effectiveness of the measures in promoting the growth of the ecosystem while ensuring its stability and security**.

The Report provides a first attempt to associate the different types of crypto-assets (stablecoin, utility tokens, financial tokens, Bitcoin, etc.) with the category used by MICAR and the applicable European regulations, to facilitate a transversal reading of the phenomenon. The DeFi ecosystem is analysed focusing on institutional investors (crypto funds); crypto exchanges; token offerings. The crypto ecosystem is characterised, on the one hand, by the **growing role of institutional investors** (hedge funds, venture capital and private equity), reflecting a growing confidence in the sector and a willingness to support blockchain-driven innovation; on the other hand, exchanges are entering into **activities akin to traditional financial intermediation**, such as *crypto lending* and *crypto staking*. It is therefore crucial to recognise the business models (BM) prevalent in this segment. Based on the three dimensions of

analysis proposed by the BM literature - mode of intermediation, object of transactions, distribution methods for crypto-assets -, exchanges are classified into five main business models:

1. **Total Exchange**: multifunctional, focusing on liquidity, trading and payment services;
2. **Utility-Payment**: specialising in *utility token* transactions and payment services;
3. **Trading Platform**: focused on *security tokens trading* with limited involvement in payment services;
4. **Alternative Exchange**: primarily dedicated to *utility tokens*, with less focus on traditional financial services;
5. **Market Maker**: dedicated to liquidity creation, with moderate involvement in payment services.

Most platforms are associated with the *Total Exchange* model, thus multifunctional, followed by the *Alternative Exchange* model, indicating **polarisation and de facto dualism in exchange operations**.

On the technology front, 2024 witnessed an expansion in the depth and breadth of interventions. From Bitcoin's privacy-focused improvements and *Lightning Network* optimisations, to the proliferation of Ethereum's *zk-rollups*, Solana's high-speed innovations and *cross-chain* advances, **the crypto industry has made significant strides towards more scalable, secure and user-friendly systems**. These innovations lay the foundation for an even more vibrant, interconnected and technologically advanced blockchain ecosystem in the years to come.

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01   **Market trends**

edited by
Ferdinando Ametrano*

The year 2024 proved to be a pivotal one for the cryptocurrency market, characterised by significant developments, record milestones, but also by fluctuating investor *sentiment*. Central to this narrative were the launch of **cryptocurrency exchange-traded funds (ETFs)**, the **'Trump effect'** on market performance, a **new all-time high (ATH) for Bitcoin** and the traditional dynamics of market **volatility** and asset **correlation**.

1.1   The rise of cryptocurrency ETFs

One of the highlights of 2024 was the approval and subsequent launch of several cryptocurrency ETFs in the US and Europe.
These tools have 'democratised' access to cryptocurrencies, allowing retail and institutional investors to gain exposure to digital assets without having to directly manage portfolios or private keys.
Some key numbers:

- By the end of 2024, globally, *assets under management* **(AUM) in cryptocurrency ETFs exceeded USD 30 billion** (Figure 1.1)**;**
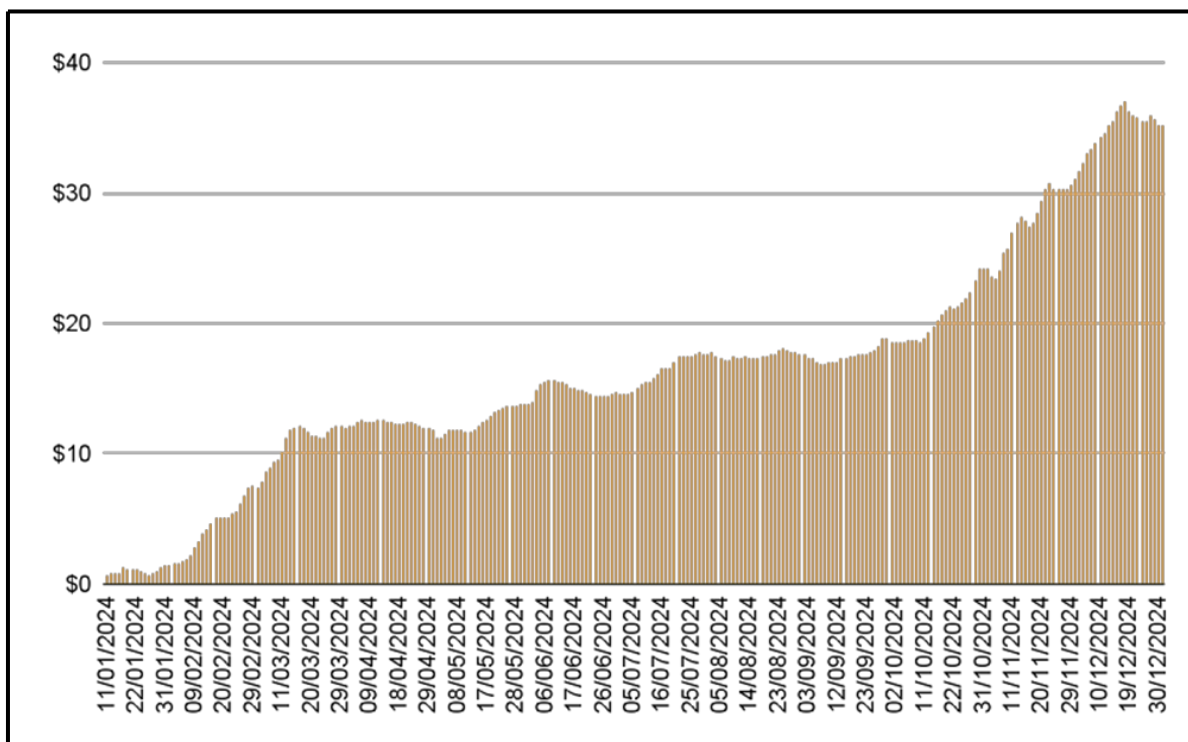- ETFs on Bitcoin accounted for 99 per cent of this market.

Figure 1.1 - **Assets under management (AUM) of cryptocurrency ETFs**

This influx of investments via ETFs has provided a significant boost to Bitcoin's price and the liquidity of its market. The success of these financial products has also contributed to increased interest from institutional and retail investors, fostering greater acceptance of cryptocurrencies as a legitimate asset class.

1.2   The 'Trump effect'

Donald Trump's return to the political scene has had significant implications for the cryptocurrency market. Mr Trump's political rhetoric, geared towards deregulation and promoting innovation in the blockchain sector, has generated optimism among market participants. **The expectation of a pro-crypto administration in the US has contributed to bullish sentiment**, particularly in the second half of 2024.

Some higlights:

- **Bitcoin rose more than 40 per cent between July and November**, partly attributed to expectations of favourable regulatory policies.
- **Between November and December, Bitcoin gained a further 20 per cent,** fuelled by investor optimism and a speculative push, finally crossing the $100,000 mark.
- **Investor sentiment indices for cryptocurrencies rose sharply**; many saw Trump's stance as a counterbalance to previous years of regulatory uncertainty.

1.3   The *all-time high* (ATH)

Bitcoin's price reached an all-time high in November 2024, surpassing $85,000 and finally hitting the $100,000 mark in December. This milestone was driven by a combination of factors, including increased inflows into ETFs, growing institutional adoption and speculative momentum.
The ATH driving factors were:

- **sustained demand from institutional investors** such as pension funds and sovereign wealth funds;
- **the supply shock caused by the Bitcoin halving of 2024**, which reduced the reward per block from 6.25 BTC to 3.125 BTC, decreasing the rate of new Bitcoins placed on the market;
- **the continued decline in interest rates**, in Europe and the US, during 2024;
- high media coverage and the so-called 'fear of missing out' (FOMO) among retail investors during the price rally.

1.4   Derivatives: *futures* and options

The derivatives market played a crucial role in the cryptocurrency ecosystem in 2024, particularly through the products traded on the **Chicago Mercantile Exchange (CME)**. Futures and options trading volumes reached new highs due to increased institutional participation.
Some key data:

- Bitcoin futures on the CME (Figure 1.2) recorded an average daily volume of more than USD 2.5 billion in 2024, a 35% increase over 2023;

- options written on Bitcoin futures (Figure 1.2) showed an annual growth of 50%, with open interest peaking at $1.8 billion in November;
- Ethereum futures and options (Figures 1.2) gained ground, with average daily volumes exceeding USD 1 billion.
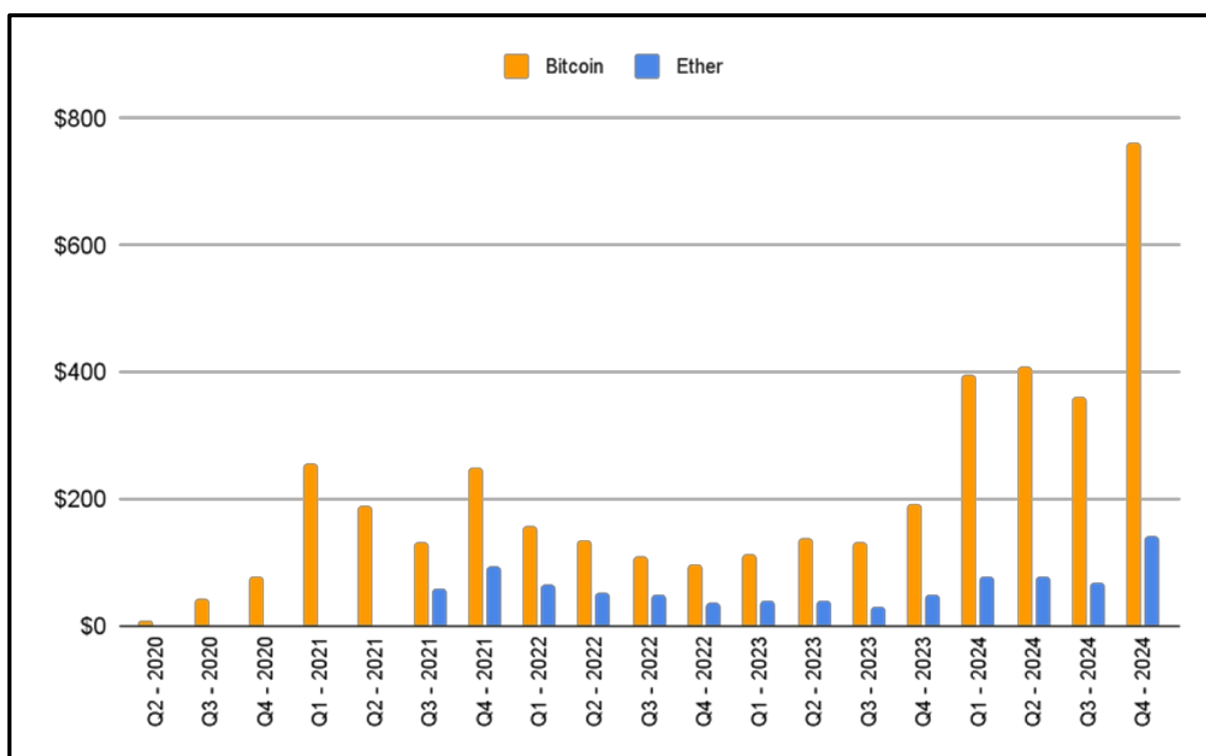

Figure 1.2 - Price of futures, traded on the CME, written on cryptocurrencies

These products have enabled sophisticated investors to hedge against price volatility, speculate on market movements and boost the instrument's liquidity. The growing adoption of derivatives has highlighted the maturation of the cryptocurrency market and its integration into the traditional financial system.

1.5   Volatility and correlation

Despite bullish trends, 2024 remained a volatile year for cryptocurrencies. **Bitcoin's annualised volatility was 52%, higher than traditional assets but slightly lower than previous years, signalling maturing market dynamics.** In particular:

- the major *altcoins* showed even higher annualised volatility, with Ethereum at 65% and Solana exceeding 85% during the main trading periods; periodic corrections of 10-15% in a single day highlight the risks associated with digital assets.

In terms of correlation:

- **Bitcoin maintained a low correlation (20 per cent) with traditional asset classes such as stocks and bonds**, reinforcing its *appeal* as a portfolio 'diversifier' asset.
- Correlations between cryptocurrencies remained high (80% on average), reflecting the market's interconnected nature.

