

Full-Year Review **2022** & Themes for **2023**

January 2023

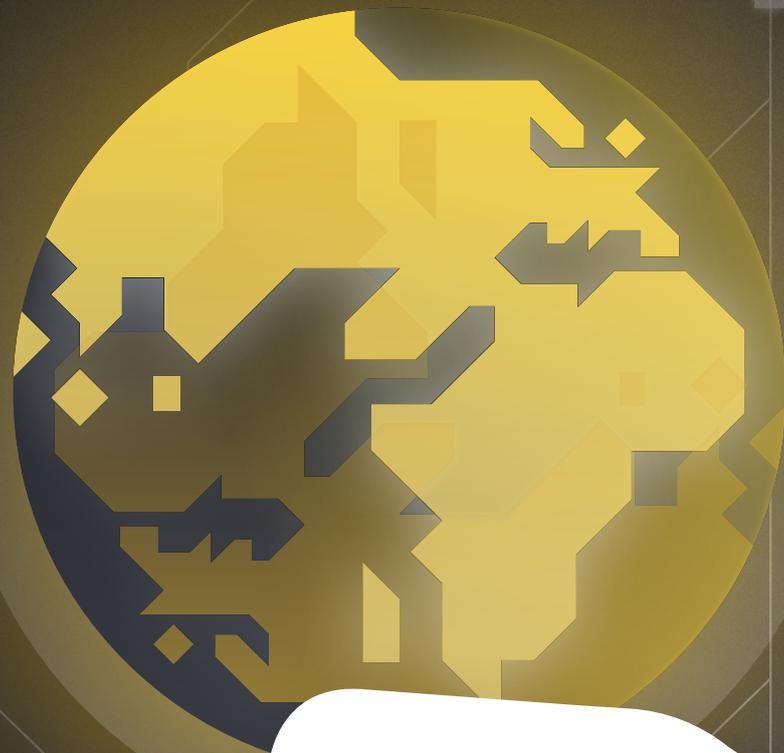


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Key Takeaways

- ❖ Overall, 2022 served as a wake-up call and juxtaposed the highs of 2021. Nonetheless, volatility is part and parcel of market cycles. This is not something new for the crypto industry, and we remain cautiously optimistic looking into 2023.
- ❖ L1s had an eventful year. Ethereum transitioned to Proof-of-Stake, BNB Chain and Polygon gained market share in the vacuum left by Terra's collapse, and new L1s such as Aptos and Sui made their first forays into the market.
- ❖ L2s had a breakout year with strong inflows across 2022. TVL rose 119% (denominated in ETH) across 2022. While USD-denominated TVL was down around 28%, this is significantly lower than the ~76% USD-denominated drawdown in the whole DeFi market and is arguably largely a factor of dropping crypto prices.
- ❖ The DeFi sector experienced a sharp drop in TVL following exogenous market events and a challenging macro environment. TVL stands at around US\$40B, or close to 25% of what it was at the start of 2022. More and more users have engaged in the "flight to quality".
- ❖ NFTs recorded US\$21.9B in sales in 2022, an increase of 10.6% YoY. This is primarily contributed by strong sales in the first half of 2022. However, the NFT market witnessed a relatively quiet second half as overall sentiment turned negative and traders exited the market following a series of market events.
- ❖ The number of blockchain gaming projects has continued to rise but there are signs of slowing growth. Hype behind X-to-Earn games also fizzled out as user growth slowed down and the spotlight was cast on the quality of gameplay, as well as the tokenomics of X-to-Earn games. Interest in the metaverse has also waned.
- ❖ Numerous market events across 2022 have fuelled the policy debate. While regulation brings much-wanted clarity, it is essential to make informed decisions.
- ❖ 2022 marked a year of record-breaking VC investment and fundraising activities. It had been a front-loaded year with funds raising high amounts of capital that they're now looking to deploy. Over H2 2022, deal flow had generally decreased.
- ❖ Finally, we wrapped up the report with a summary of key themes in 2023 amongst the different sectors in crypto. Read on to find out what we have to say.

Introduction

While 2022 has been a year that has been marked by numerous unfortunate events, one could argue that these are simply teething issues that are symptomatic of an industry in its relative infancy. More specifically, an industry in its relative infancy battling with a macroeconomic climate nestled with record-breaking inflation as well as significant geopolitical tensions leading to a continued breakdown of the era of globalization. Overall, 2022 served as a wake-up call and juxtaposed the highs of 2021. The trials of 2022 have led many to express skepticism on the future of crypto and its ability to uphold ideals of decentralization, security, and transparency - knowing this is not something new for the crypto industry, we remain cautiously optimistic looking into 2023.

While it may be difficult to find green shoots in a year where total crypto market capitalization dropped ~64% from US\$2.2T on 1st Jan to US\$786B on 31st Dec, there has been plenty going on to cheer about. Ethereum transitioned from Proof-of-Work (“PoW”) to Proof-of-Stake (“PoS”) in perhaps one of the most notable moments in blockchain history. While Terra fell, BNB Chain excelled and continued to make strides in DeFi. Polygon demonstrated continued business development acumen and recruited some of the biggest names in business to delve into crypto (Reddit, Starbucks, and Meta, to name just a few). Layer 2 (“L2”) networks continued their ascent, and while we may not have had the “L2-22” that many were hoping for, L2s did hit new milestones and exceeded the Ethereum Layer 1 (“L1”) in many ways.

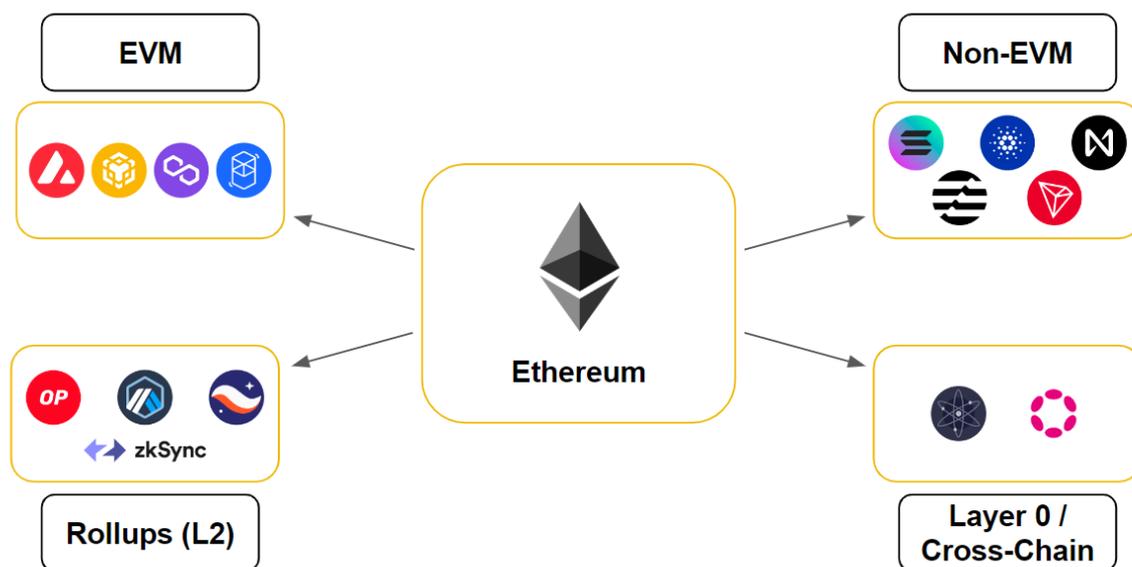
Stablecoin market capitalization also hit new all-time highs, and many players continued to dip their toes in the water, wisely understanding that embracing crypto is better than trying to fight it. DeFi had a challenging year, with notable wins in derivatives protocols and liquid staking providers, which took sizable leaps forward in both use cases and volumes. While the floor prices of most profile picture (“PFP”) NFT collections fell significantly, they still served as a key driver towards web3 adoption in 2022, where PFPs were brought to major web2 social channels such as Twitter and Instagram. Policy saw notable moves on both sides of the Atlantic, with MiCA taking the headlines in Europe, while the US continued to juggle between the SEC and the CFTC. Looking elsewhere, many nations across the globe continue to welcome those inclined towards the crypto world, with the race towards increasingly crypto-friendly regulation.

In this report, we explore the above in more detail, as well as many more stories, narratives and views of the crypto market in 2022. We also provide a flavor of what Binance Research expects when thinking about the year ahead and all the continued crypto innovation and BUIDL opportunities that it can bring.

Layer 1

Considering the standards of 2022 and all that has happened in the crypto space, L1s can still be said to have had an exciting and eventful year. **Many notable events have taken place in the L1 space over 2022.** From Ethereum’s transition from Proof-of-Work (“PoW”) to Proof-of-Stake (“PoS”) in September, to the implosion of the Terra ecosystem in May. New L1s were announced, with Aptos launching its mainnet and Sui expected to do so soon. Notable incumbent, BNB Chain and leading L2 solution, Polygon, gained market share in the vacuum left by Terra, while Solana had a more challenging year, being one of the L1s more impacted by the recent FTX saga. The year was rife with material events in arguably the most important sub-sector within crypto.

Figure 1: Classifying the L1 / L2 landscape



Source: Binance Research

To contextualize the market before diving into our discussion, in Figure 1 we provide a very high-level overview of what the current L1 / L2 landscape looks like. Fundamentally, the problem of the Ethereum base layer being unsuitable for mass adoption due to chain congestion and the corresponding high transaction costs (gas fees), still exists. The development in the L1 / L2 space is still very much revolving around finding the best solution for this scaling problem. Different chains have different opinions on how to best tackle this core issue, and they are working on a variety of solutions, some aligned with Ethereum, and some not. **Very broadly speaking, we divide four different sections; Ethereum Virtual Machine (“EVM”) chains, non-EVM chains, Rollups (L2s) and Layer 0 /**

Cross-Chain protocols. Further on in the section, we cover all of the listed projects (and more) in detail and provide some insight into their 2022 performance and what we expect going forward.

Figure 2: L1 / L2 market capitalization and daily on-chain metrics across 2022

		Market Cap (\$B)		Daily Txns (M)		Daily active addresses (K)	
		Jan 1 st	Dec 31 st	Jan 1 st	Dec 31 st	Jan 1 st	Dec 31 st
	Ethereum	449	147	1.2	0.9	523	337
	BNB Chain	88	39	6.5	2.7	1,194	909
	Polygon	18	6.6	4.0	3.0	329	430
	Solana	53	3.7	50	20	521	362
	Avalanche	28	3.4	0.5	0.1	75	25
	Optimism	n/a	0.2	0.03	0.5	3.3	88
	Arbitrum	n/a		0.03	0.2	6.1	40

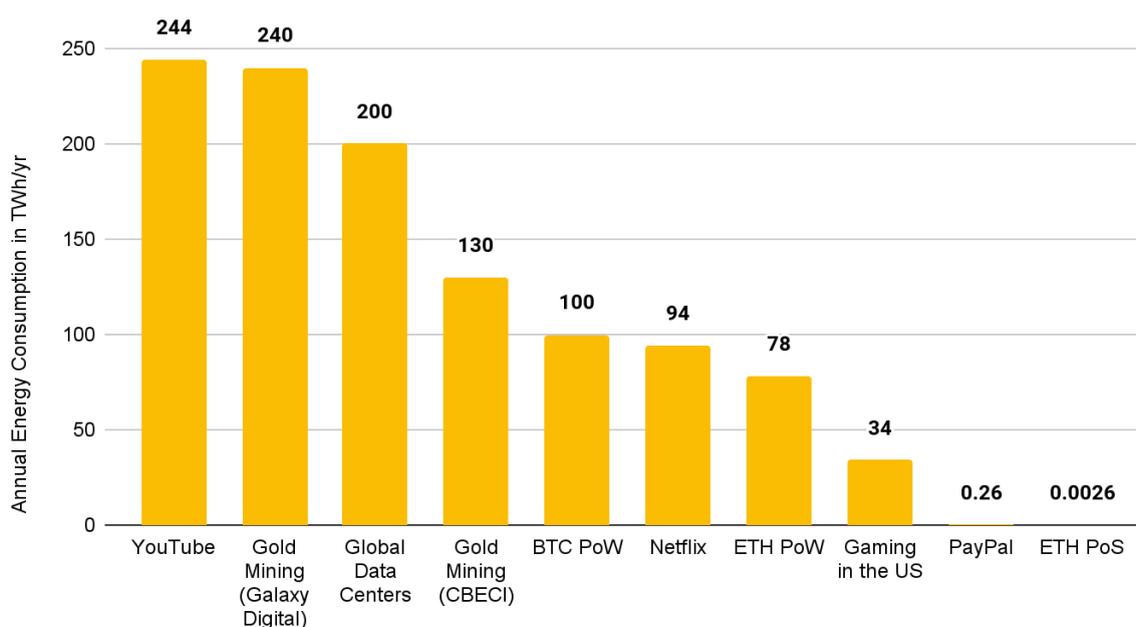
*Source: CoinMarketCap, Block explorers
As of 31 Dec 2022*

- ❖ **Market capitalization vs. on-chain metrics:** Market capitalization is, of course, lower for a multitude of reasons, overall worsening macroeconomics conditions being a key one. However, we should clearly note that **market capitalization does not necessarily correlate with important on-chain metrics in terms of daily transactions and active addresses.** As we can see, BNB Chain and Solana excel here, while Ethereum, despite the greater market cap, is evidently lower in terms of daily activity. BNB Chain has long held the top spot in terms of daily active addresses, consistently averaging over 1M per day. Similarly, Solana has been at or near the top of daily transaction figures over the last year. We discuss these figures and more further below in the individual sections dedicated to each chain.

Ethereum

- ❖ 2022 was a year where we saw the biggest moment in the history of Ethereum, and perhaps one of the most notable moments in the crypto industry as a whole. **On September 15th, [The Merge](#) finalized Ethereum’s transition from a Proof-of-Work consensus mechanism to a Proof-of-Stake equivalent.** In the process, Ethereum’s energy consumption was reduced by 99.99%⁽¹⁾, given that the blockchain is now secured by validators and stakers, rather than through electricity-intensive mining. On a broader scale, Ethereum’s migration to PoS has been reported to cut 0.2%⁽²⁾ of global energy usage. Overall, the Merge helped to remove a key source of fear, uncertainty, and doubt (“FUD”) that has been associated with Ethereum, its widespread dApp ecosystem, as well as NFTs.

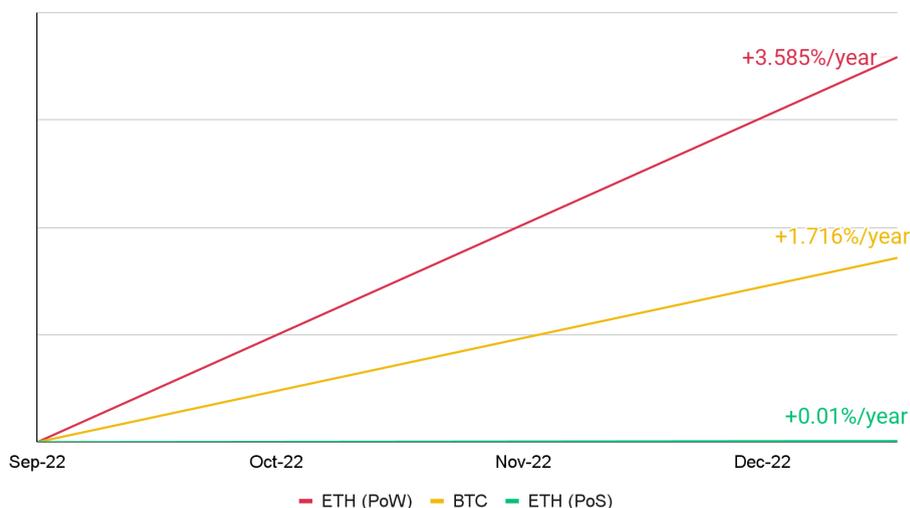
Figure 3: The Merge was key in removing ESG FUD surrounding Ethereum and its dApps



Source: Binance Research, [ethereum.org](#)

- ❖ One of the most significant effects The Merge had was in terms of **daily Ether issuance**. Due to the transition, there was no longer a need for Ethereum to pay the expensive mining rewards that incentivized actors to partake in this activity. In practice, this reduced Ether issuance from 3.58%/year to 0.005%/year - a significant drop in supply growth that is arguably yet to be fully priced in by the market. In fact, in combination with the burn mechanism that was implemented in [EIP-1559](#), Ether spent the majority of November as a deflationary asset and currently sits very close to that level.