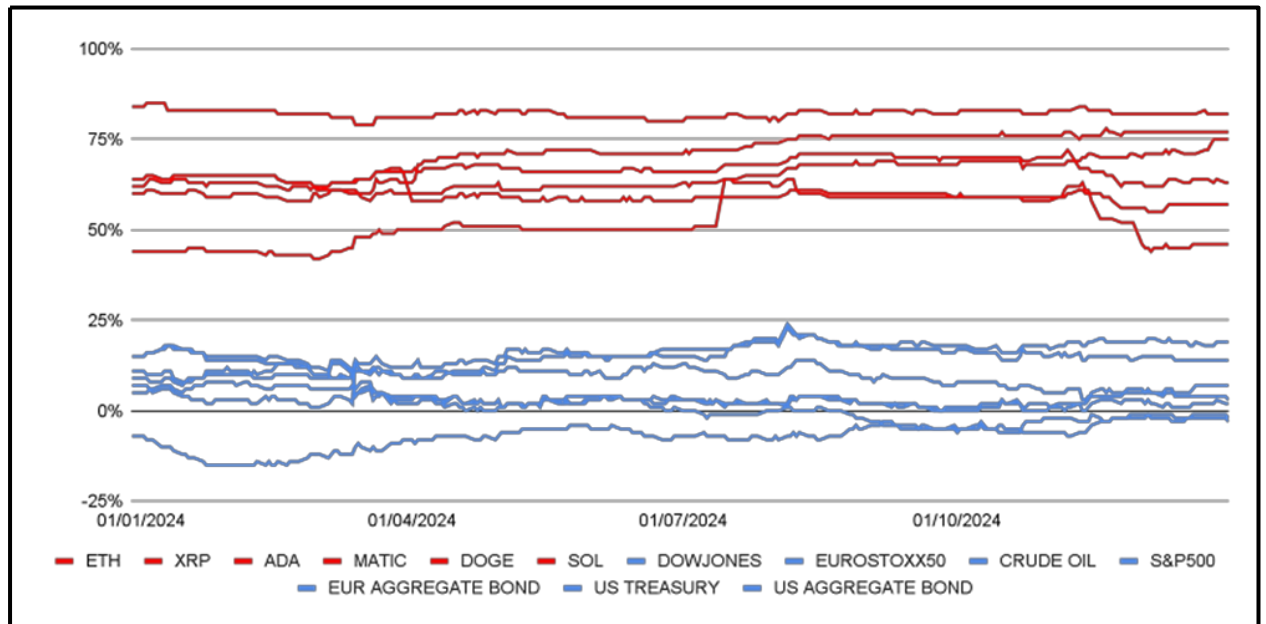Figure 1.4 shows the trend in the correlation between BTC and others over time.

Figure 1.4 - Correlation between Bitcoin and other assets

1.6   Conclusions

In 2024, the cryptocurrency market showed **a dynamic combination of innovation, evolving political landscape and changing investor behaviour**. The launch of cryptocurrency ETFs and the achievement of new price milestones underlined **the sector's growth**, while trends in volatility, derivatives and correlations highlighted its **continued maturation**.

Looking ahead, these developments position cryptocurrencies as both a promising and challenging area for investors worldwide.

02 Regulation

edited by
Francesca Mattassoglio*

2.1   Foreword

The **lack of a common taxonomy** on digital assets is oftern mentioned as the crucial obstacle to a constructive dialogue between different jurisdictions.

In the context of this Report, the term 'crypto assets' (or *tokens*) will be used, denoting one of the major applications of DLT technology within financial markets, in line with the choice made by the European regulator (see Section 2.3 below).

Globally, there are now thousands of types of cryptoassets in circulation, which may have very different characteristics. In recent years, in fact, in addition to Bitcoin and Ethereum - which belong to the category of so-called ***cryptocurrencies*** - many others have spread that can present, from time to time, characteristics similar to financial instruments or payment instruments, or offer the possibility to use goods and services. Among these, especially from 2019 onwards, so-called ***stablecoins***, i.e. those digital tokens that stabilise their value by pegging their value to other assets or currencies' value, have become really important. Initially, supervisory authorities

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and regulators did not pay too much attention to the phenomenon, as it was substantially regarded as too small to cause concern, a proof thereof being that tokens such as Tether, TrueUSD and Paxos Standard have been in circulation for years. In 2019, however, the situation changed completely with Facebook's announcement of the **Libra** project, a crypto-asset that aimed to peg its value to a basket of currencies issued by major governments, and which aspired to become a global payment instrument ('Global Stable Coin' or GSC).

As is well known, not only was the project halted - following a firm reaction from supervisory and regulatory authorities around the world - but it nonetheless triggered an intense debate on the need to regulate the sector, the fruits of which are now beginning to be seen.

This attention is undoubtedly destined to intensify given that, in the last few days, Elon Musk has announced the launch of the **X Money** payment system - i.e. *The world's digital payments network for all things money* - in 2025.

2.2   A quick overview of the international context

According to recent **mapping conducted by the Atlantic Council (link)**, crypto- assets are legal in 33 countries, partially banned in 17 and generally prohibited in 10. A report by the Bank for International Settlements (BIS, 2024) also noted that more than 60% of the jurisdictions surveyed have already or are working on establishing a regulatory framework for this type of asset. In particular, 48% appear to be working towards introducing ad-hoc regulation for the phenomenon with a large focus on the stablecoin category (especially the UK, Hong Kong and Singapore).

In just 9% of jurisdictions, these assets are subject to the same regulation as the traditional financial markets, whereas some 33% of jurisdictions do not yet have a dedicated regulatory framework in place or are working on one. This is a very important factor that needs to be emphasised and is bound to play a highly significant impact on future developments in a market that is now difficult to consider within the narrow territorial and political boundaries.

2.3   The European Framework

In such a context, the European Union is characterised by the most comprehensive and intense regulation of the phenomenon, the result of a political orientation that clearly differs from the approach adopted so far by both the US and Asian countries.

Among the most relevant regulatory interventions, mention should first be made of **Regulation (EU) 2023/1114** on cryptocurrency markets (**MiCAR**), in force since 30 June 2024 for the part concerning stablecoins and since 30 December 2024 for all remaining parts.

It aims to harmonise the regulation of the various member states, which had proceeded to introduce autonomous national laws in recent years. MiCAR focuses on investor protection and market integrity, introducing specific regulation for certain types of crypto-assets - first and foremost stablecoins - and for **crypto asset service providers (CASPs)**.

MiCAR's content can therefore be divided into two parts: the first is devoted to rules on how certain types of crypto assets, understood as 'a digital representation of a value or right that can be transferred and stored electronically, using distributed ledger or similar technology' (Art. 3(1)(5)), can be issued and admitted to a trading platform.

The second part, on the other hand, is devoted to crypto-asset service providers (CASPs), such as trading, advisory, custody, etc., for which there has been talk of a substantial recall, albeit with some adjustments, of the rules applying to traditional financial services as provided for in MiFID 2. The scope of application and the very taxonomy used by the regulation raise considerable problems of interpretation, so it may be useful to provide some clarification.

The MiCA regulation introduces specific rules for public offerings and applications for admission to a trading platform for three categories of crypto-assets: namely, **asset-referenced tokens (ARTs)**, **e-money tokens (EMTs),** both falling under the category of stablecoins, and tokens that are **'other' than the two previous categories**. Given its importance, before turning to the examination of MiCAR, we shall only briefly clarify the rules applicable to crypto-assets in the nature of financial instruments.

2.4   The regulation of crypto-assets with a financial nature

Tokens that are financial in nature are subject to the discipline of **MiFID 2** and the **Prospectus Regulation**, as regards both the offer and the admission on a trading platform.

Today, in fact, the definition of financial instrument contained in MiFID 2, as it has also been transposed into Italy's financial law, provides that the 'financial instrument' must now be understood as any instrument listed in Section C of Annex I, including instruments issued through distributed ledger technology.

It follows, in full application of the so-called **principle of technological neutrality**, that in the EU all financial instruments, including those dematerialised using DLT technology, must be subject to the same rules. This translates into the obligation to draw up, where necessary, a prospectus and, in the case of the offer of services crypto activities of a financial nature (such as, for example, investment advice, portfolio management, operation of trading venues), to abide by the rules on reserved activities and those provided for by MIFID II (and, with regard to Italy, as they have been transposed by TUF).

Conversely, as for the secondary market, reference should be made to the provisions contained in the **Pilot Regulation (EU) 2022/858** and to Law No. 52 of 10 May 2023, which converted, with amendments, Decree-Law No. 25 of 17 March 2023, 'containing urgent provisions on the issuance and circulation of certain financial instruments in digital form and the simplification of FinTech experimentation'. The Pilot Regulation is an important example of a *regulatory sandbox*, i.e. an experimental and limited framework for the circulation of tokenized financial instruments on the secondary market, aimed at overcoming regulatory gaps due to legal, technological and operational specificities related to the use of distributed ledger technology and crypto-assets that fall under the definition of financial instruments.

To this goal, the regulation introduced a number of requirements in relation to DLT market infrastructures and their operators regarding:

(a) the granting and revocation of specific authorisations to operate;

(b) the granting, modification and revocation of exemptions to specific authorisations;

(c) the imposition, modification and revocation of conditions attached to exemptions and in relation to the imposition, modification and revocation of compensatory or corrective measures;

(d) the management of DLT market infrastructures;

(e) the supervision of the DLT market infrastructures;

(f) cooperation between DLT market infrastructure operators, competent authorities and the European Securities and Markets Authority (ESMA).

2.5   MICAR and asset-linked tokens

That having been clarified, it is now possible to move on to consider the new regulations introduced by MICAR for the crypto assets it considers, starting with those envisaged for stablecoins.

Asset-referenced tokens **(ARTs)** are a type of crypto-asset that is not an e-money token and that aims to maintain a stable value by referring to another value or right or a combination of the two, including one or more official currencies.

For this case, Title III, Chapter 1, provides that the offer to the public and the admission to trading can only be made by a legal person in possession of specific authorisation or by a credit institution, in both cases subject to the publication of a ***white paper.*** This document, in the context of MiCAR, takes on documentary value equivalent to the prospectus, for the public offering of tokens that are not financial in nature according to the provisions of MiCAR itself (see Figure 2.1). These provisions do not have to be complied with if the offer is less than EUR 5 million or aimed exclusively at professional investors. It should be noted that Article 18 requires that the application for authorisation must be accompanied by a 'legal opinion' stating not only that the crypto-asset is not excluded from the scope of application of the regulation in question, but also that it is not an EMT. In the case of **ARTs with an issuance value of more than EUR 100 million**, the issuer must submit a set of information to the competent authority on a quarterly basis, such as:

a) the number of holders;
b) the value of the ART issued and the size of the reserve of assets;
c) the average number and average aggregate value of transactions per day during the relevant quarter;
d) an estimate of the average number and average aggregate value of transactions per day during the relevant quarter that are associated with its use as a means of exchange within a single currency area.

Thus, a special case of issuance restriction is foreseen, only for this type of token, if the estimated quarterly average number and aggregate value of daily transactions associated with its use as a medium of exchange in a single currency area exceeds one million transactions and EUR 200 million, respectively. In such cases, the issuer is required to cease issuing the token and, within 40 business days of reaching this threshold, submit a plan to the competent authority to ensure that the quarterly average number and the estimated average aggregate value of daily transactions are kept below one million transactions and EUR 200 million respectively.

Finally, Chapter 5 introduces a discipline with enhanced requirements for so-called ***significant ART***, i.e. tokens that meet three of the following five criteria:

i) **large user** base: the size of the customer base of the broadcaster or suppliers must exceed 10 million;

ii) high market capitalisation: the total value of tokens issued must exceed EUR 1 billion;

iii) high transaction volume: the average value of transactions per day is expected to exceed EUR 500 million;

iv) cross-border activity: the issuer's token offer is available in more than seven EU Member States.

 v) interconnectedness: the token has strong links with the traditional financial system or is used by a significant number of financial institutions.

2.6   MICAR and e-money *tokens*

An ***electronic* money *token* (EMT**) is a type of crypto-asset that aims to maintain a stable value by reference to the value of an official currency. Title IV of MiCAR provides that the public offer or admission to trading of an e-money token may only be made by a person authorised as a credit institution or e-money institution and subject to the publication and notification of a White Paper, according to the contents defined in the same Regulation (see Figure 2.1). EMTs are considered electronic money; if the reference currency is the official currency of a Member State, they are considered to be offered to the public in the Union. For this reason, unless expressly provided otherwise, the regulations contained in **Dir. 2009/110/EC (*Electronic Money Directive* II, EMD2)** on the taking-up, pursuit and prudential supervision of the business of electronic money institutions apply to them. In this case, the prohibition on granting interest applies.

Chapter II of MiCAR is devoted to the so-calle ***significant* EMTs**, introducing, again, enhanced   criteria. For the identification of 'significance', the criteria indicated above apply (see Section 2.5)

2.7   MICAR and crypto-activities 'other' than ARTs and EMTs

Title II of MICAR deals with the regulation of public offerings of crypto assets *other than* asset-linked tokens or e-money tokens. Here, however, the regulator does not introduce a precise definition of the potentially even broad category, which naturally excludes not only stablecoins but, also, tokens of a financial nature.

For its delimitation, it is necessary to refer to Article 4(3), pursuant to which the Title does not apply when:

a) the crypto-asset is offered free of charge;

b) the crypto-asset is automatically created as a reward for maintaining the distributed ledger or validating transactions;

c) the offer concerns a utility token that provides access to an existing or managed good or service;

d) the owner of the crypto-asset has the right to use it only in exchange for goods and services in a limited network of merchants with contractual agreements with the provider.

From subparagraphs *(b)* and *(c),* which are the ones of most interest, we can draw important indications. In particular, point *(b)* excludes crypto-assets such as Bitcoin, i.e. those that are a mere product of mining activity, from the scope of MiCAR. This interpretation is also in line with the content of Recital 22, which provides that the Regulation should only apply when it is possible to identify a natural and legal person who is responsible for the activity or service, inherent in a digital asset. If the crypto-activity is 'fully decentralised' and has no identifiable issuer, the rules of Titles II, III or IV of the Regulation do not apply to it; it may, however, be the subject of services provided by CASPs.

It follows from this that **Bitcoin is not subject to the rules on issuance and application for admission to a trading platform in Part I of MICAR, but may be subject to advisory activities, gatekeeping, order execution, etc. under the new rules on *Crypto Assets Service Providers* (CASPs) contained in Part II of the Regulation.**

Point *(c)*, on the other hand, concerns the case of so-called **utility tokens**, which, according to Article 3(1)(9), are a type of crypto-asset intended solely to provide access to a good or service provided by its issuer. Given that this letter excludes application to cases of tokens providing access to a good or service 'already in existence or under management', it may be inferred that cases of utility tokens promising access to assets not yet in existence or under future management, the offer of which, however, takes place within 12 months of the date of publication (par. 6), are instead included. In this case, the Regulation provides for simplified requirements with respect to the provisions for *stablecoins*, in that the offer (Art. 4) and the request for admission to a trading platform (Art. 5) can also be made by a mere legal entity and subject to the drafting, notification and publication of a ***white paper***, pursuant to Art. 6 (see Figure 2.1).

This obligation does not apply if the offer is addressed to fewer than 150 natural or legal persons per Member State in which those persons act on own account;

the total consideration, over a period of 12 months from the commencement of the offer, does not exceed EUR 1 million or the equivalent amount in another official currency or cryptocurrency; and is intended only for qualified investors where the cryptocurrency may be held only by such qualified investors.

2.8   The discipline for crypto service providers

As far as crypto-asset service providers (CASPs) are concerned, they must be distinguished into three categories: **on-demand providers**, **European law providers** and **national law providers**. They can be either crypto-asset providers, such as an *exchange* or a *wallet service provider*, or traditional financial market players that also start offering *token* services.

Crypto-activity services, in turn, are defined under Art. 3(1)(16) of the MiCAR as any service in connection with any crypto-activity that takes the form of:

a) provision of custody and administration of crypto assets on behalf of clients;
b) running a cryptocurrency trading platform;
c) exchange of crypto-assets for funds;
d) exchange of crypto-assets with other crypto-assets;
e) execution of cryptocurrency orders on behalf of clients;
f) placement of crypto-assets;
g) receiving and transmitting crypto-activity orders on behalf of clients;
h) provision of advice on cryptocurrencies;
i) portfolio management service on crypto-assets;
j) provision of cryptocurrency transfer services on behalf of clients.

The regulatory status of CASPs, which fall within the scope of MICAR, is contained in Title V, which in turn has two different levels. The first level is represented by rules that apply, in a general way, to all CASPs and provides respectively for: 1) the authorisation procedure; 2) the obligations for all service providers; 3) the rules on the acquisition of service providers; 4) the rules on so-called significant service providers. The second level is, on the other hand, represented by rules applicable, from time to time, to providers under European or national law, or for the performance of specific services.

It should be noted that from the point of view of regulation, the distinction between **centralised exchanges (CEX**) and **decentralised exchanges (DEX)** is particularly important, as MiCAR excludes from its scope cases where services are offered in a fully decentralised manner. It follows that the phenomenon of **decentralised finance (DeFi)** should be considered outside the scope of MiCAR if it cannot be traced back to a responsible entity.

2.9   The AML and KYC discipline

In addition to the regulations referred to above, the sector must also comply with the rules on anti-money laundering and countering the financing of terrorism for all crypto-assets, not only those now assimilated to financial instruments.

MiCAR requires CASPs to comply with both KYC and AML rules, as well as an enhanced due diligence in the case of customers from high-risk countries. In particular, as a member of the Financial Action Task Force (FATF), the EU has aligned itself with the rules on the so-called **travel rule**, with reference to reporting requirements for all transaction information, with a threshold of €1,000 for self-hosted wallets.

In Italy, for years already, **Legislative Decree No. 90 of 25 May 2017** introduced the definition of *service providers relating to the use of virtual currency* and *virtual currencies*, while Article 1 of **Legislative Decree No. 125 of 4 October 2019**, transposing the Fifth Anti-Money Laundering Directive, introduced the definition of *digital wallet service providers*, extending to them the registration requirements already in force for those who exercised, towards the public, the activity of money changers. In this context, 'virtual currency' means *the digital representation of value, not issued by a central bank or public authority, not necessarily linked to a legal tender, used as a medium of exchange for the purchase of goods and services and transferred, stored and traded electronically* (Art. 1(2)(qq)).

2.10   The DORA Regulation

Finally, the overview of the European regulatory framework on crypto-assets must still include at least a mention of the DORA Regulation, which aims to promote the harmonisation of digital resilience requirements for the entire European financial sector and regulates the following profiles: **(1) ICT risk management; (2) ICT incident reporting; (3) digital operational resilience testing; (4) third-party risk management arising from the use of ICT service providers; (5) infosharing**.

In particular, financial entities are required to establish, monitor, and update over time a robust, comprehensive, and adequately documented cyber risk management framework to address such risks quickly, efficiently, and comprehensively through a digital operational resilience strategy.

2.11   Decentralised Finance (DeFi)

As mentioned above, the term **decentralised finance (*decentralised finance,***

DeFi) usually refers to the offering of financial assets *on* crypto assets that occur *on-chain*, thanks to automated, decentralised and disintermediated blockchain protocols. Precisely these characteristics, and in particular an effective and complete decentralisation, represent one of the most delicate challenges regulators and supervisors worldwide at present, and justify the exclusion from the scope of MiCAR.

For this reason, the Regulation mandated the Commission to prepare a series of reports to the European Parliament and the Council, after consultation with the financial authorities. In particular, by 30 December 2024, it was to submit a *report* containing *an assessment of the development of decentralised finance in markets in crypto-assets and of the appropriate regulatory treatment of decentralised crypto-asset systems without an issuer or crypto-asset service provider, including an assessment of the necessity and feasibility of regulating decentralised finance* (Art. 142); and two reports, to be submitted in June 2025 and June 2027 respectively, which are to provide *an assessment of the development of decentralised finance in markets in crypto-assets and of the appropriate regulatory treatment of decentralised crypto-asset systems* (Art. 140). To date, however, the report has not been submitted.

2.12 Is European regulation working?

Is it helping the development of the financial system?

For the moment being, it is too early to give an answer. Only in the next few years we will be able to understand whether the regulation contained in MiCAR has pursued its ambitious goals. It is not to be forgotten that MiCAR refers to the adoption of a series of delegated regulatory acts that have already been recently adopted or are in the process of being adopted. For now, the implementation front for the pilot scheme, which has now been in force for more than two years, is certainly very disappointing.

Indeed, in April 2024, ESMA had to admit that, given the state of substantial non-application, it was pointless to prepare the report required by Article 15, and merely drafted a short letter pointing out that there were only four official requests to participate in the trial, compared to eight others still waiting to start the procedure.

The letter also mentions a number of obstacles that, according to the European authority, would stand in the way of the realisation of a market for financial instruments on DLT, including, first and foremost, the **absence of a public digital currency (i.e. a 'digital euro'), which would be essential for settlement operations**.

As is well known, we are in fact still far from the introduction of such an

instrument. It was not until October 2023 that the European Central Bank, after a two-year period of work, decided to embark on a subsequent investigative phase concerning the digital euro, which will last a further two years. Of course, in the meantime, it will be interesting to see what effect MiCAR will have on the spread and use of private stablecoins.

In addition to the issue related to the essence of a widely used e-money, among the obstacles to the realisation of a digital asset market on DLT, ESMA also points to other aspects, such as: the **uncertainty related to custody services, especially of *self-hosted wallets***, which is not fully addressed by either MIFID 2 or MiCAR; the **difficult interoperability between traditional centralised market structures and the new ones on DLT introduced by the Pilot Scheme; and the uncertainties related to the very duration of the sandbox regime introduced by the Pilot Scheme.**

To these critical elements, which hitherto have certainly made the launch of an effective asset market on DLT difficult, a further profile must be added, relating to the uncertainty surrounding the tax regime of crypto-assets. An area that, among other things, has remained within the competence of nation states.

It is evident, in fact, that the push for the creation of a parallel and competing market based on decentralised technology could be stopped, right from the start, if assets on DLT were to be subjected to different and higher taxation than other dematerialised assets in traditional form. Therefore, it can be assumed that the path to regulating the crypto phenomenon is still in its infancy and that many important decisions still have to be matured.

White paper for ARTs/EMTs	White paper for *other tokens*
(a) information about the issuer of the ART/EMT; **(b)** information about the ART/EMT; **(c)** information about the offer to the public of the ART/EMT or its admission to trading; **(d)** information on the rights and obligations attached to the ART/EMT; **(e)** information on the underlying technology; **(f)** information on the risks; **(g)** information on the reserve of assets; **(h)** information on the principal adverse impacts on the climate and other environment-related adverse impacts of the consensus mechanism used to issue the ART/EMT.	**(a)** information about the offeror or the person seeking admission to trading; **(b)** information about the issuer, if different from the offeror or person seeking admission to trading; **(c)** information about the operator of the trading platform in cases where it draws up the crypto-asset white paper; **(d)** information about the crypto-asset project; **(e)** information about the offer to the public of the crypto-asset or its admission to trading; **(f)** information about the crypto-asset; **(g)** information on the rights and obligations attached to the crypto-asset; **(h)** information on the underlying technology; **(i)** information on the risks; **(j)** information on the principal adverse impacts on the climate and other environment-related adverse impacts of the consensus mechanism used to issue the crypto-asset.

Figure 2.1 - Contents of the white paper according to MiCAR

02.A Categories of crypto-assets and applicable regulations

General category	Category entailed by MiCAR	Offer to the public and admission to trading	Crypto-asset service providers (CASPs) not fully decentralized
Stablecoin	Asset-referenced tokens (ARTs)	MiCAR (white paper)	MiCAR, AML & KYC, DORA
Stablecoin	Electronic money tokens (EMTs)	MiCAR (white paper), EMD2*	MiCAR, AML & KYC, DORA
Utility token	Token 'other than' ARTs and EMTs	MiCAR (white paper)	MiCAR, AML & KYC, DORA
Token finanziari	Crypto-assets qualified as securities	MiFID II, Prospectus Regulation, DLT Pilot Regime (mercato secondario)	MiFID II, AML & KYC, DORA
	Non-fungible tokens (NFTs)		
Bitcoin (es.)			MiCAR, AML & KYC, DORA
Other tokens fully decentralized			MiCAR, AML & KYC, DORA

*only if the *fiat* currency is euro

Acronyms and normative references

ART	*Asset-Referenced Token*
EMT	*Electronic Money Token*
NFT	*Non-Fungible Token*
MiCAR	*Markets in Crypto-Assets Regulation* , Reg. (UE) 2023/1114
MiFID II	*Markets in Financial Instruments Directive* , Dir. 2014/65/UE
DORA	*Digital Operational Resilience Act* , Reg. (UE) 2022/2554
AML	*Anti-Money Laundering* (normativa antiriciclaggio)
KYC	*Know Your Customer* (normativa in materia di trasparenza nei rapporti con la clientela)

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03 The ecosystem

edited by
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The chapter aims to provide an overview of the ecosystem that characterises *Decentralised Finance* (DeFi) by analysing the professional investors active in this context, the platforms where the exchange of tokenized instruments takes place, as well as the characteristics of the latter.

3.1 Institutional Investors in DeFi

The world of cryptocurrencies has seen an increasing presence of institutional investors, such as funds specialising in crypto assets (**crypto funds**), indicating an increasing degree of market intermediation.

Evidence from various studies shows that crypto funds, including family offices and hedge funds with fewer regulatory constraints, are increasingly gaining influence in decentralised finance (DeFi).

Their presence has helped improve efficiency in the token offerings market in terms of performance and volatility, as well as improving the ability of companies to attract new lenders.