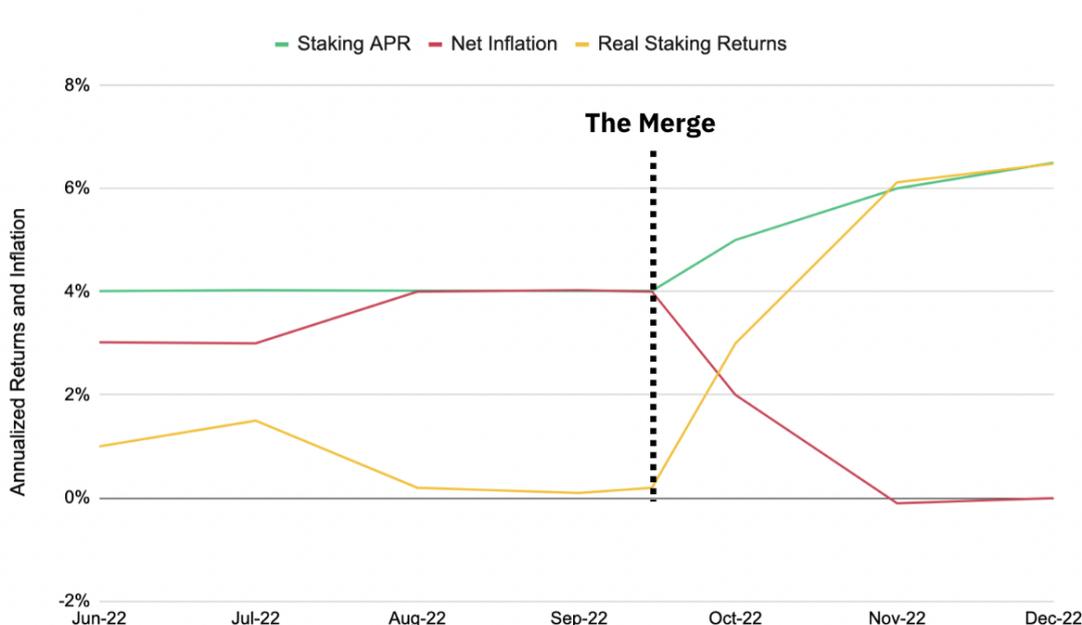
Figure 4: PoS ETH supply growth is many magnitudes lower compared to PoW ETH and even Bitcoin



Source: Binance Research, ultrasound.money

- ❖ Real staking returns, which were non-existent pre-Merge, have fluctuated between 5-7% post-Merge. Ethereum’s staking yield is dependent on the level of activity on the network as well as the amount of the token staked. You can think about the staking returns as setting the “risk-free rate” for the broader Ethereum ecosystem.

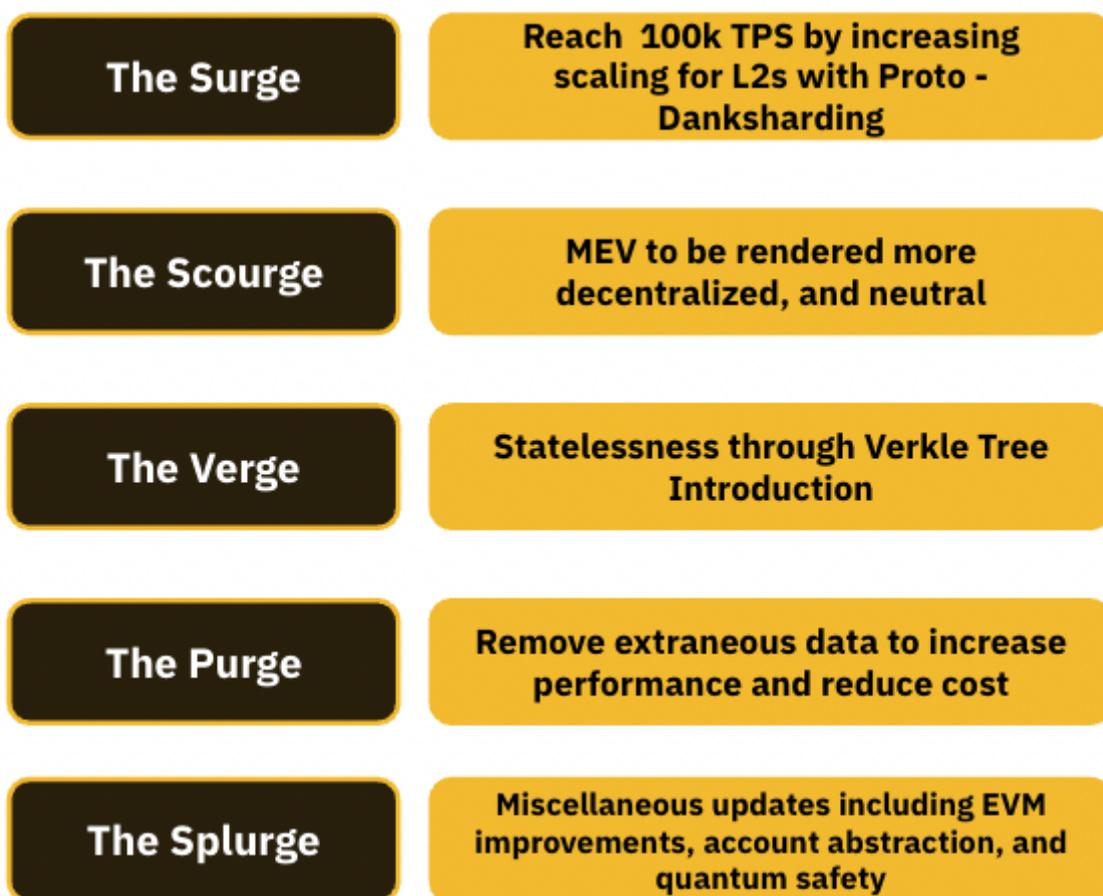
Figure 5: In a post-Merge world, real staking yields exploded, while net inflation fell



Source: Binance Research, Messari, Dune: @LidoAnalytical

- ❖ The next steps in Ethereum’s journey will involve the **Shanghai Upgrade** in the coming months, which will give users the ability to withdraw staked Ether. Following that, **EIP-4844 will be the next major goal, enabling Proto-Danksharding** - a major step on the way to full [sharding](#). While priorities within Ethereum shifted towards The Merge and Layer 2s helped to fill the scalability gap, the increase in L1 and L2 capacity that sharding is expected to bring remains highly anticipated and developments in this area will be closely followed through 2023.

Figure 6: Vitalik’s updated Ethereum [roadmap](#)

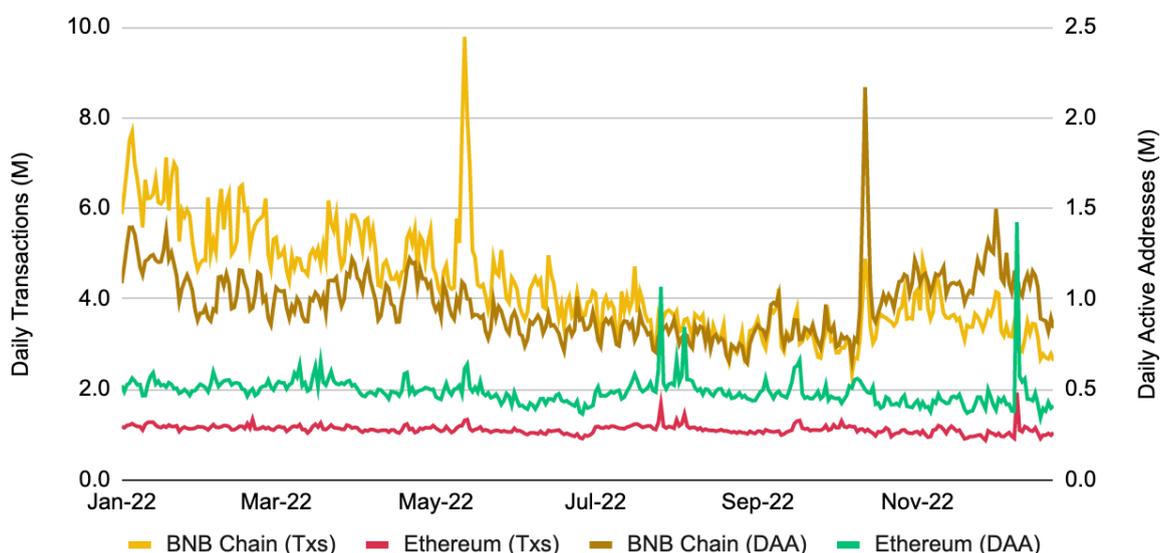


Source: Binance Research, Vitalik Buterin⁽³⁾

BNB Chain

- ❖ A relatively strong year for BNB Chain with good performance across DeFi and continued strength with on-chain metrics. Market cap, while down, remained solid on a relative basis. Across 2022, BNB market cap was down ~55%, compared to Ethereum (-67%), Solana (-93%) and Avalanche (-88%).
- ❖ On-chain metrics held strong, with daily transactions closing 2022 around 3M/day, second only to Solana. **Daily active addresses, on the other hand, continue to be an area of strength, with BNB Chain leading the chart across the year** (see Figure 2 for more details).

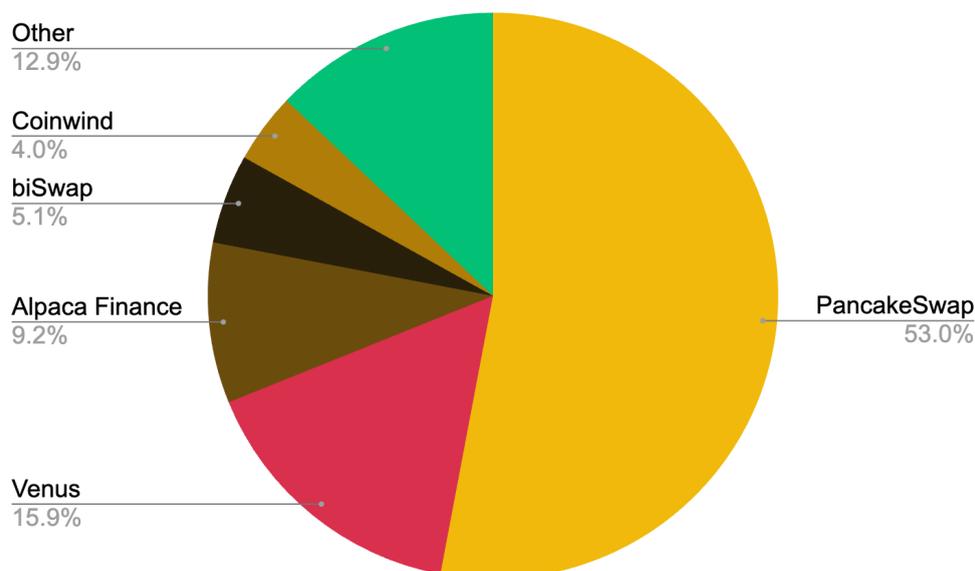
Figure 7: BNB Chain has consistently beaten Ethereum in terms of daily on-chain activity



Source: Binance Research, Gokustats

- ❖ In terms of DeFi, BNB Chain has continued a consistent ascent throughout the year, and after remaining relatively steady up until May, saw a strong uptick following the collapse of the Terra ecosystem. In fact, after seeing its dominance fall as low as 6.3% in April, **BNB Chain more than doubled its TVL share to over 13% in early December**. PancakeSwap continues to dominate TVL and regularly sees over US\$300-500M in daily volumes. Their introduction of StableSwap and integrations with Aptos⁽⁴⁾ and Ethereum were notable 2022 highlights and we look forward to seeing what the team ships this year. Additionally, the launch of Wombat Exchange (stablecoin swaps) and the growing ecosystem around it (e.g. Wombex Finance) has been promising and might see increasing usage if BUSD continues to take market share through this year (see [Stablecoins](#) for more detail on BUSD)

Figure 8: PancakeSwap continues to lead BNB Chain DeFi TVL



Source: Binance Research, DeFiLlama

- ❖ In terms of security, **BNB Chain led the creation of AvengerDAO**. AvengerDAO is a collaboration of web3's leading security firms and early adopters of blockchain brought together in a unique community-run security infrastructure project designed to protect users on BNB Chain from possible hacks, scams, and malicious actors. **AvengerDAO remains a priority in 2023 and we expect to see further progress** in improving the quality and quantity of the services it can offer to dApps.
- ❖ From a scaling point of view, BNB Chain has a set of solutions for dApps looking to deploy on the network. BNB Sidechain was deployed earlier in 2022 and while this has seen some traction, the major announcement out of BNB Chain has been around their own version of zk Rollups - **zkBNB. Testnet launched in November and the mainnet launch is expected in Q1 2023**. Further to this, BNB Chain is also working on an **EVM-equivalent scalability solution** to complement BNB Sidechain and zkBNB, and further details are expected in 2023.
- ❖ The launch of **BNB Liquid Staking** and the **integration of BNB Chain NFTs on OpenSea** were also notable highlights in 2022. Furthermore, BNB Chain also saw the launch of its **first-ever Soulbound Token**, with **Binance Account Bound ("BAB") tokens**. The tokens represent identity credentials for Binance users who completed KYC verification, and are expected to be further integrated into other BNB Chain dApps. At the time of writing, over **620,000** BABs had been minted.

Solana

- ❖ A year of what seems like multiple halves for Solana. 2022 was challenging for the classic “alt-L1” trade of 2021, and Solana was no exception. Where the chain saw traction with NFTs and dApp innovation, as well as maintained a consistently high level of daily transactions, Solana also saw continued challenges with system outages, and an arguably outsized impact from the FTX situation.
- ❖ **NFTs were a bright spot for Solana**, with collections on the chain benefiting from the cheaper gas fees compared to Ethereum. **Marketplaces like Magic Eden helped lead the effort** and were instrumental in helping push Solana NFTs to new highs. As Figure 9 shows below, **Solana NFTs were second only to Ethereum through 2022 and now sit in third place in the all-time sales rankings**. On the other hand, we recently saw leading Solana collections, DeGods⁽⁵⁾ and y00ts⁽⁶⁾, announce moves to bridge over to Ethereum and Polygon, respectively. If this becomes part of a broader trend, this could prove to be a major headwind to a sub-sector within Solana that has been shining in recent months.

Figure 9: Solana NFTs have seen notable traction, trailing only Ethereum in 2022 metrics

		All Time	2022			
		Sales (US\$B)	Sales (US\$B)	Unique Buyers (M)	Unique Sellers (M)	Total Txns (M)
	Ethereum	33.2	17.9	2.9	2.5	13.3
	Ronin	4.1	0.3	1.1	0.9	4.8
	Solana	3.3	1.8	1.5	1.6	14.6
	Flow	1.1	0.3	0.5	0.7	11.2
	Cardano	0.5	0.3	0.6	0.07	2.4

Source: Cryptoslam

As of 31 Dec 2022

- ❖ From a network perspective, Solana continues to suffer from performance issues and suffered multiple outages through 2022. The recent FTX situation has also not been kind to the L1, given the very public endorsement and relationship between

the FTX, Alameda, and the Solana ecosystem. Perhaps not surprisingly, Solana and ecosystem projects have seen significant bleeding in both market capitalization and DeFi share metrics.

- ❖ What has been interesting is their venture into the hardware space, with **Solana Mobile**⁽⁷⁾. Solana Mobile promises a premium hardware experience that is custom-designed for crypto usage - betting that users will value the safety and security that would come from a phone natively designed with crypto in mind. **Hardware devices (the Saga phone) are expected to start shipping in Q1.**
- ❖ This year, we expect to see further progress and possibly the final implementation of **Firedancer**. [Firedancer](#), being built by Jump Crypto, will be the **second, fully independent consensus node client implementation for the Solana network**. It will increase decentralization by removing the single point of failure (the current Solana Labs client implementation) and is also expected to improve the performance and resiliency of the network, alongside making it cheaper to run your own node. Remember, having this second client essentially means that if a bug takes down the Solana Labs client, the chain will continue to run on the other client. **When completed, this will make Solana the only chain except Ethereum to have more than one independent validator client.** This will be a key next step for the Solana network and will be an important story to monitor throughout the year.

Tron

- ❖ A strong year for Tron, which saw good traction for the chain, especially within the DeFi space. 2022 saw the launch of **Tron's decentralized, algorithmic, USD-pegged stablecoin, USDD**. For a stablecoin launched in the aftermath of the Terra / UST collapse, USDD has performed well and has been key in helping Tron stay near the top of the DeFi TVL charts. While the recent FTX collapse has caused some instability, it should be noted that USDD maintains an over-collateralization ratio of 201.1%⁽⁸⁾. Nonetheless, as things stand, USDD continues to trade slightly below peg.

Figure 10: While Tron maintains strong TVL, its lack of protocols stands out among top chains

		# of protocols	TVL (US\$B)	24h Volume (US\$M)
	Ethereum	630	24.6	803.6
	BNB Chain	524	4.4	147.7
	Tron	14	4.1	5.6
	Arbitrum	162	1.0	46.5
	Polygon	354	1.0	63.9

Source: DeFiLlama

As of 9 Jan 2022

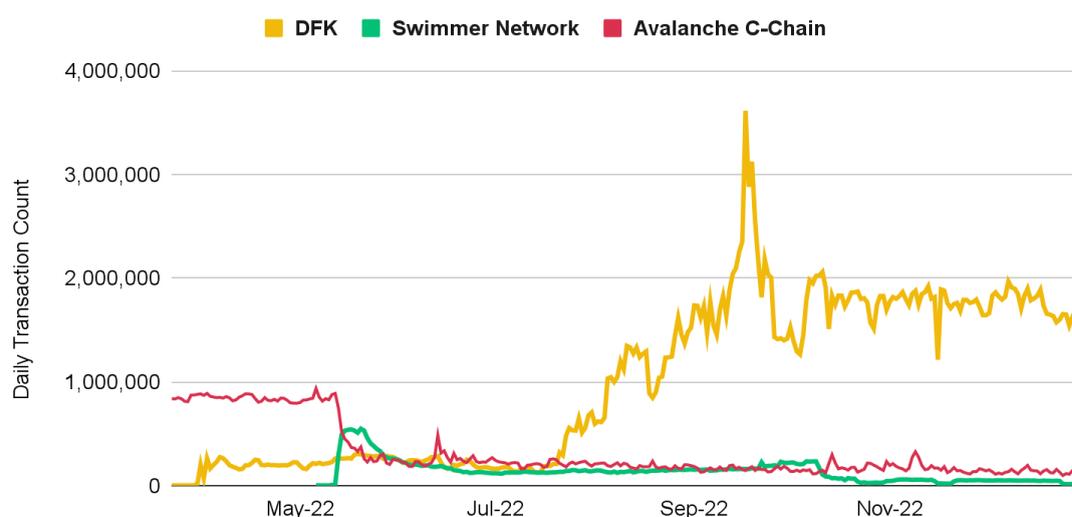
- ❖ One major piece of news for the chain was Tron being announced as the **official protocol for the national blockchain infrastructure of the Commonwealth of Dominica**⁽⁹⁾. Official documents even show that USDD is now an authorized digital currency and medium of exchange in the nation⁽¹⁰⁾. It will be interesting to see how this partnership progresses and we will follow the situation closely and hope it can continue to help drive adoption.