From 2017 to 2023, crypto funds showed strong growth in numbers. Half of the funds were launched between 2017 and 2018: more than 300 were born in that period; in the following years, there was a gradual slowdown, followed by a brief recovery in 2021.

**Crypto Asset Lab (CAL), University of Milano-Bicocca

At the end of 2023, there were 868 funds specialising in crypto companies, operating in 85 different countries and managing *assets* worth around USD 70 billion (CryptoFund Research, 2024*). Of these 868, 50 per cent are based in the United States; the remainder are spread in smaller percentages between Europe, where the United Kingdom counts for 6 per cent, and Asia, with Hong Kong and Singapore each at 5 per cent (Figure 3.1).
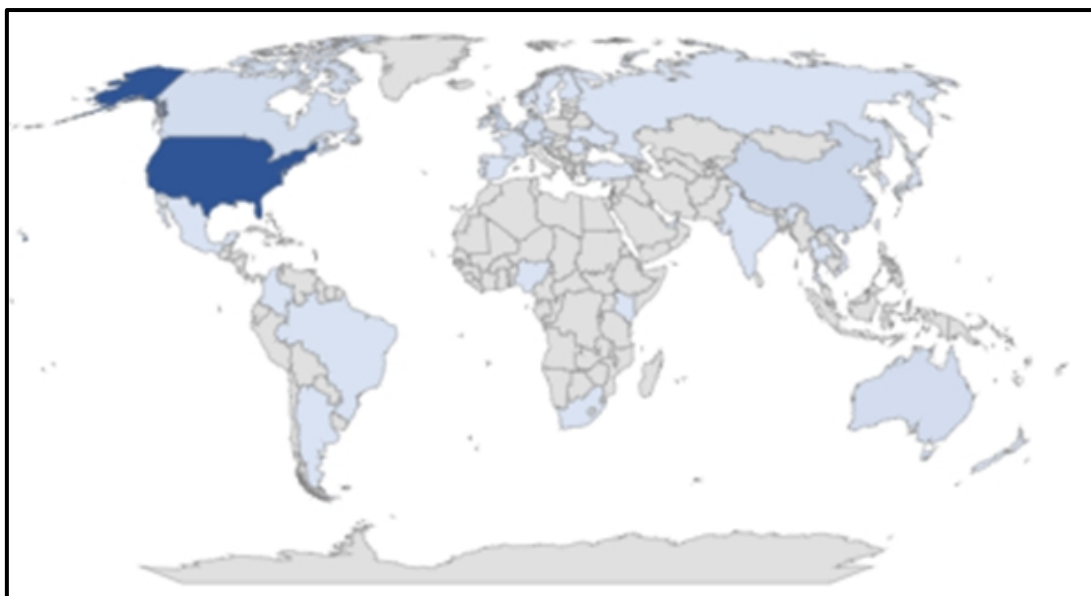

Figure 3.1 - **Geographical distribution of *crypto funds***
In countries shaded in grey, the phenomenon is absent; in those shaded in blue, *crypto funds* are present in numbers ranging from 1 (lowest) to 428 (highest, corresponding to the United States).

The areas that therefore host the most funds are also those where there is traditionally a well-structured alternative finance sector with its own 'historicity'.
American cities with the highest number of funds include San Francisco
- where the Silicon Valley area is already home to other established *venture capitalists*
-, New York and Chicago. In Europe, London and Zurich dominate; in Asia, Singapore and Hong Kong.
Of those based in the US, strictly speaking less than 20% are domiciled in the US: the others are headquartered in the Cayman Islands or the British Virgin Islands for tax and regulatory reasons. Moreover, of the US-based funds, a third are registered with the Securities and Exchange Commission (SEC) under the *Investment Company Act of* 1940; others, being small, qualify as purely *advisory* providers and are therefore not required to register with the regulator.
The number of funds discontinuing their activity each year (Figure 3.2) was around 5-10% between 2019 and 2021; in the last two years, however, not only has the number of new openings decreased, but also the number of discontinuations. **Compared to the past, therefore, there seems to be more stability in terms of *crypto funds* operating in manner continued in this market segment**.
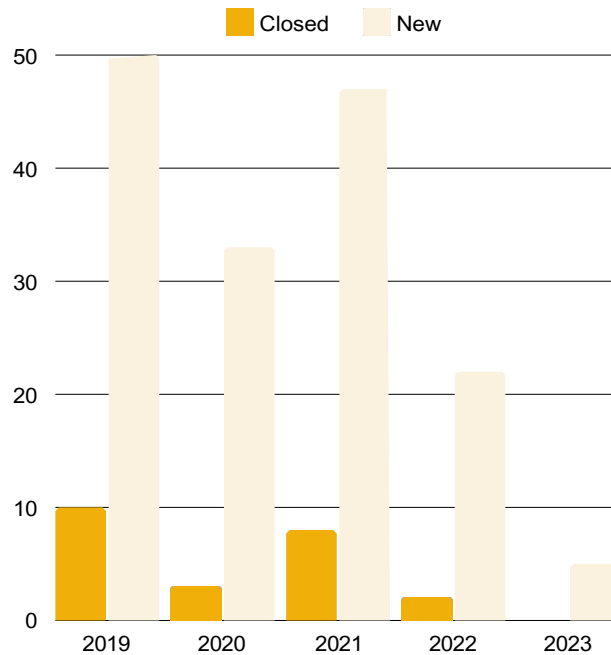
Figure 3.2 - *Crypto funds* in recent years: new openings and closures

On the basis of the investment strategy, different types of investors can be distinguished:

- **hedge funds**, with a short-term orientation and therefore frequent *asset* trading;
- **venture capital** (**VC**) **and** **private equity** (**PE**) **funds**, with investment strategies more oriented towards the long term. The latter category also includes 'hybrid' funds that invest in liquid cryptocurrencies (e.g. Bitcoin) and participate in *token offerings*.

Currently, the market sees more *hedge funds* (Figure 3.3), which hold (Figure 3.4) as much as 55% of the volume of *assets under management* (AUM) and often have investment activity exclusively focused on the crypto segment (77% of investments).
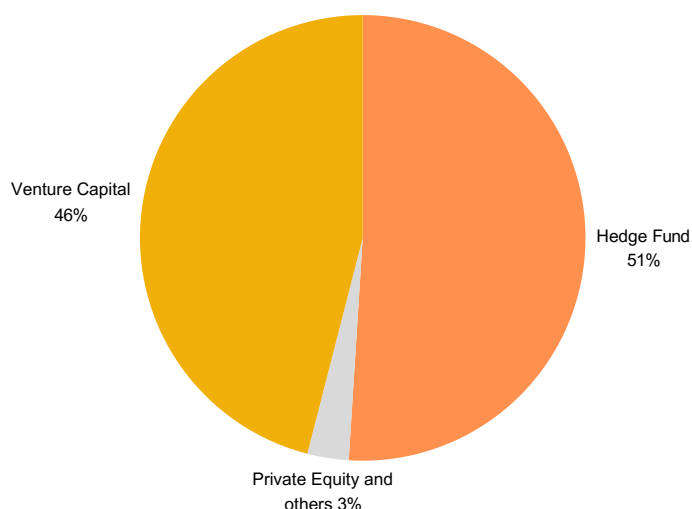

Figure 3.3 - Breakdown of *crypto funds* by type (*hedge, venture capital, private equity*)

PE funds account for only 3% of the total but weigh 17% of the AUM in the market; VC funds hold 28% of the AUM in the market and a balanced investment activity between companies focused on the crypto ecosystem (*exchanges*, DApps, *blockchain* developers, etc.) and companies operating in other sectors.

Although the AUM *of crypto* funds continues to grow, *assets* remain heavily concentrated in the hands of a limited number of funds.
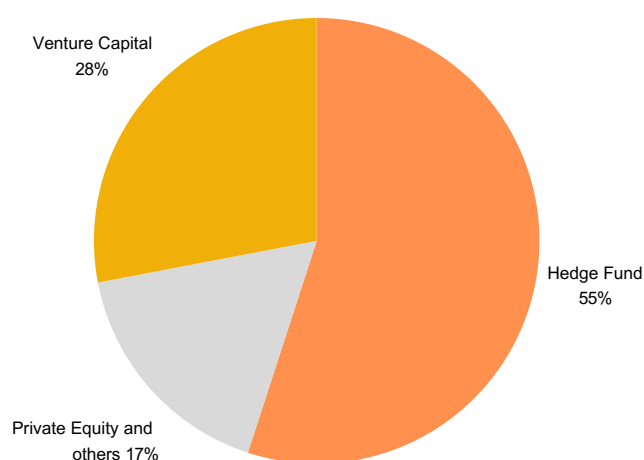
Figure 3.4 - Percentage of AUM by type: *hedge funds*, *venture capital*, *private equity*

3.2 Exchanges in DeFi

Exchanges of crypto-assets or *tokens* take place within so-called exchanges, platforms for the promotion and exchange of DeFi. Recent international developments in the political and regulatory spheres seem set to strengthen the role and demand for crypto-assets and, thus, the need for a deeper understanding of the characteristics of these platforms. Among them:

- the market *rally* that took Bitcoin (BTC) over the threshold of $100,000, for the first time, in December 2024;
- the arrival of a new*, pro-crypto* administration in the United States, where some of the ideas discussed could also entail a revision of the supervisory architecture: for instance, entrusting the Commodities and Futures Trading Commission (CFTC) with the oversight of crypto-assets in place of the SEC, which currently has jurisdiction over them;
- the rapid changes in South Korea, one of the world's *crypto hubs*, where the institutional crisis seems to have blocked - at the same time - both a proposal to tax *capital gains* on crypto-assets and a broader review of the regulatory framework.

Such events could further stimulate demand for crypto-assets, as well as interest on the part of policy and technical decision-makers. However, the entry of *exchanges* into activities akin to traditional intermediation - e.g. *crypto lending* and *crypto staking* - and the news about the damages suffered by some investors due to the fraudulent behaviour of certain operators - think of the FTX scandal, an *exchange* that ended up in liquidation - should push towards a deeper understanding of how platforms work, in order to understand their risks and opportunities. In particular, a first level of analysis should concern their *business models* (BM), i.e., the way in which an organisation generates and allocates value; in other words, the characteristics of the company's activity - in this case, (the operator of) a platform for the exchange of crypto-assets - that allow it to generate revenues and economic sustainability over time.

The identification of the adopted BMs *of exchanges* should also make it possible to understand the differences from traditional finance operators.

Integrating existing studies on exchange operations with the recent IOSCO (2024)* study on trading venue business models suitably adapted to the DeFi environment, we proposed to consider the following 'dimensions' as the basis for identifying specific BMs:

1. **modes of intermediation** ('market infrastructure' in the narrow sense), both in relation to the nature of the platforms - as DeFi includes primary and secondary markets, as well as clearing houses - and the role they play in transactions (e.g. *market makers* can be considered part of the clearing functions), and in relation to services other than trading and offered to a wide range of *stakeholders*;

1. **object of the transactions**, where exchange platforms deal not only with *cryptocurrencies* (i.e. 'virtual currencies') but also with *security tokens* (e.g. linked to administrative and/or patrimonial rights and subject to financial activities legislation), as well as so-called *utility tokens*, which are intended solely to access to a good or service provided by its issuers (Article 3(1)(9) MiCAR);

1. **mode distribution of crypto-assets**: i.e., the mechanisms adopted for the transfer of tokens into investors' wallets, which may take place either free of charge (as in the so-called *airdrop*) or against payment.

Below, we report and describe the main characteristics that can be associated each dimension (indicated in brackets):

1. **Decentralisation** (A): *decentralised exchanges* (DEX) operate by means of automated protocols governed by smart contracts, without an entity actively presiding over the various functionalities, unlike 'centralised' *exchanges*, i.e. managed by an operator who ensures the smooth functioning of the market infrastructure;
2. **liquidity creation** (A), i.e. services to support the trading phase (e.g. *market making* activities also in an automated manner*)* and/or post-trading services (e.g. trade settlement services);
3. **performance of activities instrumental and related to** investment services (A), analogous to those regulated by MiFID II (e.g. custody of crypto assets).
4. **provision of payment services** (A), by analogy with those governed by PSD II.
5. **trading in *security tokens*** (B), including derivatives whose underlying are crypto assets.
6. **trading in *utility tokens*** (B), including so-called 'non-fungible' *tokens* (NFT).
7. **use of *airdrops*** (C), either systematically or even only occasionally, as these can have a non-negligible effect on the price of crypto-assets and the volume of their transactions.

Figure 3.5 summarises the relationship between the three BM dimensions and the seven characteristics of *exchanges*, highlighting those that will be the subject of the analysis aimed at identifying 'typical' BMs.

A	**Intermediation mode**	1	Decentralization
		2	Liquidity creation
		3	Performance of ancillary activities
		4	Provision of payment services
B	**Object of transactions**	5	Security tokens trading
		6	Utility tokens trading
C	**Crypto-assets distribution mode**	7	Use of airdrops

Figure 3.5 - Conceptual diagram for the analysis of business models (BM) of cryptocurrency *exchanges*. Highlighted in grey are the variables considered for the identification of BMs.

The starting point for identification of WBs is the collection of data **on elements characterising the nature and operation of the platforms**, which we mapped for a globally representative group of *exchanges*. We analysed 400 *exchanges* among those surveyed in 2023 via the Crunchbase platform; for each of them, we collected information on the seven characteristics presented above. Figure 3.6 summarises the results: majority of the *exchanges* are centralised (77.3%) and did not *airdrop* (80.8%); they do not facilitate the trading of *security tokens* or *utility tokens* (65.7% in both cases) and do not provide payment services (71.0%); however, they predominantly provide liquidity creation (71.0%) and perform ancillary activities by providing customised services to their customers (74.0%).

The identification of homogeneous groups of BMs adopted by crypto exchanges starts from the consideration of the characteristics presented above relating to the mode of intermediation and the object of transactions, with the exception of decentralisation as the 'primary' characteristic that informs the entire BM. We therefore focus our analysis on: liquidity creation, trading of *security tokens*, trading of *utility tokens*, provision of payment services, and performance of instrumental and related activities.

Figure 3.6 - Presence of various characteristics in the structure and operation of *exchanges.*

Through the statistical methodology known as principal component analysis (PCA), it is possible to identify relationships between *input* variables, aggregating them on the basis of mutual correlations. In our study, PCA identifies five different configurations, each representative of a different BM. To identify the type of BM, it is necessary to analyse the relevance (i.e. correlation) of each input variable within the specific configuration. Figure 3.7 shows the value of these correlations in the five aggregation groups identified by the analysis. As the intensity of the orange (grey) colour increases, so does the positive (negative) relevance of the analysed variable within the configuration. It is therefore possible to assign a label to each of the five different configurations representing as many BMs:

1. **Total Exchange**, focused on creating liquidity and carrying out instrumental and related activities, with a not insignificant involvement in securities *trading* and the provision of payment services; in general, *exchanges* of this type perform multiple tasks, with the sole exception of *utility token* trading;

2. Utility-Payment, focused on the provision of payment services and the management of *utility token* transactions; the liquidity-creating function tends to be missing in this WB;

3. **Trading Platform**, focused on the trading of *security tokens* and, at the same time, away from the provision of payment services and the performance of instrumental and related activities;

4. **Alternative Exchange**, whose core business lies in trading utility tokens, avoiding both *security tokens* and payment services, a model far removed from the tasks more typically performed by TradFi institutions;

5. **Market Maker**, strongly committed to the creation of liquidity and disinclined to perform instrumental and related activities; it also shows a certain inclination towards the provision of payment services.

Variable	Comp1	Comp2	Comp3	Comp4	Comp5
Clearing and/or market making, dummy	**0.601**	-0.303	0.161	0.294	**0.659**
Crypto securities/derivatives trading, dummy	**0.405**	0.168	**0.657**	**−0.583**	-0.192
Utility tokens trading, dummy	0.078	**0.813**	0.221	**0.533**	0.011
Payment services, dummy	0.310	**0.446**	**−0.637**	**−0.467**	0.286
Ancillary activities, dummy	**0.610**	-0.143	-0.298	0.267	**−0.669**
Business model	*Total Exchange*	*Utility-Payment*	*Trading Platform*	*Alternative Exchange*	*Market Maker*

Figure 3.7 - Correlation between *exchange* characteristics (dichotomic variables, or 'dummy' ones) and principal component analysis factors; identification of business models.

Figure 3.8 shows the distribution of the different BMs within the analysed sample. The relative majority of platforms is associated with the *Total Exchange* model (162 platforms, or 40.9%), followed by the *Alternative Exchange* (117; 29.5%); the other three BMs are relatively marginal, delineating a substantial polarisation and de facto dualism in exchange operations.
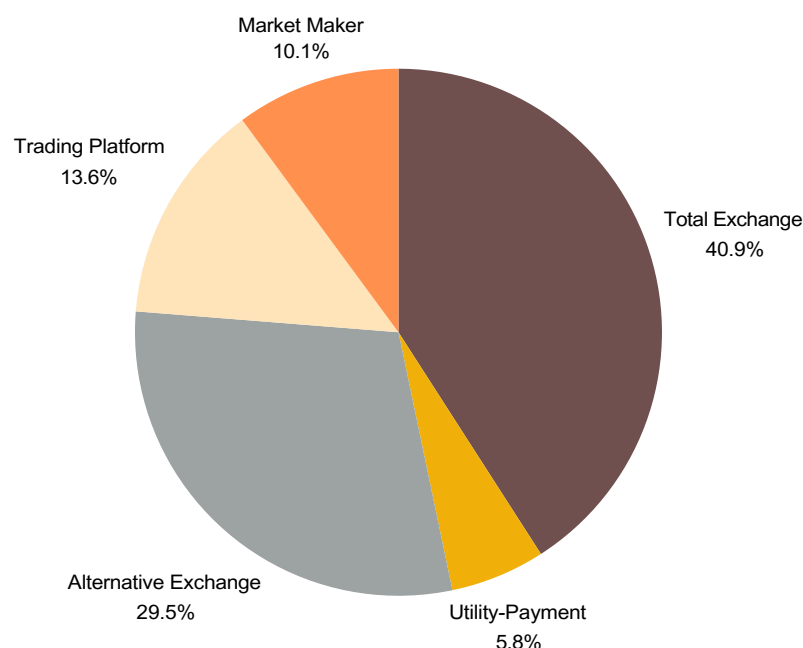

Figure 3.8 - Distribution of our *exchange* sample by business model.

3.3   *Token Offering*

Information on *t*oken sales conducted from 2020 to mid-2024 was gathered from various sources. Based on the selection criteria of several aggregators, the data were mainly obtained from FoundICO.com, ICOMarks.ai and CryptoRank.io.

Regarding the geographical distribution, Figure 3.9 and Figure 3.10 show respectively the number and amount of token sales conducted in the different countries. Considering the period 2020-2024 (July), the top five countries for both dimensions shown are the US, the UK, Singapore, Vietnam and India. Specifically, **the United States** shows a considerable distance from the others: it recorded 470 crowd-sales from 356 venture issuers, for a total funding of approximately USD 1.16 billion. The **UK**, which is in second place, recorded 266 crowd-sales from 207 issuers, amounting to 232 million. **Switzerland** and **Germany** - which in terms of number of issuances are in eighth and tenth place respectively - are ranked second and fourth respectively when looking at amounts: on average 1.73 million and 1.04 million per issue.
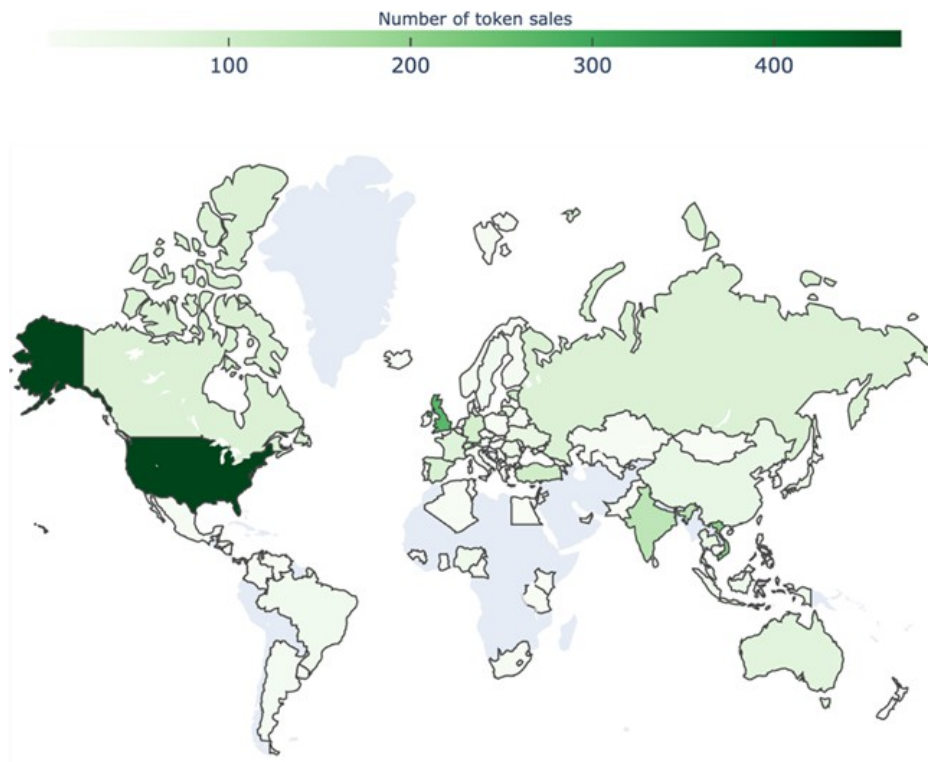
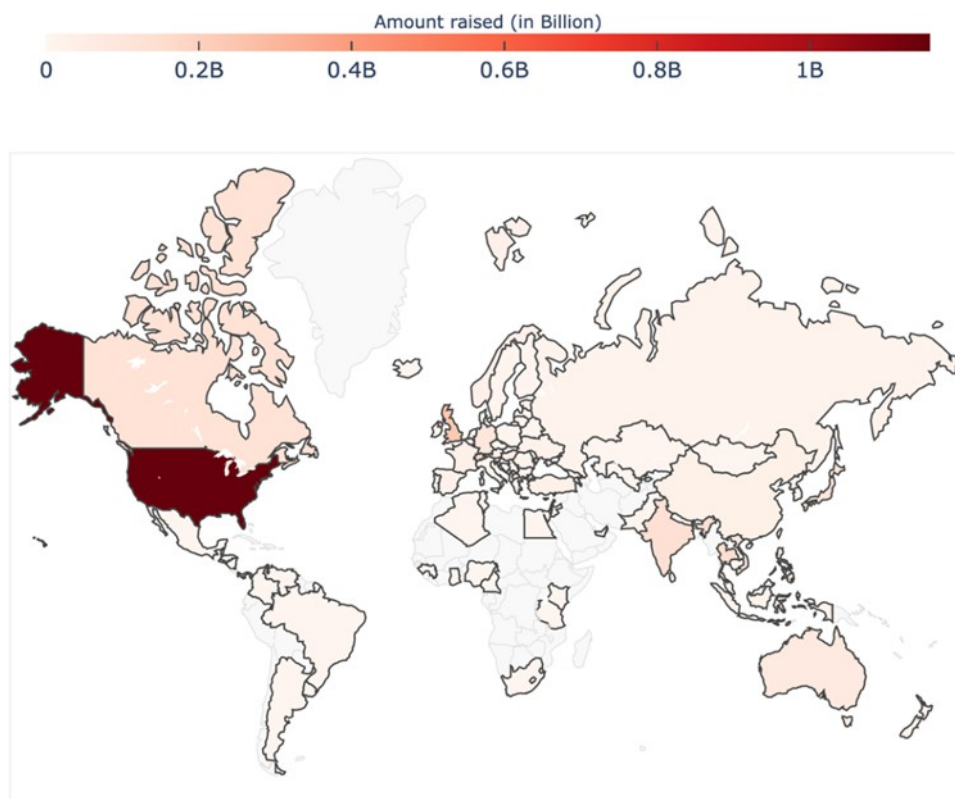**Figure 3.9** - Number of public *token* offerings, January 2020 to July 2024, by country.

Figure 3.10 - Total amount raised through public *token* offerings,
January 2020 to July 2024, by country.

Methodological note. *ICOMarks* is the main source for ICOs and IEOs; *CryptoRank* is the main platform collecting IDOs, while other *token* offerings were added by *FoundICO*. Other aggregators such as *ICOHolder*, *Cryptototem*, *CoinCarp, CoinCodex*, *ChainBroker* or *ICODrop* have high overlap rates with the three primary sources mentioned above. Therefore, to minimise overlap errors, the additional inclusion of *token* offers from these sites in the main dataset was not considered. Since several projects may have the same ticker, data from different sources merged according to the URLs of the project websites. In addition, bids without a declared website URL were still added to the main dataset after manually comparing the logos with those of other projects with the same ticker or name.

The different types of *token sale* are analysed below, distinguishing between *Initial Coin Offering* **(ICO)**, *Initial Exchange Offering* **(IEO)** and *Initial DEX Offering* **(IDO)**.