Avalanche

- ❖ A challenging year for Avalanche, which saw its share of DeFi market cap drop from ~6% to ~2%, as well as significant falls in terms of daily on-chain metrics (see Figure 2 for more detail). Avalanche saw positive headlines on the back of their **Subnets**, which offered scalability, particularly for gaming dApps on the Avalanche blockchain. DeFi Kingdoms and Swimmer Network were the notable first subnets launched and have generally seen growth in activity, suggesting healthy functionality and usage.
- ❖ One point to note about Avalanche's architecture is that activity occurring on Avalanche's C-Chain (their main smart contract chain) is the primary value driver of their AVAX token. Avalanche burns 100% of transaction fees from circulating supply and thus creates value for the token by increasing scarcity. Because Subnets feature their own sovereign security, native tokens and value accrual mechanisms, their usage essentially reflects usage that would otherwise occur on the C-Chain. Thus,

as Subnet activity grows, there is a corresponding downward pressure on Avalanche revenue and thus the AVAX tokens. On the other hand, it is also possible to argue that if the Subnets didn't exist, this activity would not necessarily have been captured on the C-Chain and might have gone to a different chain altogether. The relationship between Subnets, the C-Chain and revenue, and the AVAX token is complicated and remains an interesting angle to consider.

Figure 11: A clear shift from C-Chain activity to Subnets. While encouraging for Subnet functionality, the downward pressure on revenue might be an issue



Source: DeFiLlama
As of 31 Dec 2022

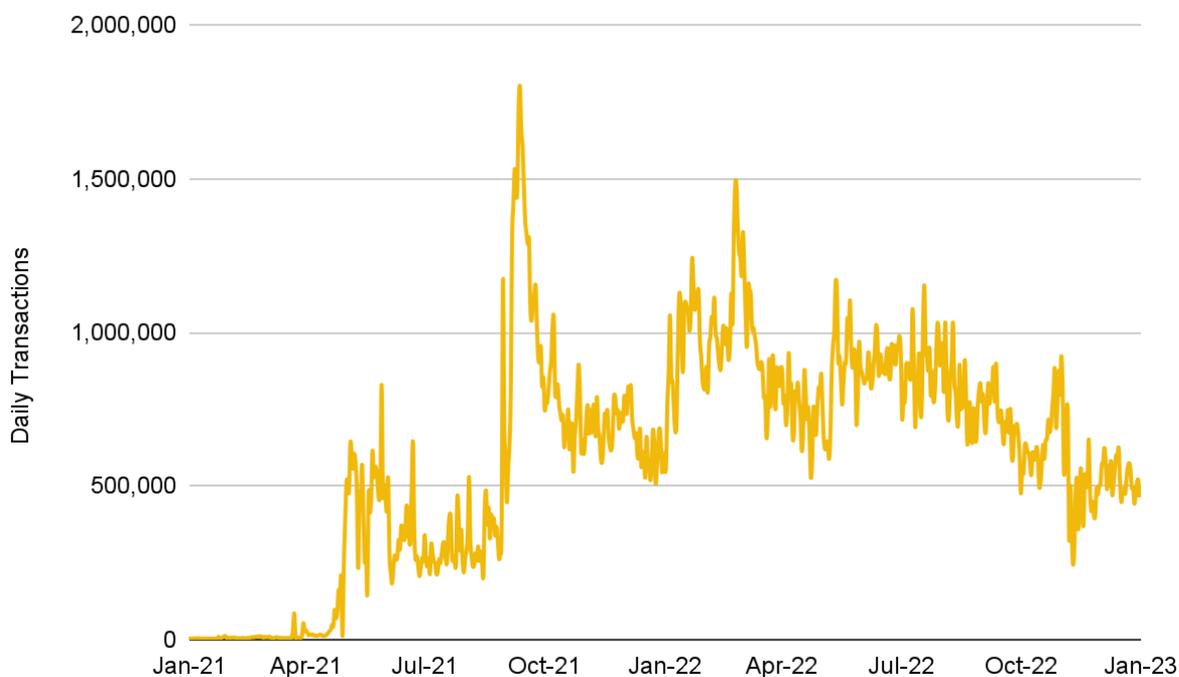
- ❖ The release of Ava Labs' **Core Wallet**⁽¹¹⁾ was a highlight. Core, originally launched as a non-custodial browser extension and now also available on mobile, provides a seamless way for users to use the full suite of Avalanche dApps. Core launched with nine primary features, including Bridging and Swapping facilities, as well as an integration with MoonPay to on-ramp from fiat.
- ❖ Most recently, Avalanche upgraded to Banff 5⁽¹²⁾. Banff 5 introduces native communication between all Avalanche subnets, adding a new level of horizontal composability, which the team hopes will drive another wave of Subnets to launch on the chain.

Fantom

- ❖ A mixed year for Fantom, with top-line metrics down significantly (market cap -92%, DeFi market share -51% in 2022) and a significant amount of uncertainty around the chain following the departure of Andre Cronje in early 2022. However, Fantom still

remains a top 10 DeFi TVL chain and Andre has since returned to the front line and has been active in his ‘architect’ role.

Figure 12: Fantom’s daily transactions have trended down Q-o-Q (-30% in Q4-22)



Source: Ftmscan
As of 29 Dec 2022

- ❖ Fantom’s mission is to “provide the highest throughput blockchain available to provide a single secure settlement layer for all decentralized activity”. Through 2023, Fantom will aim to further hunker down on this mission and focus on building a better environment for devs to deploy dApps. Specifically, Fantom will focus on details like **gas monetization, gas subsidies, and account abstraction**, as well as on building new middleware like the **Fantom Virtual Machine**⁽¹³⁾.

NEAR Protocol

- ❖ A highlight for NEAR in 2022 was the release of their **JavaScript SDK**⁽¹⁴⁾. This opened the doors for JavaScript developers to start building dApps for NEAR. Although difficult to say what sort of effect this had, particularly given the launch only happened in August, we can confirm that **NEAR remains among the top 10 blockchains**⁽¹⁵⁾, in terms of weekly dev activity (as of the time of writing).

- ❖ It has been a difficult period for NEAR in terms of Market Capitalization (-88% in 2022). However, the team has confirmed that despite adverse conditions, the NEAR Foundation has sufficient capital to sustain at least five years of operations. In terms of 2023, **NEAR will focus on partnerships as a way of driving usage**. NEAR will focus on real-life use-cases that drive engagement, such as ticketing⁽¹⁶⁾. NEAR will also utilize a grassroots approach by **assigning capital allocation decisions (which currently the Foundation controls) to community-run DAOs**.

Cardano

- ❖ Whenever we look through top chain rankings, whether that be developer stats, market cap, NFTs, or simply longevity - one name we are guaranteed to see is Cardano. In fact, 2022 saw the **five-year anniversary** of the chain, a notable achievement given how precarious market cycles in crypto can be. While Cardano seldom gets much coverage in the mainstream, the smart contract network remains one of the largest in the market (and has been for numerous years).
- ❖ **Cardano has a roadmap of five stages; we are currently in the fourth; Basho**. Basho focuses on scaling the network, with the 2022 completion of the Vasil hard fork being a notable highlight. Vasil was focused on increasing TPS and reducing fees.
- ❖ This year, we expect to see **Cardano's L2 scaling solution, Hydra**, to be rolled out. We also expect the **Midnight⁽¹⁷⁾ Sidechain (a privacy-focused Sidechain that leverages zk-proofs)** and an **EVM Sidechain** to be launched. Also in 2023, prior to the completion of the Basho era, Cardano will enter the final stage of its current roadmap, the Voltaire era, which will be focused on Governance.
- ❖ Notable ecosystem project, **Coti, is also expected to launch its algorithmic stablecoin, Djed⁽¹⁸⁾, in the near future**.

The Layer 0s

Cosmos

- ❖ The **Cosmos application-chain (“app-chain”) thesis gets more interesting as developers and users seek more customization.** Deploying as a sovereign blockchain within the Cosmos “Hub” provides flexibility advantages over deploying as a dApp on an L1 or L2. Developers are afforded the benefits of deploying your application in its own chain, and thus benefiting from potentially higher throughput and better performance. All the while, they do not have to worry about things like consensus ([Tendermint](#) solves this), and interoperability ([Cosmos’ InterBlockchain Communication](#) (“IBC”) protocol), while [Cosmos SDK](#) will help them build a secure app-chain.
- ❖ 2022 was a packed year for Cosmos. Their annual Cosmoverse event was well attended and unveiled ATOM 2.0; the plan for a new vision to upgrade Cosmos and the native ATOM token. However, the official proposal was actually rejected due to the lack of information about some of the changes. Further proposals with clarification are expected through 2023.
- ❖ Cosmos app-chain activity has been steadily increasing, with **53 IBC-enabled chains within the ecosystem**, totalling US\$9.3B in market capitalization (at the time of writing). Last 30 day volume within IBC chains is US\$714B, with leading ecosystem DEX, Osmosis, being the most popular dApp.

Figure 13: Osmosis dominates last 30D on-chain activity within Cosmos app-chains

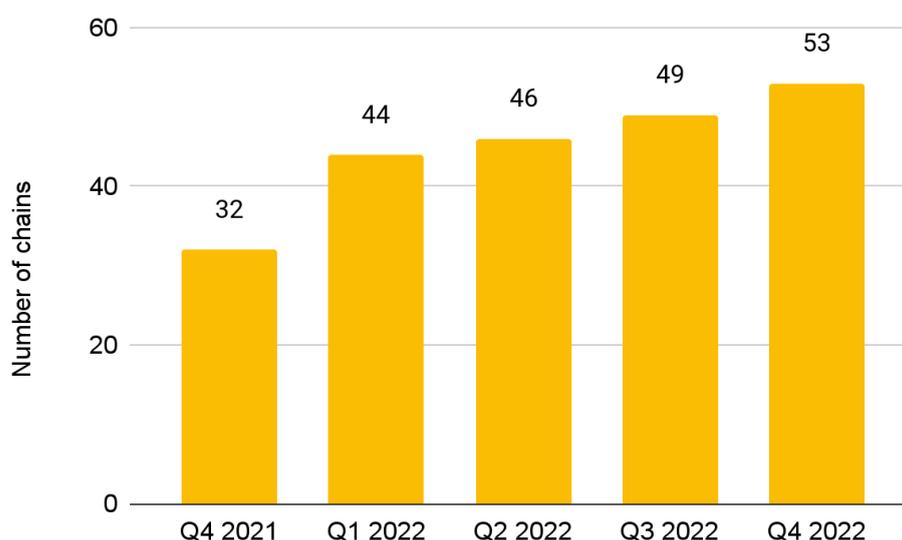
		IBC Volume (US\$M)	Total Txns (M)	Monthly Active Users (K)
	Osmosis	277.0	3.5	142.4
	Cosmos Hub	115.5	1.4	175.9
	Bostrom	83.8	0.2	3.4
	Axelar	66.9	1.6	8.5
	Stride	31.9	0.4	19.8

Source: [mapofzones.com](#)

As of 31 Dec 2022

- ❖ A major announcement and the first notable validation of the Cosmos thesis (i.e. successful dApps will eventually require their own chains), was **dYdX's announcement of their move from an Ethereum L2 solution (StarkWare's StarkEx) to a Cosmos app-based chain for their upcoming v4**. Given dYdX's position as the leading decentralized perpetual exchange and their position as StarkEx's leading client, this is quite a material story and an important case study to follow this year. More recently, we also learnt that **infrastructure protocol, Syntropy, has decided to migrate from the Substrate framework within Polkadot to Cosmos**. Whether this is the beginning of the rush into Cosmos app-chains or just a small selection of projects migrating will be a key question we will get clarified this year.

Figure 14: The number of Cosmos app-chains have been steadily growing



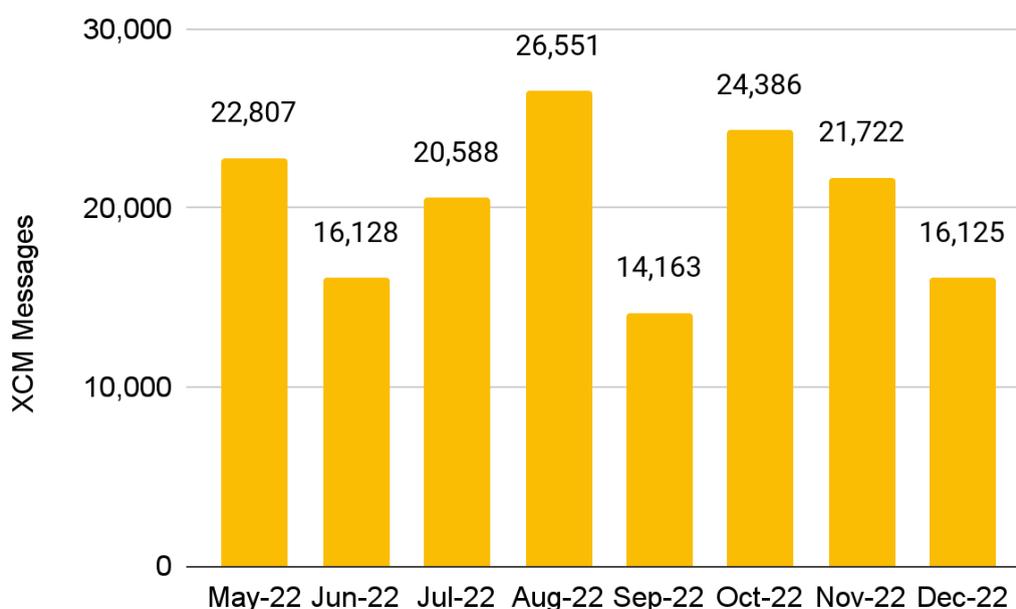
Source: mapofzones.com

- ❖ The next few months will see a number of upgrades within the Cosmos network. Q1 will see the Lambda Upgrade, which will feature **improvements to the Cosmos SDK and add a liquid staking module**. Q2 and Q3 will see the Epsilon and Gamma upgrades, which will focus on interchain security.
- ❖ For more detail on IBC and Cosmos, make sure to check out our recent research report: [Interoperability Solutions: Connecting Worlds](#).

Polkadot

- ❖ Polkadot has a similar interoperability thesis and uses its Relay Chain / Parachain model to achieve its connected network of heterogeneous blockchains. The Relay Chain is at the heart of Polkadot and handles consensus, shared security and cross-chain interoperability, while the [Parachains](#) are sovereign blockchains that can optimize for their respective use cases. **Following the December 2021 launch of Parachains, Polkadot saw 33 deployments across 2022.**
- ❖ A major milestone Polkadot achieved in 2022 was the launch of their **Cross-Consensus Message Format (“XCM”)**. XCM is a language for cross-chain communication that allows parachains to exchange messages in a trustless and secure manner. While the release was a milestone, note that XCM is a language, and it cannot actually send messages. The tool to send messages i.e. XCMP is still in development and Parachains are having to use temporary solutions in order to bypass this. Persistent delays in XCMP and the difficulties that Parachains have experienced has possibly discouraged a few projects and could perhaps be one reason why we have seen Syntropy leave the Polkadot ecosystem in favor of Cosmos. The launch of XCMv3 this year, in addition to further news about XCMP will be welcomed by the community, particularly given that Polkadot’s primary thesis is essentially about efficient cross-chain communication.

Figure 15: Polkadot’s XCM message growth has been inconsistent



Source: [polkadot.subscan](#), Binance Research

- ❖ This year **we also expect to see the launch of Parathreads**, which can best be described as “pay-as-you-go” Parachains, and can be accessed without going through an entire Parachain slot auction process. Security within both types of chains is the same and Parathreads might very well serve as viable alternative entry points for some developer teams. It will be interesting to see if the launch of Parathreads and further development in XCM, as well as innovation within existing and new Parachains, can attract more projects to Polkadot and how it fares vs. Cosmos in the coming year.

New Kids on the Block

❖ Aptos:

- The first of two major chains that have come out of Meta’s Diem (formerly Libra) project, **Aptos is a PoS blockchain** that launched its mainnet in late 2022. **Aptos utilizes the Move programming language** and provides **parallel execution** via its novel **Block-STM execution engine**. Aptos is built with modularity and flexibility in mind and designed to support frequent upgrade cycles in order to adopt the latest technological advancements.
- Initially announced in early 2022, Aptos went through four testnets through the year before launching mainnet in October. In the limited time since launch, Aptos has demonstrated consistent runtime and seen some growth in activity. The [block explorer](#) shows between **20-30K daily active accounts**, while **user transactions so far peaked around 150K and have trended towards 70-80k per day**.
- Notable **integrations include PancakeSwap, Wormhole, Pyth and LayerZero**. Through 2023, it will be interesting to monitor if we see any new use cases emerging or any significant improvements in dApp throughput due to the performance that Aptos promises.

❖ Sui:

- Also borne from the same Diem project, **Sui is an upcoming PoS L1 project being developed by Mysten Labs**. Sui brings a number of new innovations, including **parallel transaction execution** which allows simple transactions to bypass consensus altogether and be executed near-instantly. This is made possible due to the **object-centric nature of Sui**, which differs from traditional blockchains (which are usually based on addresses).

- Sui makes it easy to implement **horizontal scalability** and features **localized fee markets** and a **novel gas fee mechanism**. Sui utilizes ‘**Sui Move**’; a slightly modified version of the core Move programming language that is designed to fully leverage the object-oriented architecture of Sui.
- Sui concluded its Testnet Wave 1 in December and **expects to launch their next Testnet Wave early this year**. Mainnet is expected later through the year, and Sui also recently [released](#) token allocation details.
- For more details on Aptos, Sui and their novel innovations, as well as their similarities and differences, **do check out our report - [Aptos and Sui: The New Kids on the Block](#)**.