Through an ICO, the issuer sells a defined number of digital *tokens* directly to the public, in exchange for cryptocurrencies or *fiat* (i.e. conventional) currencies. The *token* may be associated with patrimonial rights to the issuing company, or the right to use the company's goods and services, including crypto-assets that may be developed in the future as a result of the funding raised. An IEO is a sale of *tokens* conducted on a cryptocurrency *exchange* platform. Unlike an ICO, the *exchange* facilitates the fundraising process and acts as an intermediary or counterparty. This provides greater security and trust, as *exchanges* perform verifications on the projects they host. An IDO is similar to an IEO, but takes place on a decentralised *exchange* (DEX).

The time distribution of the number of *token sales* and the amount collected through the different types of offers are summarised in Figure 3.11.
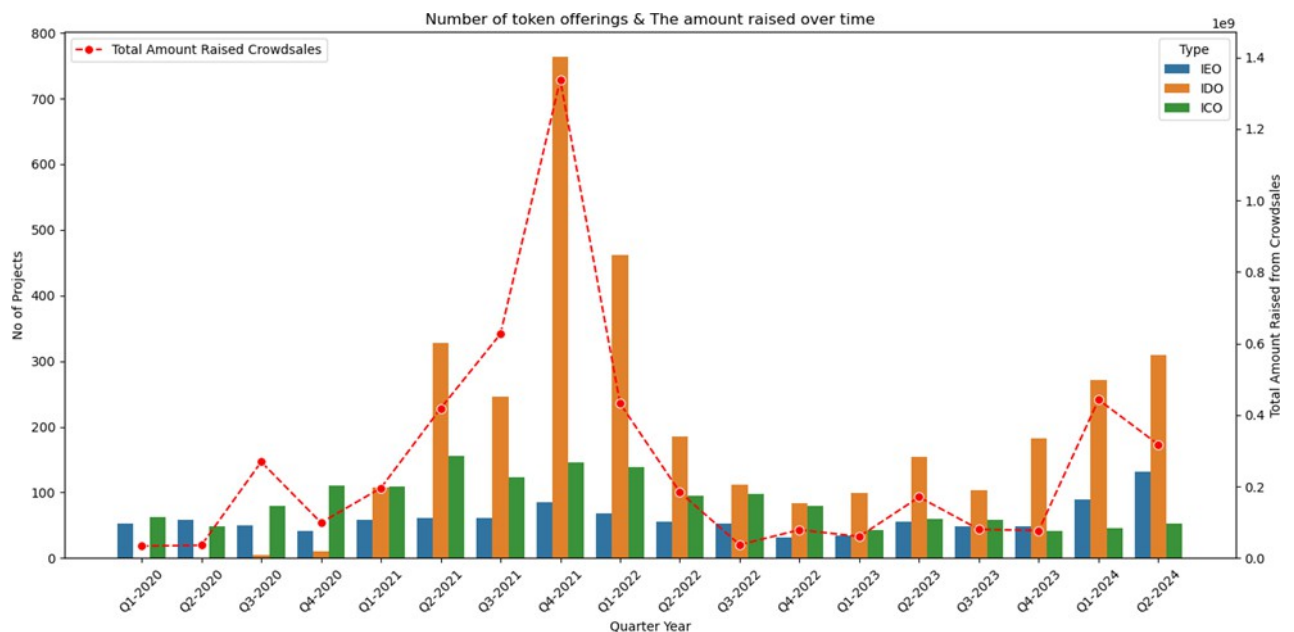

Figure 3.11 - *Token crowd-sale* over time.

The time distribution of the number of *token sales* and the amount collected through the different types of offers are summarised in Figure 2.

The introduction of IEOs and IDOs dates back to mid-2019, but *token* issuers have adopted them differently. While the number of IEOs per quarter remains stable, IDOs have overtaken the other two modes since the first quarter of 2021. This success is partly explained by the fact that many token-based initiatives preferred to use multiple IDOs on different launch pads (*launchpad*): *see* Figure 3.12. Looking at the number of companies that used the different types of tokens mentioned above, it can be seen that IDOs and ICOs have similar values: 1,792 and 1,539, respectively issuers. The number of companies that have used IEO is 1,020.
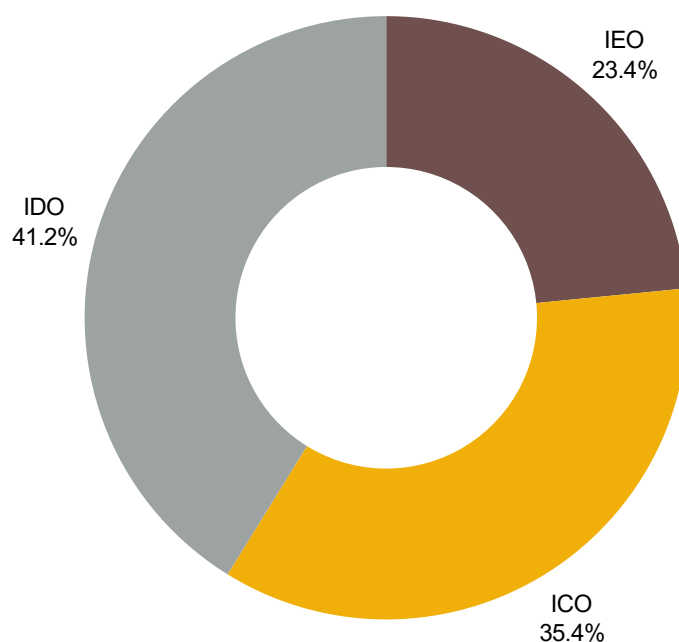
33

Figure 3.12 - Cumulative distribution of *token* offers by type

The use of IDOs in comparison to ICOs and IEOs also differs in terms of campaign duration: an IDO lasts on average only 2 days, whereas the average duration of an ICO and IEO is 70 and 10 days respectively (see Figure 3.13).
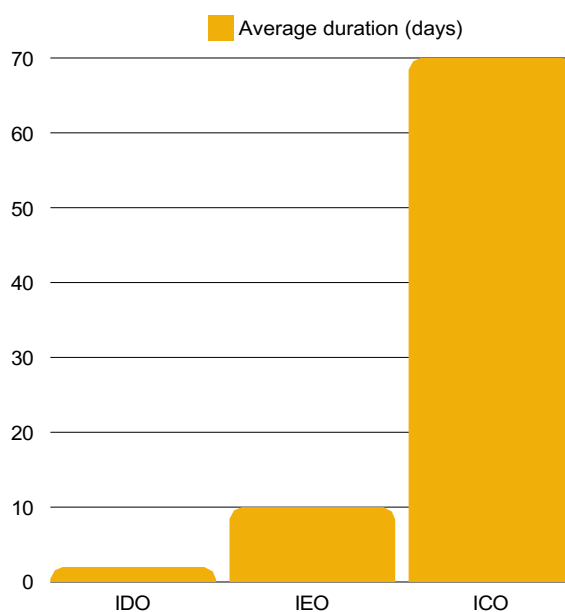

Figure 3.13 - Average duration of *token* offers, by type.

We then calculated the average return of the various *token sales* (ICO, IEO, IDO) along different time horizons from the date of issue: one day, one week, one month, three months, six months, one year. The results are given below:

1. for each quarter of each year in the 2013-2024 horizon (until Q3 2024), the yield of each issue was weighted by the market capitalisation of the *token* in calculating the weighted average yield for that quarter;
2. The average yields thus obtained were aggregated to obtain an annual one, weighting each quarterly value by the proportion of issues in that quarter in relation to the total;
3. the returns on an annual basis thus obtained were brought back to a daily basis, thus making the different measures comparable with each other.

The values resulting from the analysis show a **significant tendency for yields to stabilise in positive territory over a longer-term horizon, especially in recent years**.

The first-day performance (Figure 3.14a) was negative in the three-year period 2014-16, close to zero in 2018 and in more recent years (2022-2023); it was increasing between 2019 and 2021 and very positive again in 2024, when it exceeded 34%, as it had already been three years earlier.

After one week (Figure 3.14b), the yield was much lower, peaking at over 62 per cent in 2022; it fell below 20 per cent in 2023, and stood at just over 7 per cent in 2024: a value that, however, signals very high profitability in the first few days after issuance.

The one-month performance (Figure 3.14c) is at much lower levels, often around 2-4% daily, again with the notable exception of 2022 (almost 40%).
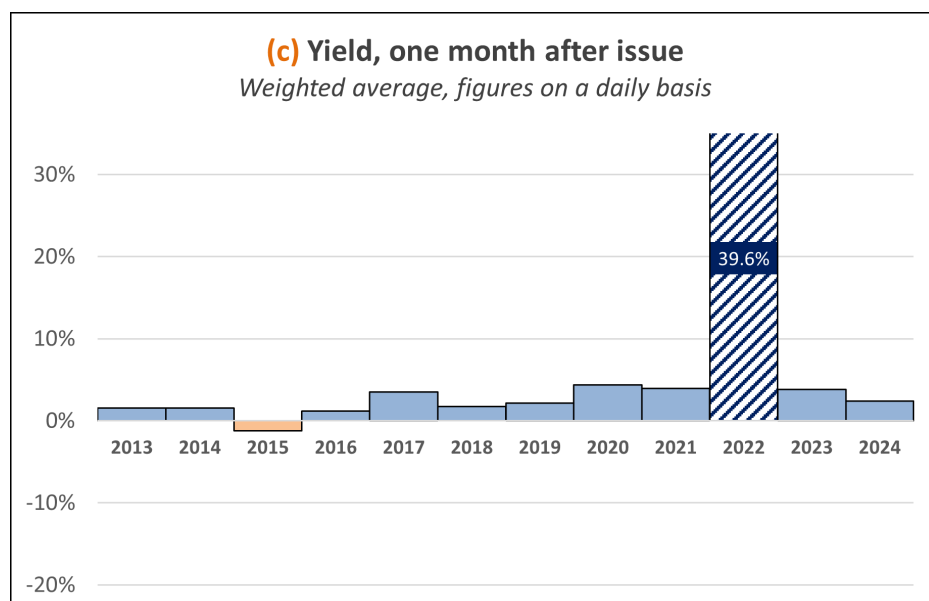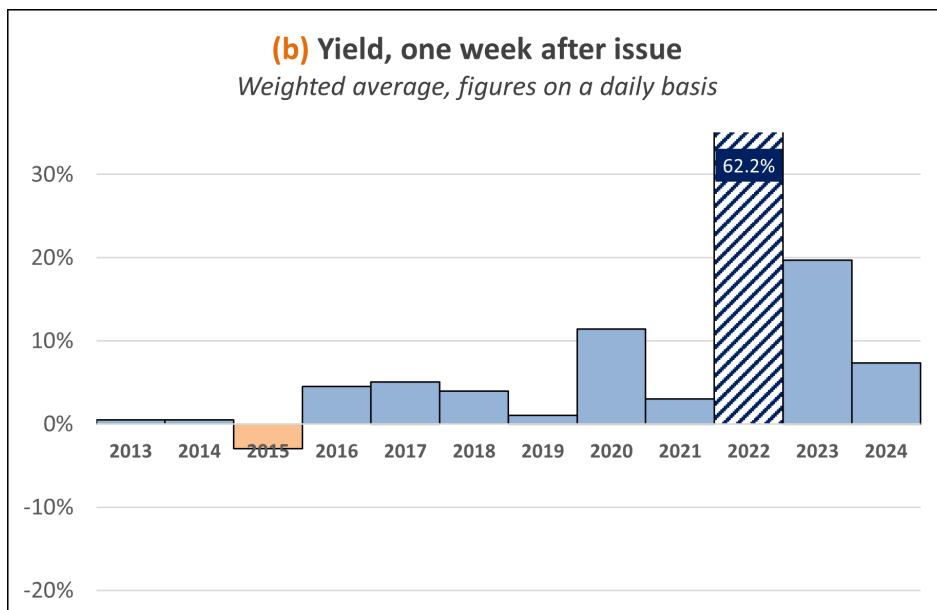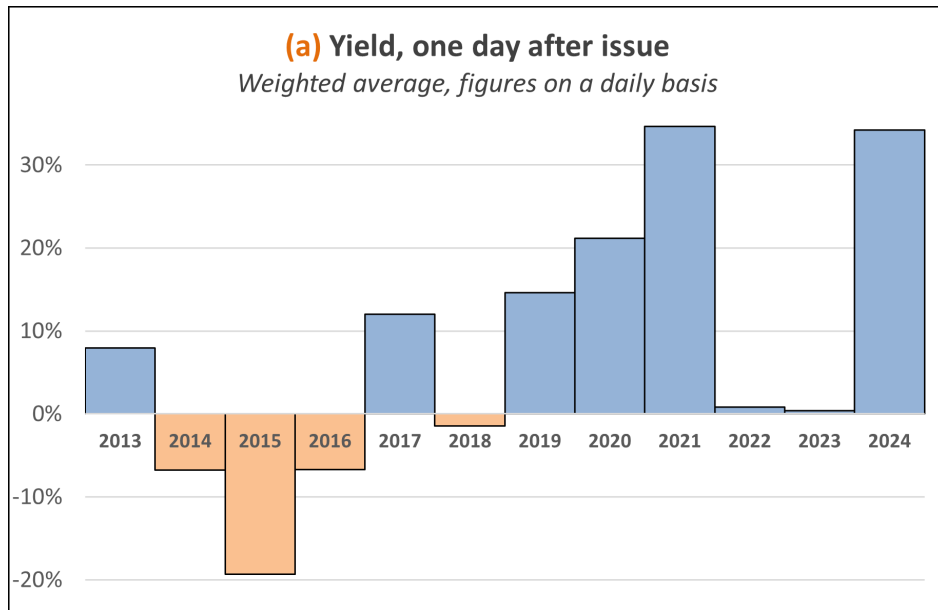
Over time, the three-month yield (Figure 3.14d) was rather volatile; starting in 2019, it stabilised at just under 2%, except in 2020 (5.4%) and 2022 (9.2%); in 2024, however, it remained at a lower level (0.8%).

The six-month performance (Figure 3.14e) was often around 1.0-1.5%, again with a significant increase in 2022 (4.0%) and a significant decrease in 2024 (0.2%).

Finally, for the one-year yield (Figure 3.14f) we observe the good level of the two-year period 2016-17 (over 2%), still a record in 2020 and 2022 (for both around 2.8%) and a lower, but still appreciable, result in the last available year (1.3% in 2023).

Although the market since 2013 has presented numerous cases of failure, the performance of trading-ready instruments has shown **a gradual 'normalisation' of returns over time, with volatility persisting only in the very short term**. This is testimony to the growing maturity *of token sales*, whose aggregate *performance* is decidedly superior to that of many TradFi instruments; at the same time**, the "erratic" trend, while confirming itself as a fundamental datum, seems to decrease as the market expands** (*see* Chapter 1).

(a) Yield, one day after issue
Weighted average, figures on a daily basis

(b) Yield, one week after issue
Weighted average, figures on a daily basis

62.2%

(c) Yield, one month after issue
Weighted average, figures on a daily basis

39.6%

(d) Yield, three months after issue
Weighted average, figures on a daily basis

(e) Yield, six months after issue
Weighted average, figures on a daily basis

(f) Yield, one year after issue
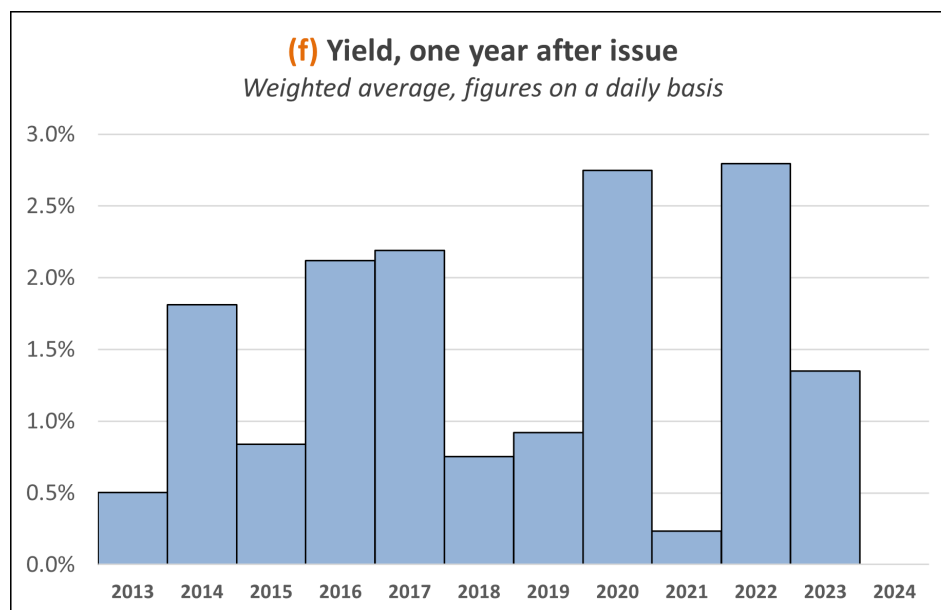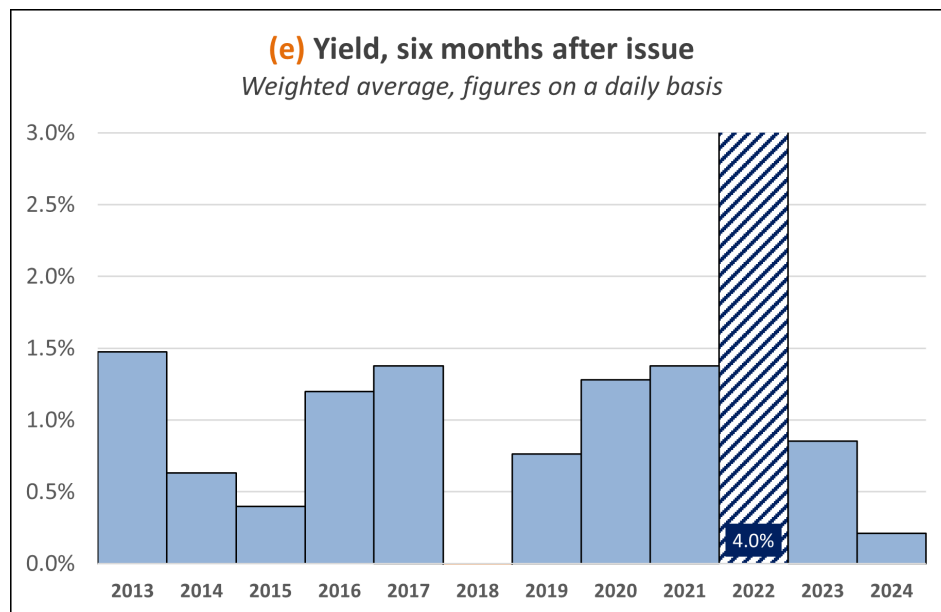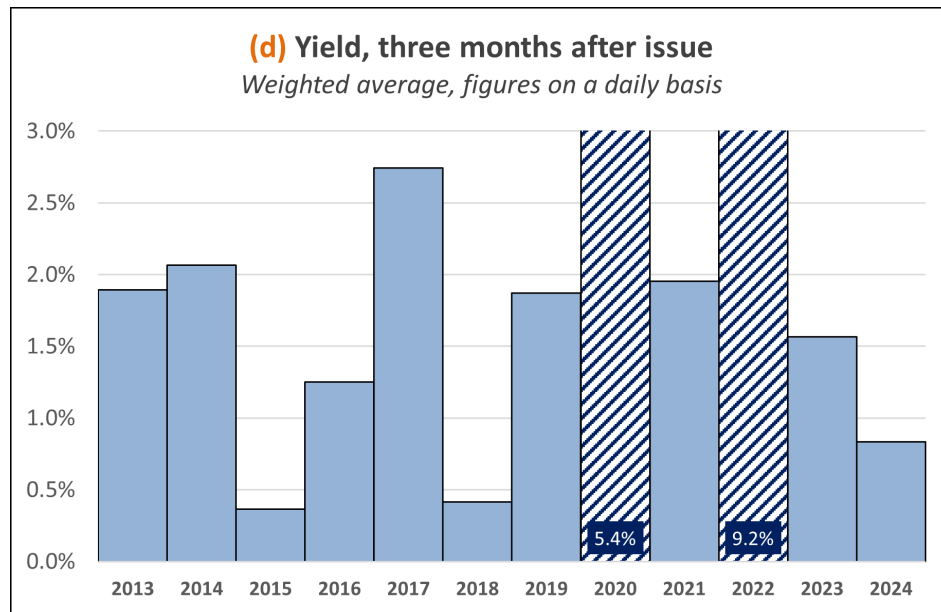*Weighted average, figures on a daily basis*

Figure 3.14 – Weighted average return on token sales, by time horizon.

04 Technology and applications

edited by
Ferdinando Ametrano*

In 2024, the cryptocurrency ecosystem witnessed significant technical developments. Although some of these innovations were based on long-standing initiatives, others emerged as entirely new solutions aimed at improving scalability, privacy and interoperability of cryptos. With milestones achieved in Bitcoin, Ethereum, Solana and other platforms, the year proved crucial for the future of decentralised technologies.

4.1 The continuing evolution of Bitcoin

Bitcoin's developers and research community have continued to refine and expand its technical capabilities. A key achievement has been the adoption of **advanced Taproot-based scripts**, which have enabled increasingly complex and efficient multi-signature schemes. These improvements have allowed developers to introduce more sophisticated payment terms and greater on-chain privacy. In April 2024**, Bitcoin Core released version 25.0**, which included improvements to the mempool policy, more efficient blockchain transmission mechanisms, and experimental functionality for cross-input signature aggregation - an approach that could

reduce the size and fees of transactions. The developments of the **Lightning Network** were equally remarkable. By mid-2024, new routing algorithms introduced by Blockstream and other developers made payment paths more reliable and faster. This year saw the first large-scale implementation of so-called **'trampoline payments'**, which simplified the routing process for light nodes. In addition, research on dual-funded channels and channel factories - actively tested in late 2023 - found wider adoption in 2024, further improving the capacity of the Lightning Network and reducing on-chain congestion.

Bitcoin's privacy has been enhanced by the extensive use of **PayJoin transactions** through widely used wallets such as Wasabi Wallet (version 2.0.3 released in February) and Samourai Wallet (which launched advanced coordination services in September). These transactions have obscured on-chain connections, improving user privacy without Bitcoin's fundamental transparency.

4.2   The Layer 2 ecosystem and the Ethereum roll-up

Ethereum's transition to a rollup-centric roadmap has produced tangible results. Earlier this year, Polygon zkEVM, StarkNet and zkSync Era achieved significant usability milestones, enabling developers to deploy existing Ethereum smart contracts with near-native performance. The release of **StarkNet Alpha v13** in March 2024 introduced critical optimisations for Cairo 1.0, reducing testing time and making it easier for dApps to use zero-knowledge scaling.

zkSync Era, one of the first production-ready zkEVMs, surpassed 2 million active addresses by mid-2024. This was achieved through the integration in June 2024 of **zkPorter**, a system that delegates data availability to external validators while maintaining *zk-proof* security. This innovation reduced transaction costs by more than 50 per cent and attracted new DeFi protocols and NFT platforms.

Optimism rollups also experienced significant upgrades. Arbitrum and Optimism implemented **advanced fraud-proof mechanisms** that reduced challenge periods to less than 24 hours by September 2024, making withdrawals almost instantaneous. This improvement came after extensive community testing and third-party audits conducted earlier this year.

4.3   Solana's high-performance innovations

Solana, known for its **speed and cost efficiency**, continued innovate in 2024. In August, Solana Labs launched the new generation of the Sealevel runtime,

improving parallelisation and management of network resources. These upgrades enabled Solana to consistently process over 6,000 transactions per second, while keeping transaction fees below a fraction of a cent. **State compression techniques** were further improved, reducing the storage load for on-chain data by up to 40 per cent. This allowed more complex applications to run on Solana without increasing costs, making the platform even more attractive to developers. The release of Anchor v3 in May improved the smart contract development process, while new SDKs for JavaScript and Python developers expanded access to the Solana ecosystem. These improvements generated a new wave of applications and further consolidated Solana's reputation as a hub for scalable DeFi protocols, NFT platforms and Web3 games.

Solana also made progress in cross-chain interoperability. The Wormhole bridge continued to thrive, handling billions of dollars in cross-chain value transfers. With improved EVM compatibility, developers found it easier to bring Ethereum-based applications to Solana, improving the overall attractiveness and utility of the ecosystem.

4.4 Cryptographic and security innovations

The year 2024 was marked by rapid advances in cryptographic techniques. Zero-knowledge proofs have become even more efficient, with major breakthroughs presented at the ZKProof Workshop in Paris in May. Researchers from the Ethereum Foundation and Electric Coin Company unveiled a **new system, Nova**, which achieved higher proof compression rates, making recursive proofs more practical for on-chain use. This allowed dApps to verify increasingly complex calculations at minimal cost, paving the way for more secure private voting, decentralised identity verification and confidential asset transfers.

Homomorphic encryption and **secure multi-party computation** techniques have started to grow. In July, Fireblocks integrated an updated MPC-CMP (Crypto Multi-Party Computation) protocol, allowing custodians to manage keys without ever exposing them, thus reducing the risk of internal attacks and increasing institutional trust.