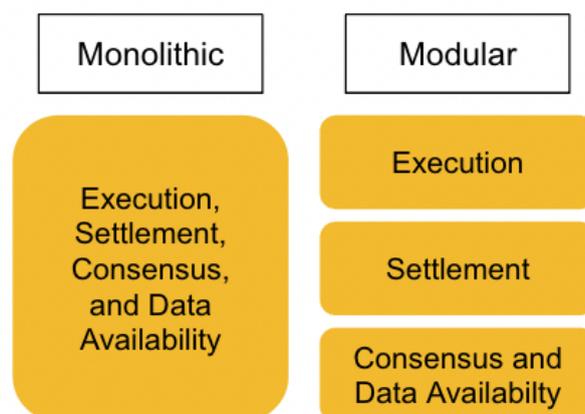
The Modular Blockchain Gang

As a brief overview; blockchains need four core layers to fulfill their purpose:

1. **Execution**: executing transactions to update the state
2. **Settlement**: verification, resolving disputes
3. **Consensus**: agreeing on transaction ordering
4. **Data Availability (“DA”)**: making transaction data available - required for the other three functions

In traditional **monolithic blockchains**, all four stages are executed by the same system together in a single layer. This essentially prevents optimization for any one of these four functions and ultimately limits throughput and efficiency. **Modular blockchains** aim to provide a solution and are based on the idea that these four functions can operate through separate, more specialized and efficient systems and deliver an increase in blockchain throughput.

Figure 16: Monolithic vs. Modular blockchain architecture



Source: Binance Research

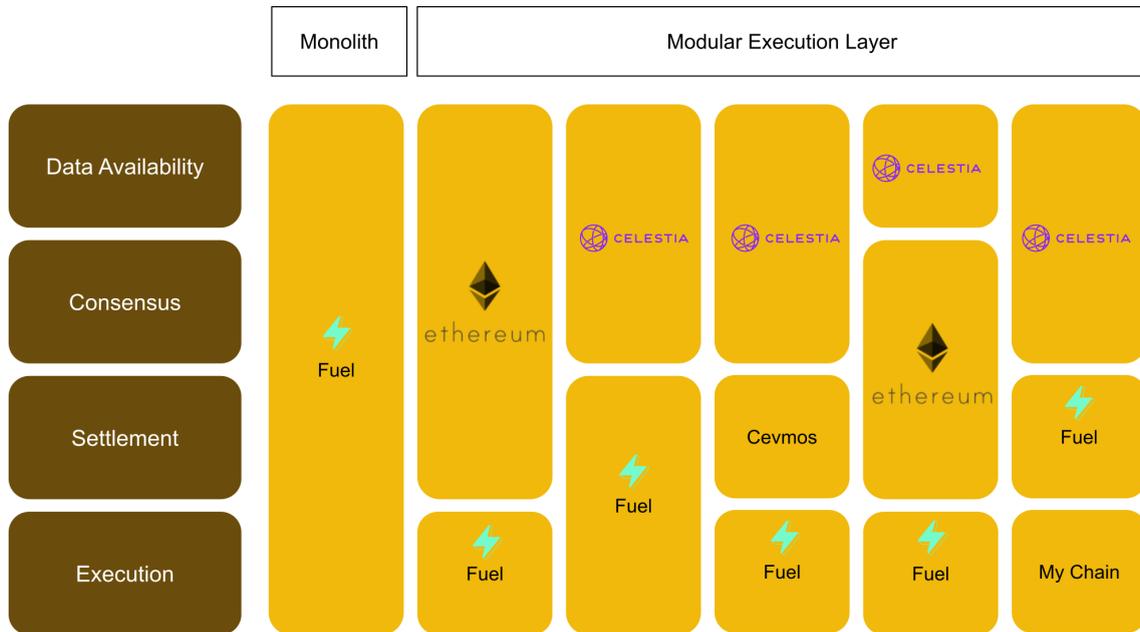
❖ **Celestia:**

- Celestia is a **modular blockchain network that aims to build a scalable data availability layer**. Thus, Celestia targets the Consensus and Data Availability layers of the modular blockchain as shown in Figure 16. To facilitate this, Celestia uses data availability sampling and Namespaced Merkle trees. More details in their [docs](#).
- 2022 saw the release of three major testnets, including the Mamaki Testnet⁽¹⁹⁾, which was the first to support data availability sampling. Celestia also announced a US\$55m raise late in the year. **In 2023, Celestia aims to launch both an incentivized testnet and mainnet**. One potential group of users for Celestia's product are Rollups (more detail on Rollups in the [Layer 2 section](#)), many of which currently use Ethereum for data availability.

❖ **Fuel Labs:**

- **Fuel** targets a different part of the structure and bills itself as a **modular execution layer**. Fuel provides **parallel transaction execution**, which is not something that the Ethereum Virtual Machine (“EVM”) offers. Fuel also features the Fuel Virtual Machine (“FuelVM”), which the team say includes improvements and lessons from the EVM. In fact, they also go on to describe a number of Ethereum Improvement Proposals (“EIPs”) that have been implemented in the FuelVM⁽²⁰⁾. The FuelVM utilizes **Sway**, which is a domain-specific, Rust-based programming language.

Figure 17: Fuel can operate in numerous different configurations



Source: [Fuel Labs](#), *Binance Research*

- Fuel Labs raised US\$80M in 2022, as well as announced two public testnets. Their most recent beta-2 testnet processed over 620,000 transactions and brought cross-chain bridging abilities to Fuel.

Layer 2

One of the major predictions for 2022 was the so-called “L2-22”, referring to 2022 being the breakout year for L2s. Did we see this?

To start with, **how did TVL perform?** [Data](#) shows that **L2 TVL rose 119% (denominated in ETH) across 2022**. While USD-denominated TVL was down around 28%, this is significantly lower than the ~76% USD-denominated drawdown in the whole DeFi market and is arguably largely a factor of dropping crypto prices. In combination with the significant increase in ETH-denominated TVL, this would suggest that L2s have seen strong inflows across 2022.

Figure 18: L2 TVL ramped up in 2022 (at least in ETH terms)

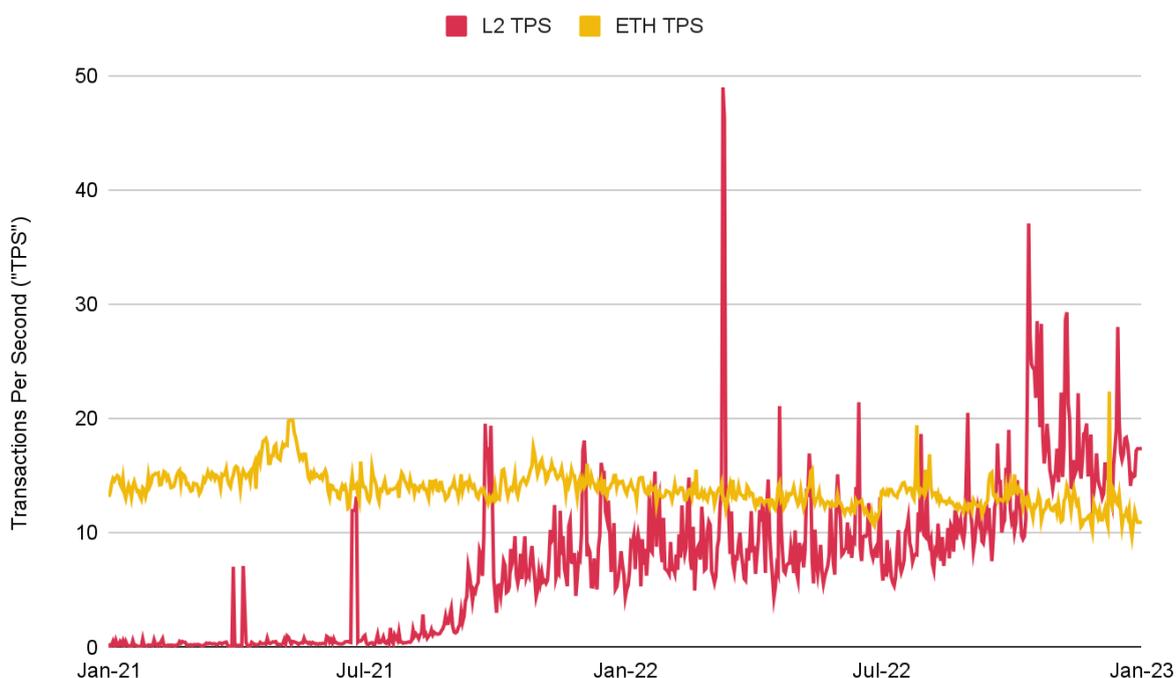


Source: L2Beat, Binance Research
As of 31 Dec 2022

How about activity? **L2 activity has been steadily ramping up since late 2021, with Optimism and Arbitrum leading the charge** (more on this later). In October 2022, **L2 TPS finally overtook the Ethereum L1’s TPS** for a sustained period, and this is how things remain. At the end of 2022, the average L2 TPS was ~17, whereas this was closer to ~10 for Ethereum. In fact, according to [L2BEAT’s](#) proprietary “scaling factor” calculation, the last week of 2022 saw a 2.46x L2 scaling factor. This means that 2.46x more transactions were

settled on Ethereum when considering L2s. Clearly a significant increase in year-on-year activity, further validating the narrative that L2s will become primary execution layers, while Ethereum serves as a broader settlement layer.

Figure 19: L2 TPS (a measure of activity) overtook the Ethereum L1 in October

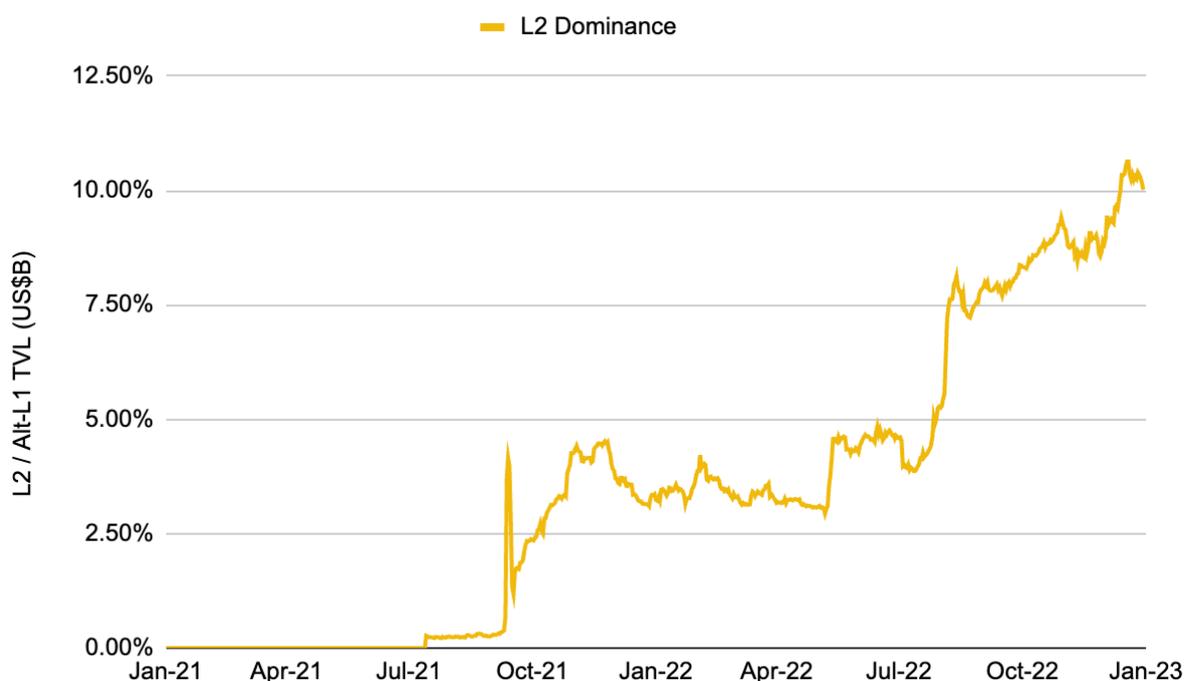


Source: L2Beat, Binance Research
As of 31 Dec 2022

How about L2s vs. alt-L1s? How is that narrative playing out? L2 TVL dominance vs. alt-L1s continues to increase, and has risen 209% during 2022, and around 118% since July. 2022 was the first real year where we saw this L2 vs. alt-L1 debate come to life and it will be interesting to see what happens across 2023.

Consider the fact that, as shown in Figure 2 in the [L1 section](#), **both Arbitrum and Optimism exceed Avalanche in terms of daily on-chain activity**. If we add to this the increasing deployment of alt-L1s dApps on L2s e.g. Trader Joe of Avalanche recently launched their mainnet on Arbitrum, and the situation for some of the smaller alt-L1s starts to look more precarious.

Figure 20: L2 dominance has been climbing, with 2022 being a breakout year



Source: DeFiLlama
As of 31 Dec 2022

At the same time, L2 TVL is around US\$4bn / ETH 3.4M. This compares to a current total Ethereum TVL of US\$23B / ETH 19M, which is very much in the depths of a bear market. This shows that **despite the growth that L2s have seen, there is still some way to go just in pure TVL terms**. Dominance vs. alt-L1s is also only at ~10% - while significantly higher than just a few months ago, there is still a mountain to climb.

Furthermore, while 2022 did see the launch of one notable L2 token, with [OP](#) for Optimism, the majority of other L2 protocols are still token-less. Given this is a key way for users to interact and get exposure to a protocol, the lack of investment opportunities has probably also limited the “L2-22” prophecy from completely fulfilling itself.

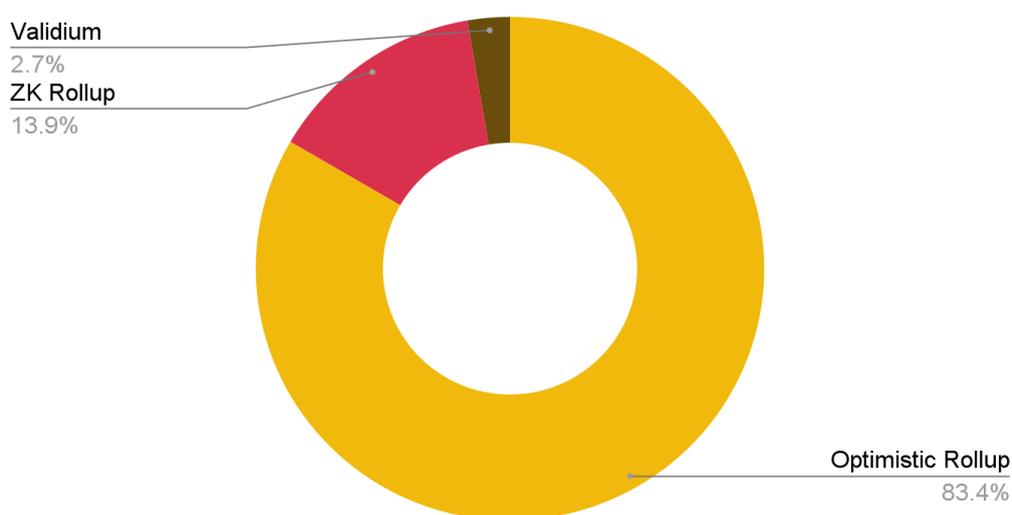
In this section, we have a closer look at Optimistic- and zero-knowledge (“zk”) Rollups, explore zkEVMs and also have a closer look at what has been going on with Polygon. We will cover the latest updates and expected developments of a number of protocols. However, for a more in-depth look at the underlying technology and more detailed discussion, we do recommend our reports on [Layer 2 Scaling](#) and [zkEVM and the Future of Ethereum Scaling](#).

Optimistic Rollups

When thinking about L2 solutions, the two primary categories we are going to focus on are Optimistic and zk Rollups. Validium and Plasma are also types of L2 scaling solutions. However, for the purposes of this report, we will be focusing on the former two categories.

The two biggest players in the Optimistic Rollup world are **Arbitrum** and **Optimism**. (In fact, these are the two biggest players in L2 scaling overall). Together, they held around **80% of the L2 market share**⁽²¹⁾ (in TVL terms) and were responsible for **~57% of L2 activity** in the month of December⁽²²⁾.

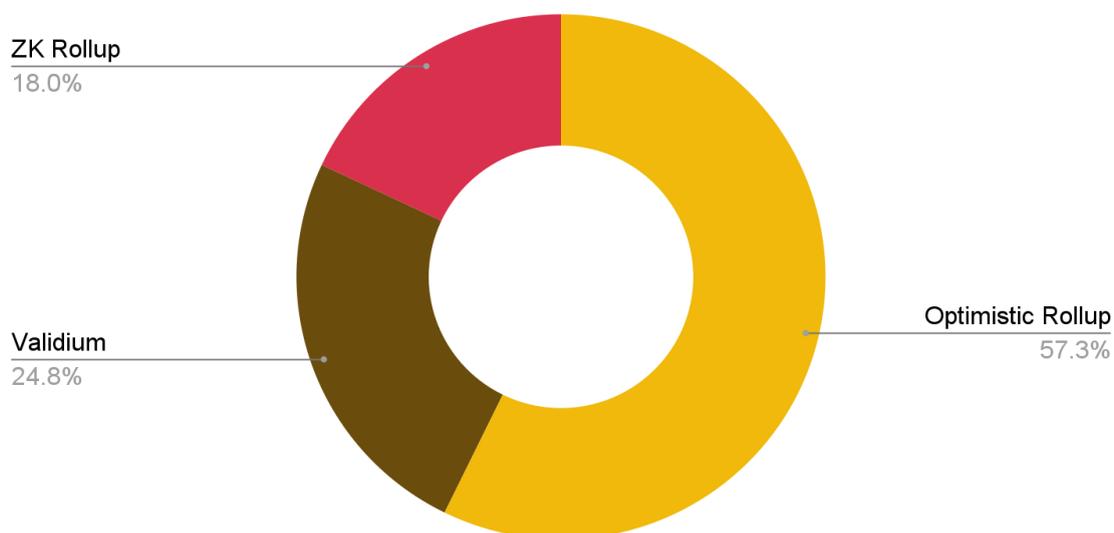
Figure 21: Optimistic Rollups dominate the L2 landscape in terms of TVL



Source: L2Beat, Binance Research
As of 31 Dec 2022

Validium-based solutions like Immutable X and Sorare, both of which focus primarily on NFTs, help push activity levels higher in this category (vs. TVL, which is very low for Validium-based solutions). dYdX is also a notable high TPS protocol and helps push the activity levels for the zk Rollup group. Of course, this number is likely to change given dYdX's upcoming migration to a Cosmos app-chain following the release of their v4 (more detail in the [Layer 1 section](#)).