4.5 Progress in interoperability and cross-chain

Interoperability efforts reached new milestones in 2024. Cosmos' **Inter-Blockchain Communication (IBC)** protocol saw its biggest update, IBCv5, in August, introducing routing of simplified messaging and improved security for lightweight clients.

By the end of the year, over 50 major chains - including Osmosis, Secret Network and Terra 2.0 - fully supported IBCv5, facilitating seamless asset transfers and data sharing between ecosystems.

Meanwhile, **Polkadot**'s parachain ecosystem continued to mature. Parity Technologies announced in November 2024 that it had successfully deployed its first production-ready **bridge hub**, enabling parachains to connect to external networks such as Ethereum and Solana without relying on trusted intermediaries. This milestone demonstrated Polkadot's ability to enable large-scale decentralised interoperability.

4.6   Milestones and events

Several conferences and workshops served as catalysts for collaboration between developers.

Devconnect Tokyo in June hosted critical discussions on the scalability of Ethereum beyond rollups, with talks by prominent developers such as Vitalik Buterin and Barry Whitehat.

The *MIT Bitcoin Expo* in March focused on advances in Bitcoin's base layer security, privacy and performance of the Lightning Network.

Solana Breakpoint 2024, held in Lisbon in October, presented the latest developments in Solana runtime optimisations, state compression and ecosystem growth.

These events highlighted the **growing sophistication of the blockchain infrastructure** and the **dedication of developer communities around the world**.

4.7   A basis for the future

In 2024, the cryptocurrency technology landscape has expanded in depth and breadth. From Bitcoin's privacy-focused improvements and Lightning Network optimisations to Ethereum's *zk-rollup* proliferation, Solana's high-speed innovations and *cross-chain* advances, **the industry has made significant strides towards more scalable, secure and *user- friendly* systems. These innovations lay the foundation for an even more vibrant, interconnected and technologically advanced blockchain ecosystem in the years to come.**

05   Interviews with operators

by   **Fintech District**

5.1   Fipto

Who are you and what do you do?

Fipto is a stablecoin-based payment infrastructure for businesses, using blockchain technology to offer fast, secure and cost-effective payment solutions. Fipto facilitates the global movement of money with instant stablecoin payment systems operating 24/7, accelerating cross-border payments and optimising treasury management for global enterprises. By linking traditional banking systems to blockchain technology, Fipto enables businesses to harness the potential of stablecoin payments while ensuring full compliance, security and compatibility with existing financial systems.

Fipto holds several licences and regulatory approvals, including a DASP registration with the AMF in France and a VASP registration with the CSSF in Luxembourg. Fipto is available via API, web platform or TMS such as Kyriba.

The market

What is happening from your point of view?

The payments landscape is evolving rapidly as companies seek faster, cheaper and more transparent solutions. The adoption of blockchain technology, along with the growing reliance on stablecoins, is fuelling this transformation. The volume of stablecoin transactions is growing rapidly and Stripe has just acquired stablecoin payments platform Bridge in its largest acquisition ever. In other words, stablecoins are transforming the global payments infrastructure.

What do you think are the main drivers of development?

Key factors include the global demand for financial efficiency, the rise of digital asset regulations such as MiCAR in Europe, and the need to mitigate risks associated with currency volatility. The need for global access to digital dollars or euros is also a driving factor. Finally, less modern banking infrastructures are driving the development of stablecoin-based infrastructures, especially in emerging economies, for use cases of cross-border payments.

What is your view on the differences between countries (e.g. Italy vs. USA)?

The regulatory and adoption landscapes vary significantly. However, both institutional and retail adoption are increasing, supported by regulations such as MiCAR in Europe. Recent elections in the US haave also sent a positive signal for the digital asset sector. In terms of payment flows, countries have unequal access to efficient payment infrastructures, resulting in disparities in payment speeds and costs. The development of stablecoin-based payment infrastructures helps solve the challenges of cross-border payments in emerging markets.

Do you see challenges with your business model? Are you currently generating profit?

Our model is sound, but global expansion requires navigating different regulatory environments. We also need to be properly authorised in each country we want to operate in and have the right liquidity partners to handle on/off-ramping. Stablecoin payments are still new to businesses; for now they are mainly understood by innovative companies or payment service providers and will likely be followed by more general businesses in the future.

What prevents you from growing more?

Regulatory uncertainty in some regions and the complexity of integrating traditional systems with blockchain may slow down expansion. Obtaining licences is also a challenge.

What are the main educational challenges in raising investor awareness of the risks and opportunities associated with crypto assets?

Many companies still see crypto-assets as high risk, including stablecoins that are not speculative and always remain equal to their *fiat* equivalent. Educating stakeholders about the stability and compliance of solutions such as stablecoins and the security measures we take is crucial.

TradFi & DeFi

How do you see your relationship with traditional finance?

We see TradFi as a partner. By integrating blockchain technology with traditional systems such as SWIFT, we offer customers a hybrid approach that retains the strengths of both systems. Some companies do not wish to interact directly with crypto-assets; this is very feasible using a so-called *stablecoin sandwich*.

What collaborations do you have with established players (banks, asset managers or other financial institutions) and where are they at? What could further develop them?

Fipto works with technology providers to ensure security and compliance, such as Fireblocks for wallets, Chainalysis for transaction monitoring or ModulR for EUR accounts.

Fipto is also integrated into treasury management systems (TMS), starting with Kyriba, allowing users to directly access Fipto payment solutions from their preferred TMS.

Maturity of the market

What is the main driver for the adoption of your product? What is the role of Blockchain?

The main drivers for adoption are:

- the efficiency of blockchain in reducing transaction time and costs;
- the stability of stablecoins in maintaining the peg with their asset (e.g. USD, EUR);
- the availability of the infrastructure 24/7;
- predictability of payments (real-time tracking through the public blockchain *ledger*);
- security inherited from the decentralised nature of the blockchain.

In the future, the programmable nature of digital assets such as *stablecoins* will give room for innovation, leading to even more efficient payment solutions.

Adjustment

Are there obstacles or uncertainties? Do you detect communication problems between start-ups and regulators in Italy? In Europe?

- Inconsistent global standards: Different countries have adopted divergent approaches to *stablecoin* regulation. Some, such as the EU with MiCAR (*Markets in Crypto-Assets Regulation*), are creating comprehensive regulatory frameworks, while others have unclear or restrictive policies.
- Competition with CBDCs: Many central banks are developing their own digital currencies (CBDCs) and see *stablecoins* as competitors that could undermine monetary policy and financial stability.
- Transparency of reserves: regulators often question whether *stablecoins* are adequately backed by reserves, leading to potential restrictions on their issuance or use. This issue is being addressed by *stablecoin* issuers with increasingly rigorous and verified proof of reserves, as well as the test of time. Major *stablecoins* such as USDT and USDC have particularly addressed this issue.

In the light of MiCAR, will it be sufficient to update existing staff or will it be necessary to recruit new profiles?

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Compliance with MiCAR will require both the upgrading of skills and the recruitment of specialised profiles. Fortunately, on the positive side, Europe now has a fully harmonised regulatory framework.

In conclusion

Collaboration, education and regulatory clarity will be central to shaping the next phase of our growth.

5.2   Young Platform

What is your view on the current market?

The cryptocurrency and blockchain sector is entering a crucial phase of adoption and regulation. The technology is evolving beyond its speculative origins, finding real-world applications, particularly in the areas payments, decentralised finance (DeFi) and asset custody. Institutions, businesses and *retail* users are interacting with cryptocurrencies in different ways, driven by increased awareness and clearer use cases.

We are also seeing an increase in demand for secure and intuitive platforms that make cryptocurrencies accessible without compromising regulatory compliance or trust, core values for Young Platform. This shift reflects a growing understanding that cryptocurrencies are not just an *asset class*, but a transformative technology for finance and beyond.

What do you think are the main drivers of development?

The main drivers of development in this area include:
- regulatory frameworks: clearer rules are reducing uncertainty and encouraging institutional players to enter the market, especially in Europe with MiCAR;
- Institutional adoption: large financial firms are developing cryptocurrency-related products, such as ETFs and custody solutions, bringing credibility and liquidity to the market.
- technological innovation: Layer 2 solutions, cross-chain protocols and advances in scalability and privacy are making blockchain systems more efficient and usable;
- education and accessibility: more and more people are understanding the benefits of cryptocurrencies and blockchain, while platforms like ours bridge the gap between traditional finance and cryptocurrency adoption;
- macroeconomic factors: inflation and the search for alternatives to preserve value are driving interest in Bitcoin, while stablecoins are becoming essential tools for cross-border payments.

What is your opinion on the differences between countries (e.g. Italy vs. USA)?

The adoption of cryptocurrencies varies widely between countries due to regulatory, cultural and economic factors:

- Italy: the country has been slower than the US in adopting cryptocurrencies, but is catching up. The focus here is on education and building trust among users. Platforms such as Young Platform play a key role, simplifying access and ensuring compliance with local regulations. The growing startup ecosystem and openness to innovation create opportunities, but traditional financial habits still need work to foster mass adoption.
- US: the US market is more mature, with higher levels of adoption and institutional involvement. However, the regulatory environment in the US remains fragmented and unpredictable, creating uncertainty for companies. Despite this, the US is home to some of the most innovative crypto projects and significant venture capital investments.

Do you see challenges in your business model? Are you currently generating profits?

Like any company in a rapidly changing industry, we face challenges, particularly related to scalability and regulatory compliance. Our business model is based on transaction fees, educational services and *enterprise* solutions. While this approach ensures diversified revenue streams, it also requires continuous adaptation to changing user needs and regulatory scenarios.

With regard to profitability, Young Platform is focused on sustainable growth. While we are growing rapidly and investing in technology, education and compliance, profitability depends on market conditions and user activity. In bullish markets, revenues grow faster due to higher trading volumes, while in bear markets we focus on cost optimisation and long-term value creation.

What prevents you from growing more?

Several factors influence our growth:

- Regulatory uncertainty: despite progress in Europe with MiCAR, the global regulatory environment remains fragmented, making it difficult to scale uniformly in different markets;
- Market volatility: cryptocurrency markets are inherently volatile, which affects user activity and overall revenues. During downturns, we focus on building infrastructure and trust, rather than short-term profits;
- User education: many potential users hesitate to enter the world of cryptocurrencies due to a lack of understanding or concerns about the risks. Overcoming this barrier requires significant investment in education;
- Competition: the cryptocurrency exchange space is highly competitive, with global players offering similar services. Differentiating through features such as local support, compliance and education requires continuous effort.

What are the main educational challenges in raising investor awareness of the risks and opportunities of crypto-assets?

- complexity of technology: concepts such as decentralisation, *smart contracts* and DeFi are not easily understood by the average investor. Simplifying these topics without neglecting the risks is a challenge. Volatility
- and risk perception: many people associate crypto-assets

to speculation or scams, obscuring the legitimate opportunities they offer. Helping users to distinguish between credible and risky projects is crucial;

- Unrealistic expectations: Some investors enter the market expecting quick gains, driven by hype or misinformation. Managing these expectations with honest communication is essential;
- Lack of trust: for many, cryptocurrencies are still perceived as unregulated and risky. Building trust through transparency, compliance and education helps to bridge this gap.

At Young Platform we address these challenges with tailored educational programmes, user-friendly interfaces and transparent communication. We believe that user *empowerment* through knowledge is the key to unlocking the full potential of cryptocurrency adoption.

How do you see the relationship with traditional finance?

Our relationship with traditional finance is symbiotic and evolving. We do not see traditional institutions as competitors, but as partners in innovation. The financial sector is gradually recognising the value of blockchain and crypto assets, and our role is to bridge the gap between traditional systems and the opportunities offered by decentralised finance (DeFi).

Traditional finance players provide credibility, reach and compliance expertise, while we bring agility, blockchain knowledge and access to new technologies. Together, we can create hybrid solutions that improve efficiency and expand access to financial services.

In view of MiCAR, will it be sufficient to train existing staff or will it be necessary to recruit new profiles?

We are looking for a Head of Risk.

CRYPTO ASSET LAB

The Crypto Asset Lab (CAL) is a joint research initiative of the Department of Economic and Business Sciences and Law of the University of Milan-Bicocca and the Digital Gold Institute.

We focus on crypto assets as investment opportunities, fintech innovation and regulatory challenges, with a focus on their disruptive role in finance.

We also pay attention to innovations in cryptography and blockchain technology, given their relevance to privacy, security and other applications.

CAL is a meeting point between academia, industry, institutions and regulators; we encourage students, researchers and professionals to join us and contribute with research, development, training, teaching and other experimental activities.

Advancing and researching
crypto assets, CBDCs, and regulatory frontiers

Learn more

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