Figure 22: L2 Activity in December was more evenly split, with Validium solutions also seeing some traction

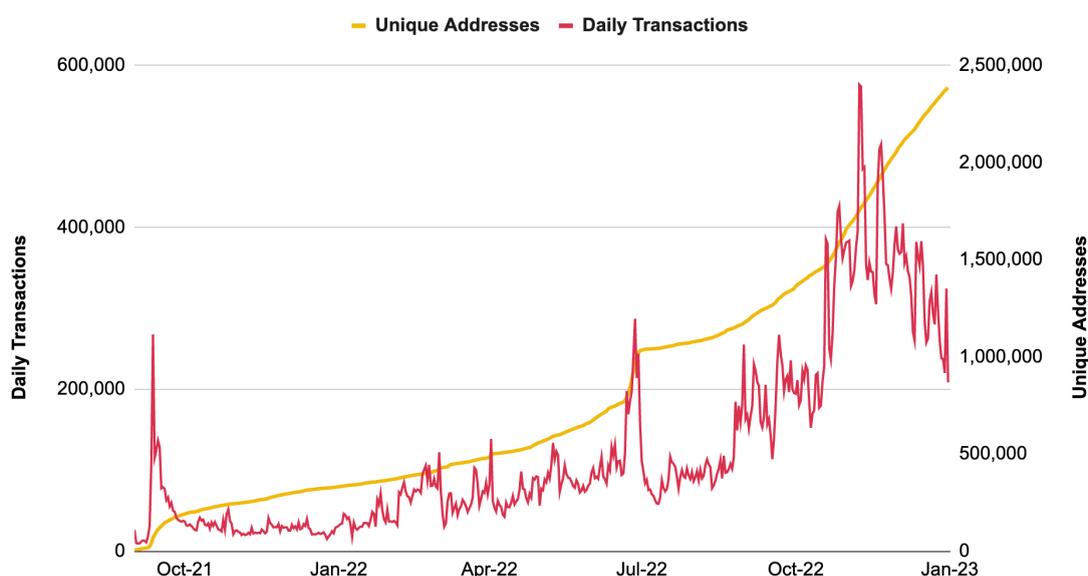


Source: L2Beat, Binance Research
As of 31 Dec 2022

Arbitrum

- ❖ 2022 was a strong year for the market-leading Ethereum L2 solution, which saw the **TVL of its flagship product, Arbitrum One, grow 171% from ETH 681K to ETH 1.8M**. Daily transactions and unique addresses both showed a strong positive uptrend, rising 560% and 618% across 2022, respectively.
- ❖ Offchain Labs (the team behind Arbitrum) was headfirst in BUIDL mode across 2022 and saw a number of developments. Following the launch of their original product, the Arbitrum One Rollup chain, **Arbitrum introduced a second chain, Arbitrum Nova⁽²³⁾ in 2022**. This is designed to be more suitable for high transaction, cost-sensitive use cases and reduces costs via utilizing a Data Availability Committee (“DAC”). **Offchain Labs also launched Arbitrum Nitro⁽²⁴⁾ in 2022**. This was an upgrade to their software stack and provided a significant increase in throughput. Nitro now powers both Arbitrum One and Arbitrum Nova.

Figure 23: Arbitrum unique addresses and daily transactions have been on a steady rise



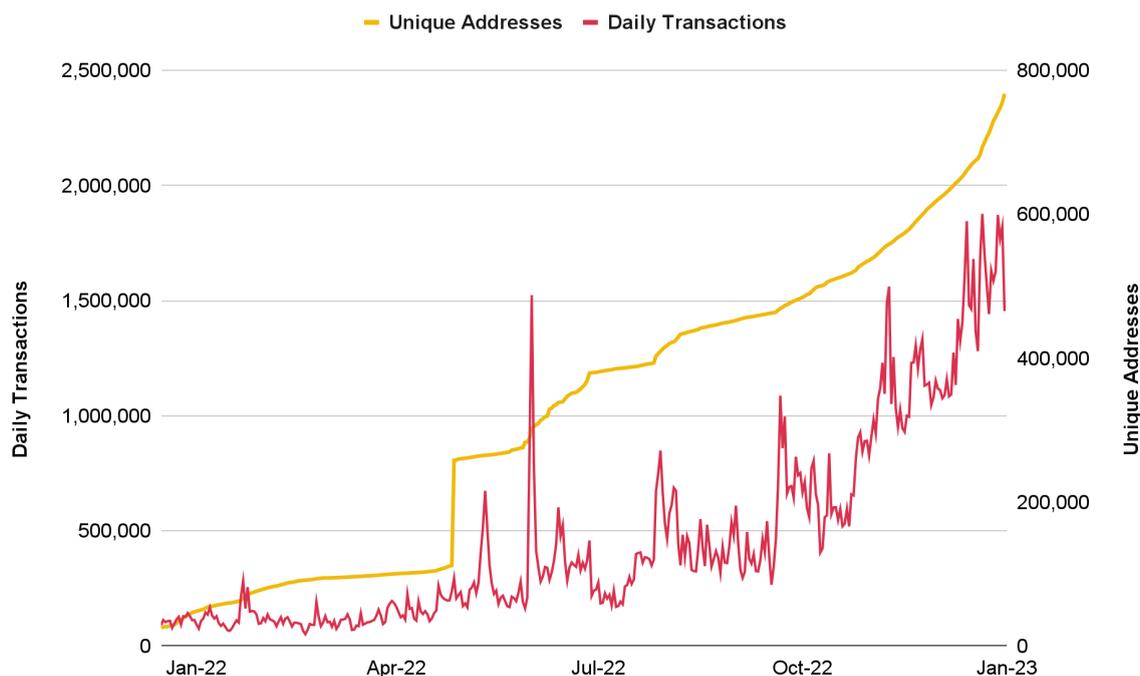
Source: Arbiscan, Binance Research
As of 31 Dec 2022

- ❖ One other development that Offchain Labs dubbed “The Merge 2.0⁽²⁵⁾” was their **acquisition of Prysmatic Labs**. Prysmatic Labs is one of the core development teams working behind Ethereum and the architects of Prysm, a leading Ethereum consensus client that helps power its PoS consensus. This was an interesting piece of M&A, given it merged leading L1 and L2 teams.
- ❖ Arbitrum also continued to see **several dApp integrations**. The recent mainnet launch of leading Avalanche DEX, Trader Joe, on Arbitrum was a notable integration. Livepeer, Aave, and OpenSea are other examples. [GMX](#), the decentralized perpetual exchange, is an Arbitrum project and was one of the most successful projects of 2022 in terms of volumes and activity. In terms of web2 collaboration, **Reddit migrated its Community Points system to the Arbitrum Nova chain⁽²⁶⁾**.
- ❖ This year, we **expect to see the leading middleware protocol, The Graph, migrate to Arbitrum One (in addition to Ethereum)**. We also expect to see the **continuation of Arbitrum Odyssey** - a campaign in which users are invited to learn about the Arbitrum ecosystem and earn NFTs. Originally launched in 2022, it was delayed because the Arbitrum One chain got overloaded and given the Nitro scalability upgrade was coming soon, the team decided to postpone it. A restart is still to happen and is expected early this year.

Optimism

- ❖ Optimism saw significant growth through 2022, with **TVL rising 580% from ETH 138K to ETH 938K**. On-chain activity was also impressive, with **daily transactions growing 1,467% and unique addresses by 1,486%, respectively**.

Figure 24: Optimism’s growth exploded in 2022, at least partially driven by its token drop



*Source: Optimistic Etherscan, Binance Research
As of 31 Dec 2022*

- ❖ In terms of milestones, 2022 was a big year for Optimism which saw numerous significant developments. We saw the introduction of the **Optimism Collective⁽²⁷⁾**. The OP Collective is a group governed by token holders and other Optimism-aligned partners in order to vote on protocol upgrades and engage in community-oriented behavior. The OP token was also introduced via an airdrop (the first of many). This was notable given it was the **first major L2 token to be available in the market**.
- ❖ Later in the year, Optimism launched the **OP Stack⁽²⁸⁾**. The OP Stack is described as a “modular, open-source blueprint for highly scalable, highly interoperable blockchains of all kinds”. Essentially, the OP Stack represents Optimism’s modular Rollup architecture and allows developers to use different parts of this blueprint to create their own blockchains. (See discussion on [Modular Blockchains](#)). So far,

OPCraft, which is an entirely on-chain 3D world / crafting-game, has been built on the OP Stack⁽²⁹⁾.

- ❖ In Q1, we expect to see the mainnet release of **Optimism Bedrock**⁽³⁰⁾. This upgrade to the OP Stack is expected to help Optimism lower transaction fees, further optimize deposits and withdrawals and also improve security for bridged assets. Through the year we also **expect to see the second OP airdrop and the continued rollout of incentives via the Optimism Collective and Foundation.**

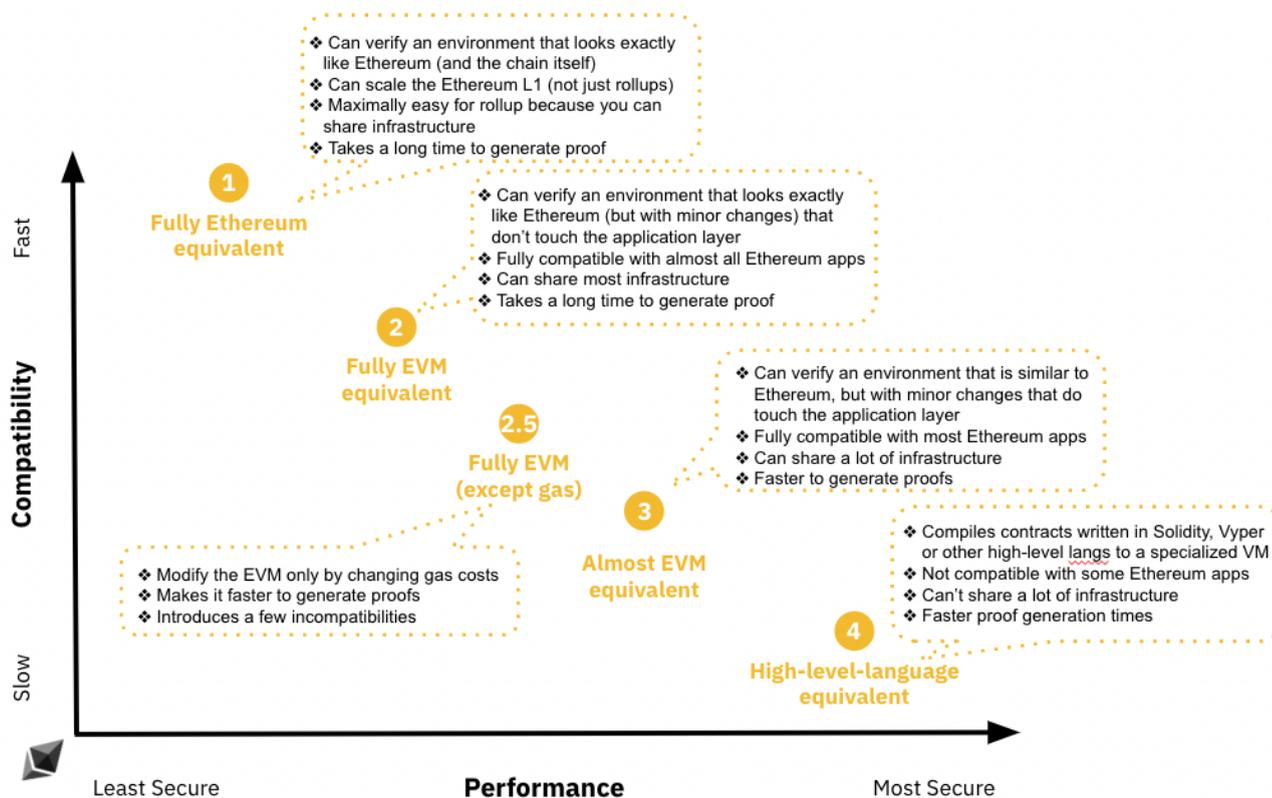
Zero-Knowledge (“zk”) Rollups

zk Rollups are the other major L2 solution that has seen strong traction in the last year and, as you can probably tell, are closely related to Optimistic Rollups. **zk Rollups rely on Validity Proofs to validate their transactions on the Ethereum L1. Optimistic Rollups use Fraud Proofs instead.** This means that Optimistic Rollups are “optimistic” as they assume that transactions are valid and do not publish Validity Proofs, but rather rely on Fraud Proofs in the case that a transaction is disputed. zk Rollups on the other hand provide proof of the validity of all transactions.

On a practical level, this means that zk Rollups can generally be thought to be slightly more complicated to build, but also considered more secure. Note that these initial zk Rollups are not EVM-compatible. The primary examples of protocols providing these solutions have been zkSync 1.0 and StarkNet.

Furthermore, one of the more interesting narratives that we saw across 2022 was of the **move from generalized zk Rollups towards zkEVM Rollups.** zkEVMs are virtual machines that execute smart contracts in a way that is compatible with zk-proof computation. **The building of the zkEVM enables zk Rollups that are EVM-compatible (or EVM-equivalent).** This is a major turning point for crypto and not something that was considered possible for a number of years, until the rapid development we saw across last year. Given that this solution joins together the scalability of zk Rollups, with the significant network effects and dominance of the EVM, it represents a significant step towards scalability. There are three major players working on this: **Polygon, Scroll and zkSync. ConsenSys and Taiko have also announced their efforts.**

Figure 25: Vitalik’s classification of the different types of zkEVMs



Source: Vitalik Buterin, Binance Research

Looking slightly more specifically at zkEVMs, we can reference Vitalik Buterin’s article on [The Different Types of zkEVMs](#). As a brief overview, Vitalik lists five different types of zkEVMs, providing trade-offs between composability with Ethereum, security and performance. Note that there are not better or worse types, simply different points in terms of trade-offs, somewhat analogous to the battle we see among L1s and their goals of solving the [Blockchain Trilemma](#).

In terms of the primary zkEVM projects, **zkSync uses a Type 4 approach. StarkNet becomes a de-facto Type 4** when using a compiler from Ethereum’s Solidity to StarkWare’s Cairo language. **Polygon Hermez and Scroll are both Type 3 and moving towards Type 2. Taiko is one of few projects working on a Type 1 zkEVM.**

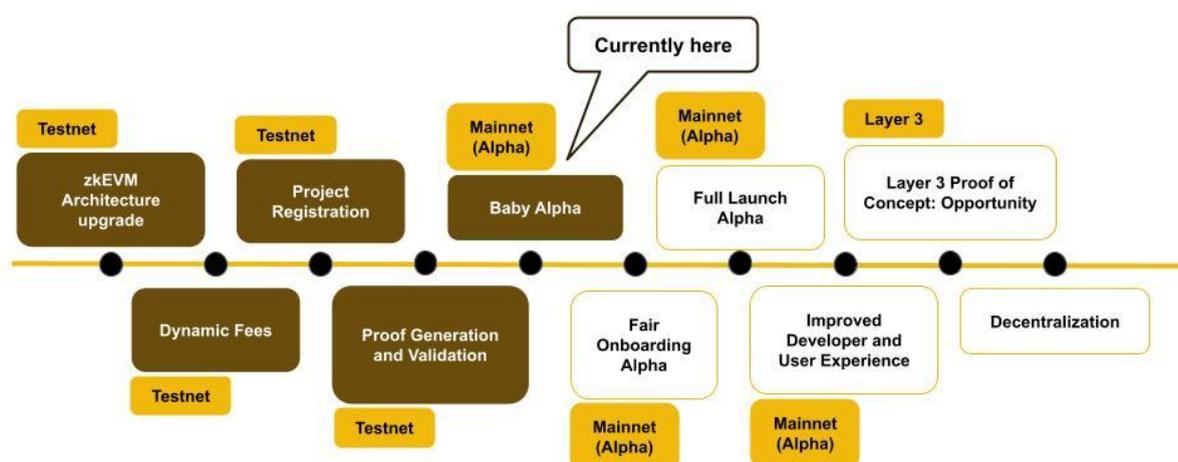
zkSync

- ❖ zkSync saw a number of developments across 2022. dApps from across the ecosystem continued to deploy on zkSync, with over 300 projects either committed to launching or already live. Matter Labs, the company behind zkSync, announced a new Series C US\$200M raise, bringing their total raised funding to US\$458M⁽³¹⁾.

They announced that **they will fully open source all of their code when reaching their “Fair Onboarding Alpha” (which should be in Q1 2023)**. They also made significant progress on their zkEVM project; zkSync2.0.

- ❖ **Matter Labs launched the zkSync2.0 “Baby Alpha”⁽³²⁾ in October.** This is essentially a developer testnet and the **first phase of a three-stage rollout**. Baby Alpha Involves stress testing, auditing, bug bounties etc. At the Fair Onboarding Alpha stage, expected in Q1, all ecosystem projects will be allowed to deploy on zkSync2.0 and further test the system. For this part of the process, Matter Labs have reportedly secured over 150 projects, including significant focus on DeFi (Aave, Uniswap v3, 1inch, Sushi etc).
- ❖ Following this, they expect to ship the Full Launch Alpha, which will open the system and all projects to users, including bridging facilities. After recent security audit updates, the **Fair Launch Alpha is expected in Q2 2023**.

Figure 26: zkSync’s public roadmap



Source: Matter Labs, Binance Research

StarkWare

- ❖ To start, let’s clarify the terminology. **StarkWare is a company** focused on building Ethereum scaling solutions. StarkWare is **building two primary products**: StarkNet and StarkEx.
- ❖ **StarkNet is a permissionless and decentralized zk Rollup.** There are 100+ projects developing or already live on StarkNet across a number of different sub-sectors, including gaming, DeFi and infrastructure. Given StarkNet uses the

Cairo programming language (not Solidity), it is not exactly EVM-compatible. However, according to Vitalik's classification, using **Nethermind's Warp compiler from Solidity to StarkWare's Cairo, StarkNet becomes a de-facto Type 4 system.**

- ❖ **StarkEx, on the other hand, is a permissioned scaling solution, tailor-made for specific applications who want to scale via zk Rollups.** Notable clients include Immutable X and Sorare. One notable development here is that **StarkEx's biggest client, dYdX, announced that their v4 iteration will leave StarkEx and instead become a standalone Cosmos-based app-chain.** This is a fairly material event in the L2 world given dYdX is the largest decentralized perpetual exchange in the world. The impending move has fueled speculation of other dApps potentially migrating away from Ethereum's L2 ecosystem towards their own sovereign chains. While dYdX remains the most notable mover so far, this will definitely be a story to closely track through the year.
- ❖ 2022 saw the deployment⁽³³⁾ of the StarkNet token on the Ethereum Mainnet. However, the token is yet to be formally distributed and offered for trading. We expect to see the launch this year. We also expect to see further development in terms of StarkNet's governance, with the first vote regarding proposed changes to the StarkNet protocol set to take place in the near future.

Scroll

- ❖ **Scroll is developing an Ethereum-equivalent Type 2 zkEVM.** However, in its current state, it is probably better considered a Type 3. Scroll has been working in close collaboration with the Privacy and Scaling Explorations group at the Ethereum Foundation and have also contributed to research being done on Type 1 zkEVMs.
- ❖ Early in 2022, Scroll announced a US\$30M Series A raise. Following this, in the summer, **Scroll announced a Pre-Alpha Testnet** for early users and developers. This saw good [traction](#) and saw 6300+ unique contracts deployed, with daily transaction volume of ~32k.
- ❖ Most recently, in October, the team released an upgraded version⁽³⁴⁾ of the Pre-Alpha Testnet, which enabled smart contract deployment on Scroll. It also allowed users to now bridge NFTs and other ERC-20 tokens between their L1 and L2 testnets. **In 2023, we can expect to see the Alpha testnet**, which will be a fully permissionless testnet for all users, eventually working up to a mainnet release.

Polygon zkEVM

- ❖ The story behind Polygon zkEVM is that Polygon completed the US\$250M purchase of the Hermez Network in 2021 and then went on to launch their L2 zk Rollup called Polygon Hermez in mid-2022. Later on in the year, Polygon announced that they are building a zkEVM and rebranded Polygon Hermez to Polygon zkEVM.
- ❖ According to Vitalik's classification, Polygon zkEVM can be considered a Type 3 in its current form, while they are building towards something that should resemble a Type 2. **Polygon zkEVM launched its second testnet in December and confirmed that this is the final step before a mainnet launch in early 2023.**
- ❖ Polygon lists DeFi, NFT, GameFi, Enterprise and Payment applications as key use cases for Polygon zkEVM and we look forward to seeing what types of dApps choose to build / deploy on it.

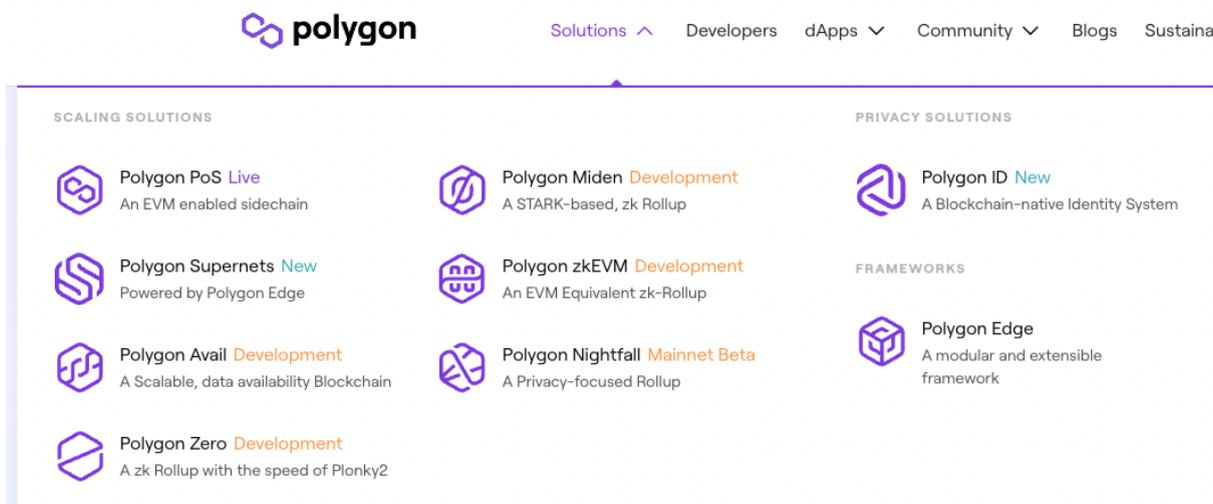
Others

- ❖ **Taiko** is building an Ethereum-equivalent zkEVM using the **Type-1 approach** i.e. fully-Ethereum equivalent⁽³⁵⁾. In Taiko Labs' own [words](#) "Taiko aims to be a type-1 zk-EVM, which prioritizes perfect EVM/Ethereum-equivalence over zk-proof generation speed".
 - **Taiko recently launched their first public testnet**; the Alpha-1 testnet. Taiko Labs expects to launch mainnet later this year.
- ❖ **ConsenSys** has also announced a zkEVM and started testing it in a private beta testnet across December. The goal of their Rollup is to be a **Type 2 zkEVM** and most recently they also [opened](#) up their private beta to be tested by allowlisted users.

The Polygon Universe

- ❖ Given Polygon's universe is larger than just one single scaling solution, we thought it made more sense to dedicate a small section to the protocol. **Polygon aims to be a general-purpose scaling solution for Ethereum, and sees the majority of its activity take place on its primary PoS Sidechain.** Other than this, Polygon has either launched or is developing a range of zk / Optimistic Rollups, a Data Availability Layer and a blockchain SDK (among others).

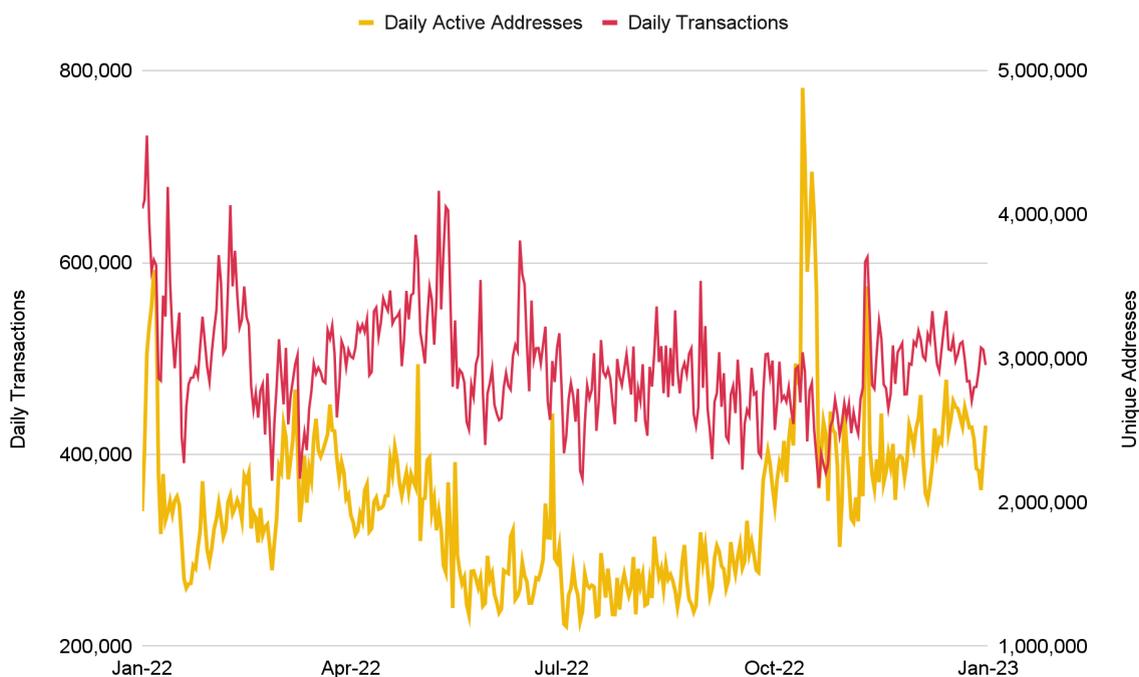
Figure 27: Polygon is working on a wide range of Ethereum scaling solutions



Source: Polygon

- ❖ In 2022, Polygon PoS reached a new milestone in terms of unique addresses (now over 207M), while Daily Active Addresses also hit an all-time high in October at over 780K. Daily Transactions, on the other hand, fell through the year, but still maintain a respectable position at around 2.6M / day.

Figure 28: Polygon PoS daily active addresses rose 26%, while daily transactions fell 27% across 2022



Source: Polygonscan, Binance Research

- ❖ **NFTs were a major growth driver for Polygon through 2022** with numerous high-profile integrations. **Reddit was perhaps the most notable of these so far, with millions of Polygon wallets having been minted to claim the NFTs.** Now, a few months later, we have over 5.7M holders⁽³⁶⁾, including 4.2M single NFT holders (indicative of the widespread holder base). Starbucks announced a major partnership with Polygon to build their new **Starbucks Odyssey NFT-drive loyalty program.** This is expected to roll out in 2023. **Nike** plans to put digital footwear and clothing on Polygon this year. Additionally, Polygon also partnered with **Meta to allow NFT minting, showcasing and selling on Instagram** - this is expected to be further expanded this year.
- ❖ Most recently, we saw the announcement of **notable Solana collection y00ts bridging to Polygon in Q1 2023**⁽³⁷⁾. This suggests that not only is the Polygon team busy on web2 business development, but is also actively involved in pitching existing web3 projects. If their relentless web2 effort is anything to go by, this can be a fruitful avenue and we will closely monitor how Polygon's efforts to tempt away projects from competing chains fares through 2023.
- ❖ As previously mentioned, Polygon's zkEVM effort, Polygon zkEVM, recently launched their second testnet and is expected to go to mainnet later this year. **Polygon Miden and Polygon Zero are also zk-based scaling solutions and are set to debut through this year.** In addition, we expect to hear further announcements with regards to their **modular blockchain development framework, Polygon Edge and the related Polygon Subnets.** A number of partnerships, in addition to the previously mentioned, including Adobe, the NFL, Robinhood, and NuBank, are also expected to see more development through the year.

Stablecoins

Stablecoins have significantly increased in importance over the past couple of years and have become true fundamental parts of the crypto market. At the time of writing, **3 of the top 7 crypto assets by market cap are now stablecoins**, with total stablecoin market cap over US\$135B. While total crypto market capitalization dropped ~65% across 2022 from US\$2.3T to US\$795M, **'The Majors' (i.e. the Holy Trinity of USDT, USDC, BUSD) remained far better insulated, with USDT dropping ~16%, while USDC and BUSD saw 5% and 13% increases, respectively.** Volumes were, as expected, significantly lower across the year, with USDT showing the greatest relative percentage drop.

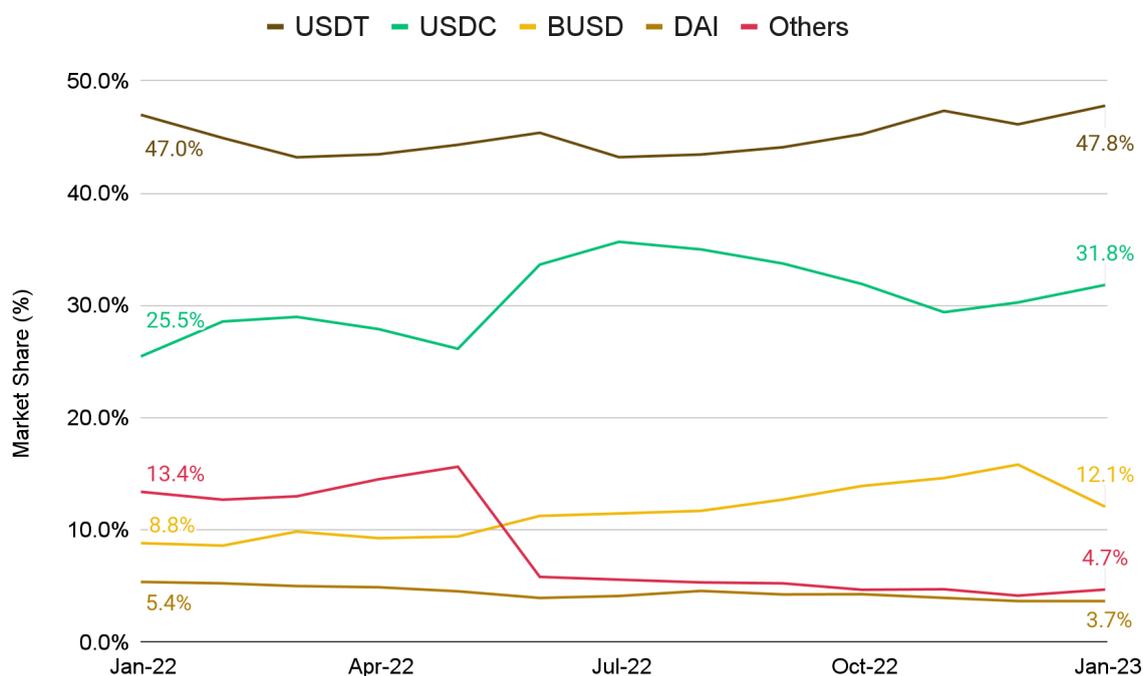
Figure 29: Stablecoin metrics across 2022

		Market Cap (\$B)		TVL Share (%)		Volume (\$B)	
		Jan 1 st	Dec 31 st	Jan 1 st	Dec 31 st	Jan 1 st	Dec 31 st
	USDT	78.4	66.2	47.0	47.8	54.1	13.5
	USDC	42.6	44.6	25.5	31.8	3.0	1.2
	BUSD	14.6	16.6	8.8	12.1	3.6	2.2
	DAI	9.4	5.8	5.1	3.7	0.4	0.1
	FRAX	1.8	1.0	1.1	0.7	0.0	0.0
	USDD	N/A	0.7	N/A	0.5	n/a	0.0

*Source: CoinMarketCap, DeFiLlama, Binance Research
As of 31 Dec 2022*

Overall, 2022 saw a **consolidation of market share among the top stablecoins** as USDT, USDC, and BUSD gained TVL share over the year. **Combined market share of The Majors increased from 81.3% at the end of 2021 to 91.7% at the end of 2022.** In this section, we look at some key themes from 2022, take a dive into The Majors and The Others of the stablecoin universe, and touch on some themes to keep an eye on through this year.

Figure 30: Market share of stablecoins based on TVL across 2022



Source: DeFiLlama, Binance Research
As of 31 Dec 2022

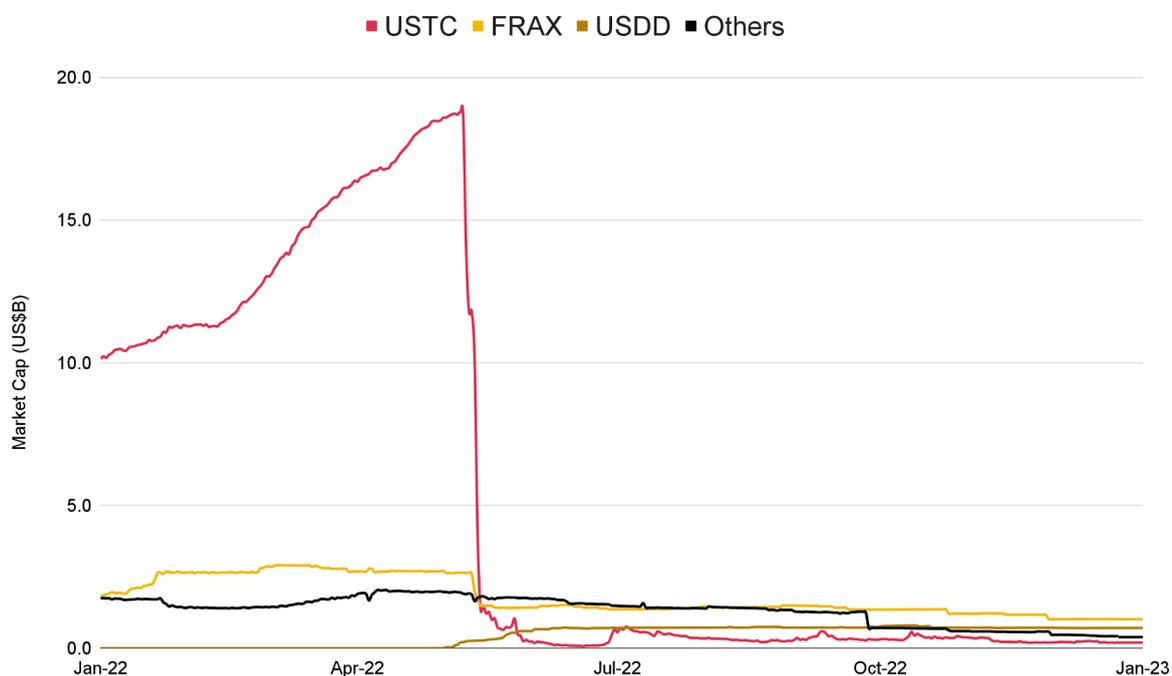
Key Themes in 2022

❖ The Decline of Algorithmic Stablecoins

The fall of TerraUSD (UST) in May wiped out nearly US\$40B in market cap across UST and LUNA. Entities with exposure to UST suffered huge losses and the subsequent contagion impact was felt by both institutional and retail investors. UST was arguably the most high-profile algorithmic stablecoin and at its peak, was the third largest stablecoin. It is therefore unsurprising that confidence in algorithmic stablecoins and their ability to maintain their pegs has taken a toll post UST's implosion.

Today, a handful of algorithmic stablecoins remain but none is anywhere close to the levels of adoption and market share that UST (now USTC) witnessed during its heyday. **The two remaining stablecoins which we cover below, FRAX and USDD, are now responsible for roughly 75% of total algorithmic stablecoin market capitalization, which is down ~90% from its May-22 peak of nearly US\$24B.**

Figure 31: Algorithmic stablecoins' market capitalization is a fraction of early 2022



Source: DeFiLlama, Binance Research
As of 31 Dec 2022

❖ Stablecoins x Real World Integration

Bridging the gap between crypto and the real world is undoubtedly one of the key ways to drive crypto adoption. In this aspect, we have seen stablecoin issuers take significant steps forward in 2022 by partnering with web2 companies, increasing use cases, and reducing friction of on- and off-ramps.

Notably, **MakerDAO penetrated the traditional finance market, and worked with financial institutions such as Société Générale and Huntington Valley Bank** to provide DAI-denominated loans in return for real world asset collateral (more below). Separately, **Circle announced the integration with Apple Pay**, increasing real world use cases of USDC and allowing traditional businesses to experience the benefits of USDC settlement. **Ecosystem support for stablecoins on- and off-ramps have also continued to expand with payment infrastructure providers (e.g. MoonPay, Ramp, etc.) reducing the friction of moving between fiat and digital assets**, and contributing to the adoption of stablecoins (e.g. BUSD, USDT, USDC, etc.).

Given muted crypto activity, looking outside of the crypto ecosystem to the real world has allowed stablecoin issuers to explore new growth opportunities. Concurrently, increased integrations between crypto and the real world expand the number of use cases for stablecoins and bridges the gap between both worlds to drive higher adoption.

❖ **Transparency of Stablecoin Reserves**

Following adverse market events related to various centralized entities (including many CeFi lenders), there have been broad-based requests for more transparency in the industry. **Currently, Paxos and Circle publish monthly attestations of BUSD and USDC stablecoin reserves respectively. Both are backed by reserves in either fiat cash or U.S. Treasuries.**

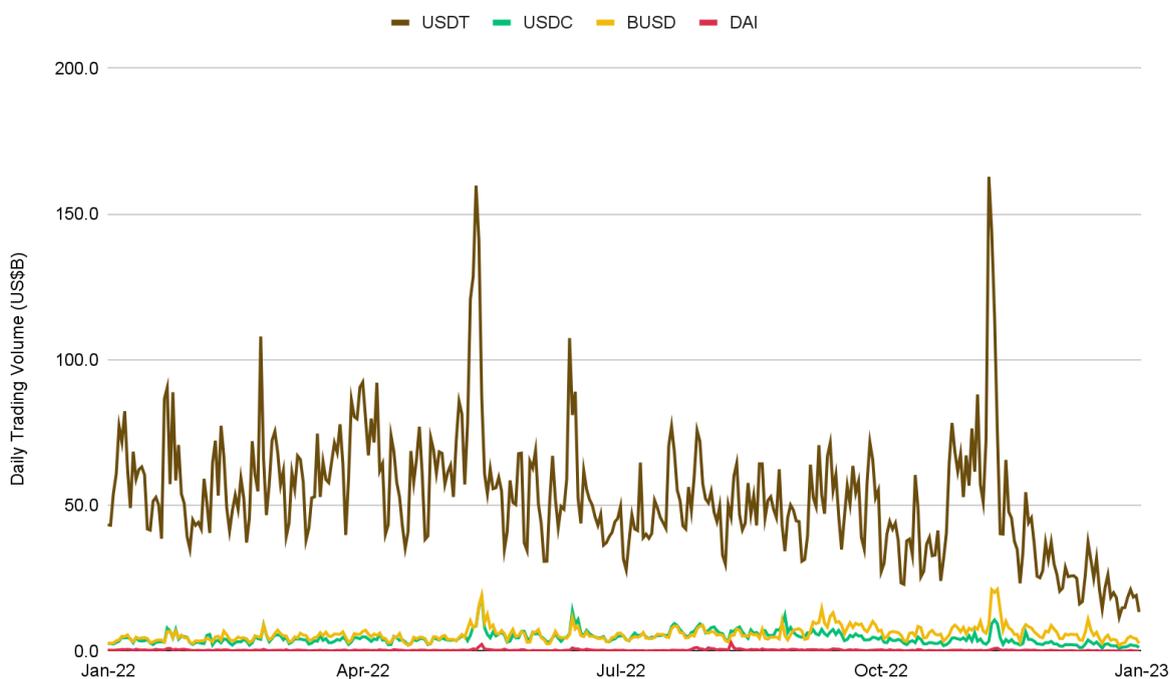
In response to long-term critics of USDT of Tether's commercial paper holdings, **Tether announced the elimination of commercial paper from its reserves to back its tokens** "with the most secure reserves in the market" as part of its "ongoing efforts to increase transparency". While Tether provides quarterly attestations and announced it will move to monthly attestations this year, a reliable third-party audit is likely key in alleviating concerns over stablecoin reserves.

The Majors

❖ **USDT**

- USDT has **maintained its leadership position as the largest and most liquid stablecoin**. Current market dominance sits at ~47-48%, with a US\$66B market capitalization, making USDT the third largest asset in crypto space. **Average December volumes were ~\$US22B per day, compared to ~US\$5B for BUSD, ~US\$2B for USDC, and ~US\$162M for DAI.** Nonetheless, market capitalization is down from a peak of US\$83B in May, while daily trading volumes have trended down from the >US\$50B average from just a few months ago. While some of this slowdown is undoubtedly the effect of a broader market slowdown, USDT has been the subject of scrutiny over the composition of its reserves in the last couple years, and competitors are slowly chipping away at its dominance.

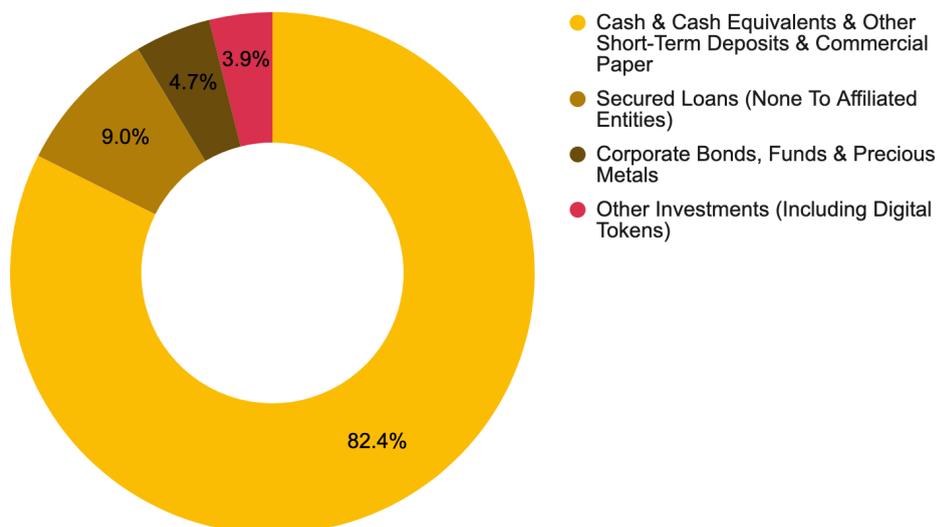
Figure 32: While USDT has dominated stablecoin trading volume for years, this is slowly trending downwards



Source: CoinMarketCap, Binance Research
As of 31 Dec 2022

- Following the crash of TerraUSD (UST) in May, there were widespread concerns of contagion risks and USDT experienced a temporary minor depegging⁽³⁸⁾. **As increased focus was placed on the ability of stablecoin issuer's to honor redemptions, the composition of Tether's reserves came into the spotlight.** This had been a topic of discussion for Tether for quite some time, but the unstable market brought upon a new level of scrutiny.
- To Tether's credit, they took tangible steps to calm such concerns and **announced that they had eliminated all commercial paper in October.** They have also been extremely active in addressing false rumors and providing increased transparency, including independent assurance reports from leading auditing firm, BDO.

Figure 33: The current composition of USDTs reserves



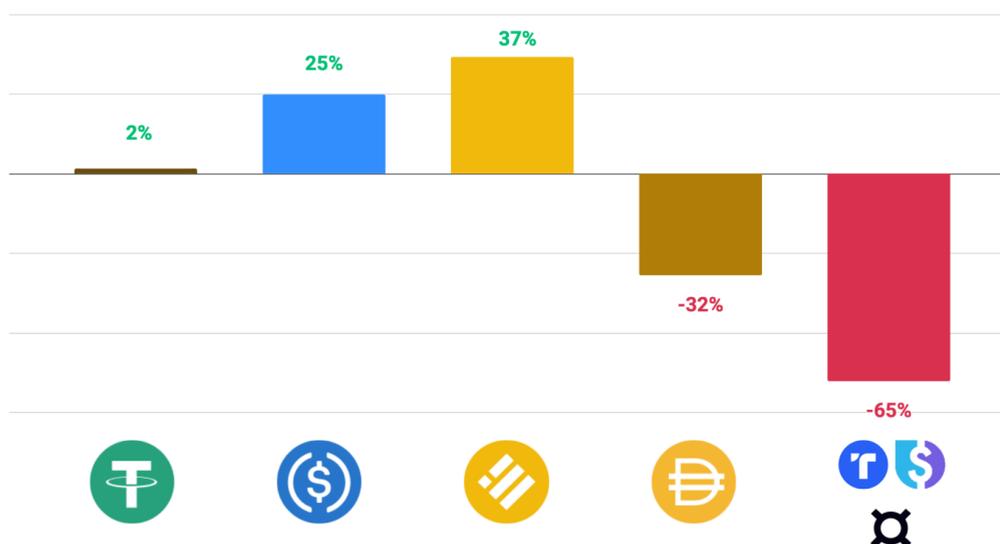
Source: Tether.to, Binance Research
As of 31 Dec 2022

- Through this year, we should also **expect to see Tether reduce the secured loans in its reserves to zero⁽³⁹⁾**.

❖ **USDC**

- USDC held its position as the **second largest stablecoin by market capitalization across 2022**. In terms of market share gain, USDC saw a 25% rise across the year, second only to BUSD (+37%) and higher than USDT (+2%).

Figure 34: Stablecoin market share gains across 2022



Source: DeFiLlama, Binance Research
As of 31 Dec 2022

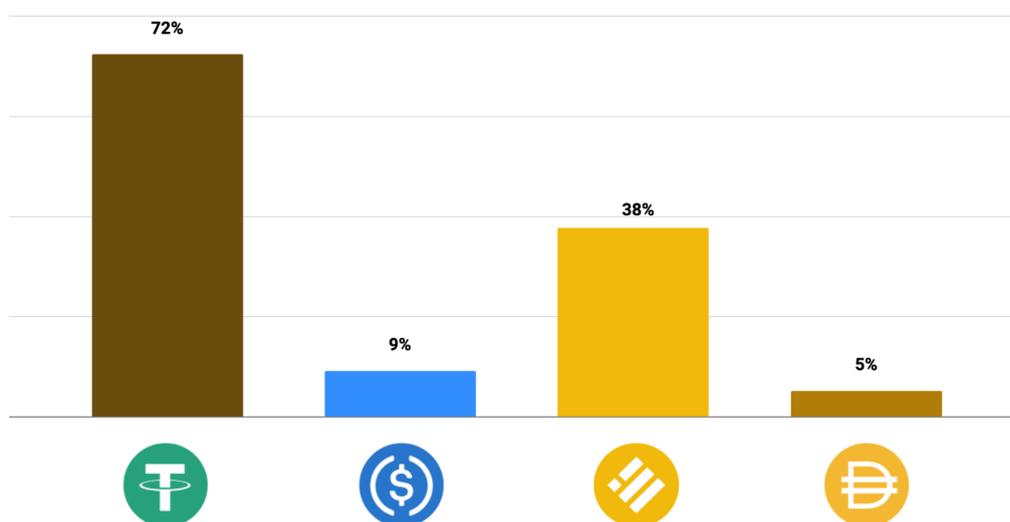
- After market capitalization peaked around US\$56B following the Terra collapse, it has slowly been heading downwards to its current US\$44B market. USDCs market cap dominance followed a similar trend. One key reason for this was the **copyright concerns** that cropped up in the aftermath of the Tornado Cash situation. As a reminder, earlier in 2022, the U.S. Office of Foreign Assets Control (“OFAC”) officially sanctioned Tornado Cash, the mixer/privacy service. Circle reacted to the sanctions by freezing addresses and USDC assets linked to Tornado Cash usage, a key issue that became a concern for many across the crypto space. Interestingly, Tornado Cash very much still operates, despite still being under OFAC sanctions.
- On the development front, **USDC continues to expand multi-chain and is currently live on eight blockchains**. In November, Circle announced an integration with Apple Pay⁽⁴⁰⁾, helping shift more retail payments to digital currency and allow crypto-native businesses a way to connect with customers who want to pay using more traditional methods. **Circle also disclosed a partnership with BlackRock to manage a portion of USDC reserves as part of the Circle Reserve Fund**. Recent data showed that this amounted to BlackRock essentially managing ~65% of USDC reserves. It will be interesting to see how this continues and whether this opens up more scope for crypto x TradFi partnerships in 2023.

- In terms of 2023, further multi-chain expansion is expected, with **Circle having announced plans to launch on five additional chains by the end of Q1**. Circle is also working on additional wallet integrations and gasless merchant transactions using USDC, among other things. They also announced a **Euro stablecoin, Euro Coin**, in 2022, and while it has seen limited usage so far, we expect further developments this coming year (i.e. a Solana launch is expected soon).

❖ BUSD

- 2022 was a year of momentum for BUSD, where it saw a 37% increase in market share (see Figure 34) and ended the year as the third largest stablecoin in terms of both market capitalization and share. While volumes were down across the board, we note that, **excluding USDT, BUSD saw the highest average of volume / market capitalization across 2022**. Given this is a **measure of active usage**, this is a positive indicator for BUSD and indicative of the increasing use-cases available for the stablecoin.

Figure 35: Major stablecoins' volumes as a % of their market capitalization (a measure of active usage)



Source: CoinMarketCap, Binance Research
Using average volume / market cap across 2022 for each stablecoin

- There have understandably been concerns around the reserves of stablecoins and demands for transparency given recent market events. In this regard, **monthly attestation & monthly holding reports are published**

by **Paxos (issuer of BUSD)**, allowing anyone to verify that **BUSD is 100% backed by cash or cash equivalents**. Additionally, Paxos' BUSD reserves are only held in FDIC-insured, bankruptcy-remote bank accounts or US Treasury instruments. Customer assets are thus protected from bankruptcy and kept separate from corporate funds.

- To drive further adoption, BUSD and **Binance-peg BUSD** also expanded beyond Ethereum and BNB Chain to several new chains in 2022, such as Avalanche, Polygon, and Tron. We expect further expansion through this year.

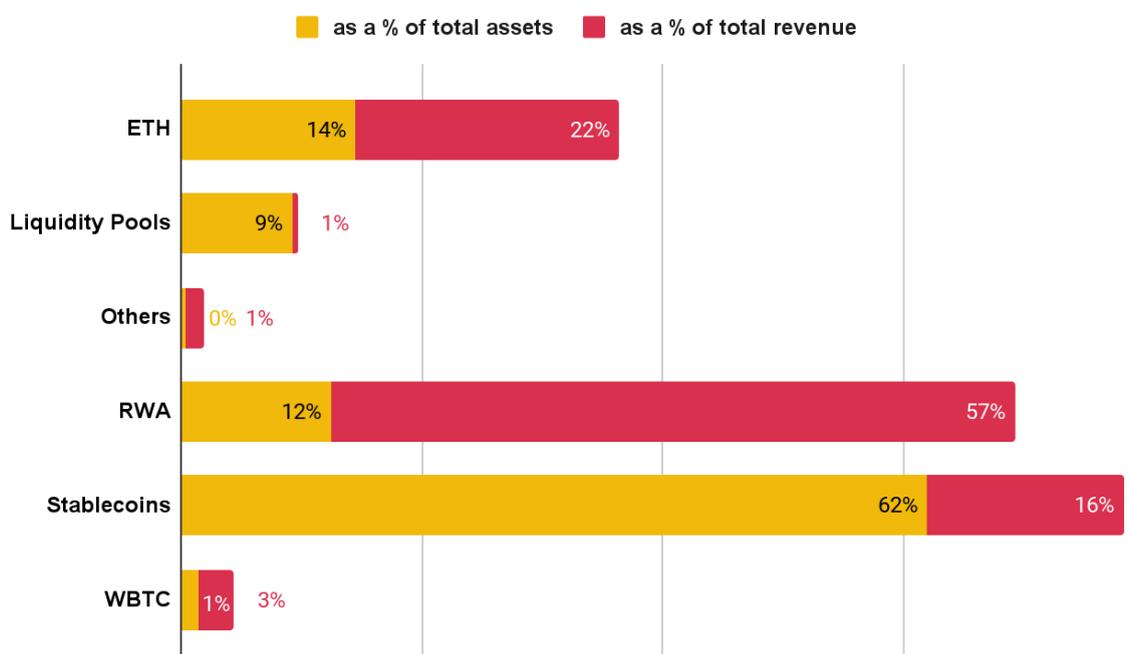
The Others

With the trio of fiat-backed stablecoins looked at, we can have a closer look at Dai (collateralized debt position) and Frax and USDD (two of very few remaining algorithmic stablecoins).

❖ Dai

- Market capitalization, market share and volumes were all lower for Dai across 2022, definitely at least partially impacted by the lack of confidence in non-fiat stablecoins following the Terra collapse in May. Nonetheless, both Dai and the protocol behind it, MakerDAO, persist and remain resilient through another market cycle. Positively, Dai has remained largely unaffected and has not seen any peg destabilization so far.
- A key focus for MakerDAO across 2022 was increasing its **real-world asset ("RWA")** business. The first notable development came in August, where MakerDAO **announced** a partnership with **Huntingdon Valley Bank ("HVB") for a US\$100M Dai loan**, collateralized by HVB's commercial real estate and business loans. Another notable highlight was a similar partnership⁽⁴¹⁾ with **SG Forge** (Société Générale's digital asset subsidiary) to borrow up to **US\$30M Dai**. Most recently, MakerDAO **announced** a partnership with institutional credit fund, **BlockTower**, where they will help **fund RWAs by providing up to US\$150M in Dai**.

Figure 36: RWAs represent only 12% of MakerDAO’s assets, but are now responsible for 57% of total revenue



*Dune Analytics (@SebVentures), Binance Research
As of 31 Dec 2022*

- One theme that MakerDAO has been exploring recently is the **diversification of Dai’s reserves / PSM** in order to generate some level of yield. Through 2022, MakerDAO approved a Coinbase proposal to **earn 1.5% on up to US\$1.6B of their USDC⁽⁴²⁾ reserves**, and also announced a [partnership](#) with Gemini in which the exchange **pays MakerDAO 1.25% on their GUSD balance**, as long as certain conditions are met. Additionally, MIP65 deployed **500M USDC from the PSM into short-term US Treasury bonds**. The decision has been particularly lucrative for the protocol in the current rising rate environment, and as of early January, the **portfolio has generated over US\$2M in profit**.
- **Endgame**: Structurally, 2022 also marked a momentous year for MakerDAO in terms of its long-term strategic plans. MakerDAO is a step closer to co-founder Rune Christensen’s “Endgame” plan to **break up the entity into smaller units termed MetaDAOs** after a proposal was successfully passed⁽⁴³⁾, notwithstanding controversy⁽⁴⁴⁾ around vote participation. Additionally, this may mark a reversal of MakerDAO’s strategy to integrate RWAs, given Christensen has [called](#) for the reduction of such exposure and

to free float the value of DAI, thereby, “limiting the degree to which regulatory crackdowns can damage the protocol”.

❖ **FRAX**

- **Following the collapse of Terra’s UST, FRAX remains the biggest algorithmic stablecoin with a market capitalization around US\$1B** (as at the time of writing). FRAX (as the name suggests) uses a fractional-algorithmic model.
- Through 2022, Frax expanded into various DeFi verticals, including lending (Fraxlend), liquidity (Fraxswap), liquid staking (frxETH) and bridges (Fraxferry). In a recent [interview](#), founder, Sam Kazemian, further discussed FRAX’s endgame. Sam talks about a number of different ideas, including his view that the only RWA that FRAX should be pursuing is dollar deposits at the Federal Reserve, rather than taking on private sector loans.

❖ **USDD**

- A new entrant to the field, **USDD was launched in May 2022 on the Tron network**. It is an algorithmic stablecoin pegged to the U.S. dollar and is marketed as an over-collateralized stablecoin, backed by assets such as TRX, BTC, USDT, and USDC. At the time of writing, USDD has a collateralization ratio of 201.1%⁽⁴⁵⁾ based on data from its website.
- As mentioned in the [Tron](#) section, it has been a difficult couple of months for USDD which continues to trade below-peg at the time of writing. In the coming year, with Tron being announced as the official protocol for the national blockchain infrastructure of the Commonwealth of Dominica, we might see some real-world integration with the USDD stablecoin. In fact, official documents show that **USDD is now an authorized digital currency and medium of exchange in Dominica**⁽⁴⁶⁾.
- As of early January, **USDD and FRAX account for nearly 75% of the algorithmic stablecoin market**. It will be interesting to follow if this sub-sector can stage a comeback in the coming years or whether the collapse of Terra and UST truly marked the end of mainstream algorithmic stablecoins.

Developments to watch in 2023

❖ Differentiated use cases

- An interesting comparison we can make is between the top pairs for each stablecoin. Below we classify, with **green** signifying a **crypto-stable** pair, **yellow** signifying a **stable-stable** pair and **orange** signifying a **fiat-stable** pair.
- Our analysis below illustrates how both **USDT** and **BUSD** see the majority of their volume coming from crypto-pairs, whereas **USDC** sees four out of its five most liquid markets being fiat-pairs or stable-pairs. This would indicate that one of the most popular use-cases for USDC is to convert from crypto into the fiat banking system, whereas BUSD and USDT are evidently utilized for more crypto-native use cases.
- Another interesting data point we can look at is Dai’s biggest sources of volume. **Dai, a decentralized crypto-backed stablecoin, sees all five of its most active markets being either fiat-pairs or stable-pairs.** Dai’s most popular trading pairs (as at the time of writing) are actually Dai / EUR and Dai / USD, suggesting a major use-case for the coin is to on/off-ramp between fiat and crypto.

Figure 37: Major stablecoins’ top 5 trading pairs

		Most Active Trading Pairs				
	USDT	BTC/USDT	BUSD/USDT	ETH/USDT	USDT/USD	XRP/USDT
	USDC	USDC/USD	USDC/EUR	USDC/USDT	USDC/USDT	USDC/WETH
	BUSD	BTC/BUSD	BUSD/USDT	ETH/BUSD	BNB/BUSD	SOL/BUSD
	DAI	DAI/EUR	DAI/USD	USDT/DAI	BUSD/DAI	DAI/USDT

Source: CoinMarketCap, Binance Research
Using top 5 trading pairs (last 24h) as of 31 Dec 2022

❖ Consolidation of liquidity

Through 2022, The Majors made active movements towards liquidity consolidation. This includes **Binance's BUSD auto-conversion** feature, **Coinbase offering zero-fee USDT to USDC conversion**, as well as **Bitfinex helping streamline access to Tether tokens**. From an operational perspective, this improvement in stablecoin liquidity has helped to consolidate trading volumes and will continue to help exchange trading be faster, better priced and involve lower slippage - all beneficial moves for the user.

This should be an interesting story to follow and we could expect to see further moves to help consolidate liquidity in the stablecoin market.

❖ **The launch of new stablecoins**

Given the importance of stablecoins in its role in the DeFi ecosystem, it is unsurprising that everyone wants a piece of the pie. Notably, **prominent DeFi protocols Aave and Curve have announced their intention to launch their own stablecoins called GHO⁽⁴⁷⁾ and crvUSD⁽⁴⁸⁾**, respectively. **Cardano's Djed stablecoin is also expected to launch in the next few months**. Considering the dominance of the top stablecoins in the market today, it will be interesting to monitor if any of the newly launched stablecoins will be able to challenge the status quo successfully.

❖ **Demand for decentralized stablecoins**

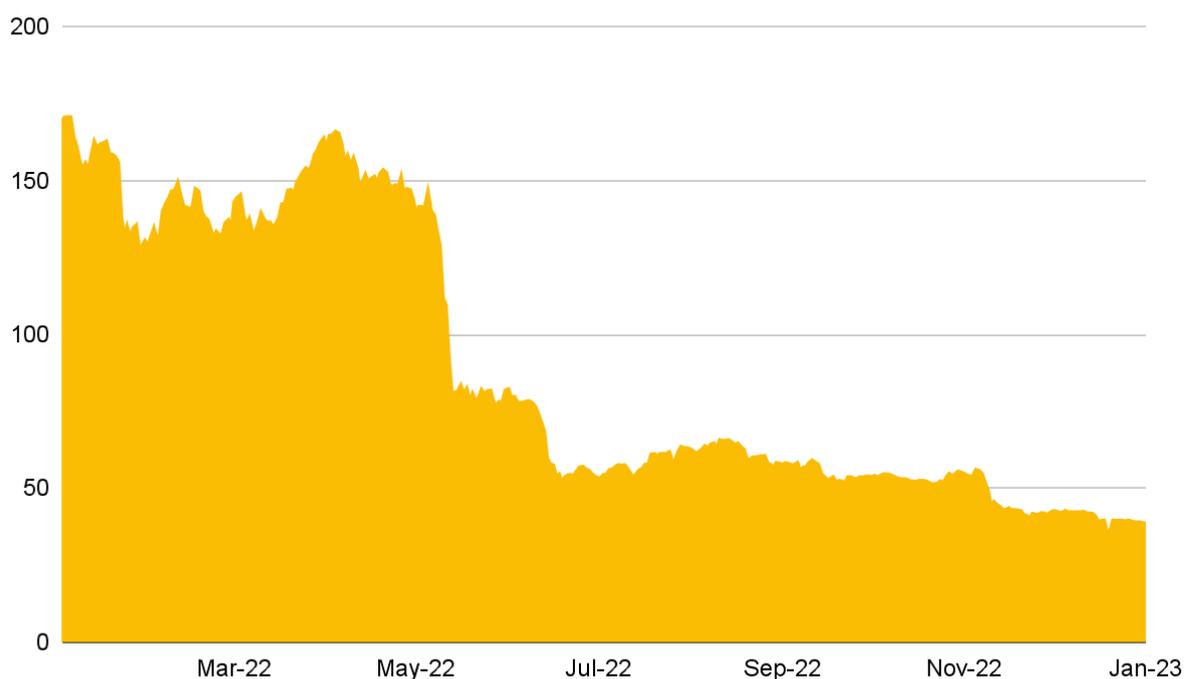
Following the sanction of Tornado Cash, Circle, the issuer of USDC, froze funds linked to several Tornado Cash addresses. This resulted in backlash from many in the crypto community and cast a spotlight on the ability of centralized stablecoin issuers to freeze assets and blacklist addresses. Correspondingly, USDC suffered a decline in market share in the following months, falling by ~13% in market share between August and November. Nonetheless, it seems that market share of centralized stablecoins as a whole has not been affected by this event. With the upcoming launches of new decentralized stablecoins, as well as MakerDAO's recent vote to move forward with its Endgame plan to make the protocol more decentralized, we are keen to see if decentralized stablecoins gain more attention in 2023.

Decentralized Finance

Decentralized Finance (“DeFi”) is a key building block of the crypto landscape. It allows you to earn interest, borrow assets, access a lending market, trade derivatives and other assets, and buy insurance. DeFi solutions are oftentimes faster than traditional banks as they cut out the third party. Financial innovation may often lead to benefits for investors and others, but it may also present risks, such as hacks and exploits.

Reviewing key developments throughout the year, **it is important to note that DeFi entered 2022 already in a bear market.** Exogenous events such as the collapse of the UST stablecoin left their mark on the sector, and paired with rising interest rates, we have seen a sharp drop in TVL in the May and June particularly. The **total value locked (“TVL”) within DeFi stands at around US\$40B, or close to 25% of what it used to be at the beginning of 2022.**

Figure 38: DeFi TVL decreased throughout 2022 (US\$B)



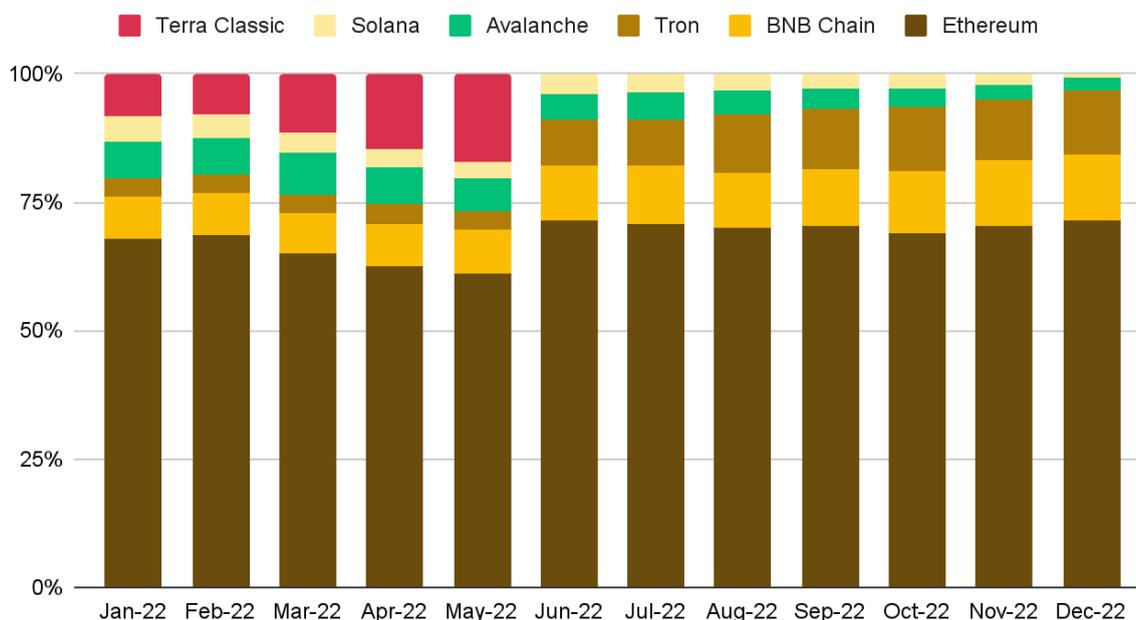
*Source: Binance Research, DeFiLlama
As of 31 Dec 2022*

Considering that the traditional finance sector is a multi-trillion dollar industry, we have seen that the **BUIDL mentality remained within the DeFi sector** despite the recent market events. One trend we observed over the last few months was **the emergence of “Real Yield”**, which stands in contrast to the high APYs that projects like Anchor Protocol or

Olympus DAO have offered. Real yield refers to yields that are generated from tangible sources of revenue and those that are not solely reliant on inflationary token emissions to provide returns to token holders.

Looking closer at the DeFi space from a top-down perspective, it is noteworthy that Ethereum is still the dominant player in the room. While not anywhere close to the initial 97% market share that Ethereum had at the beginning of 2021, **Ethereum still accounts for over 60% of DeFi TVL. BNB Chain is in second place, closely followed by Tron.** For Tron, a chain that has largely been absent from top TVL rankings for a long time, the increase in TVL has largely been driven by their USDD algorithmic stablecoin, offering lucrative yields to attract users.

Figure 39: DeFi TVL % across leading L1s

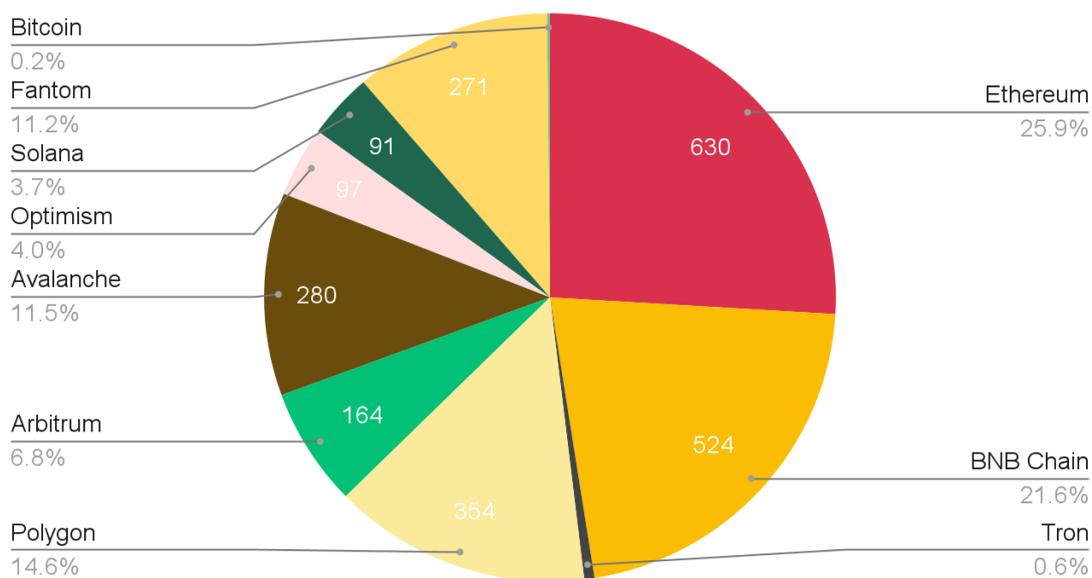


Source: Binance Research, DeFiLlama
As of 31 Dec 2022

The early 2022-rise in TVL in the Terra blockchain was short-lived. Instead, most of its TVL found itself captured by existing chains such as Ethereum and BNB Chain. While Avalanche and Solana have been prominent competitors in terms of DeFi, we have seen that recent events (mentioned in the [L1 section](#) above) have led to consistent outflows also in the second half of the year. BNB Chain has been one of the major ecosystems to have offered incentives to Terra developers to migrate over and bring their talent to work on its projects.

Looking at each chain in more detail, some interesting observations come to light. **Of the ~2,400 major DeFi applications, ~630 of them call Ethereum their home. Another ~524 call BNB Chain their home. However, only 14 are building on Tron.**

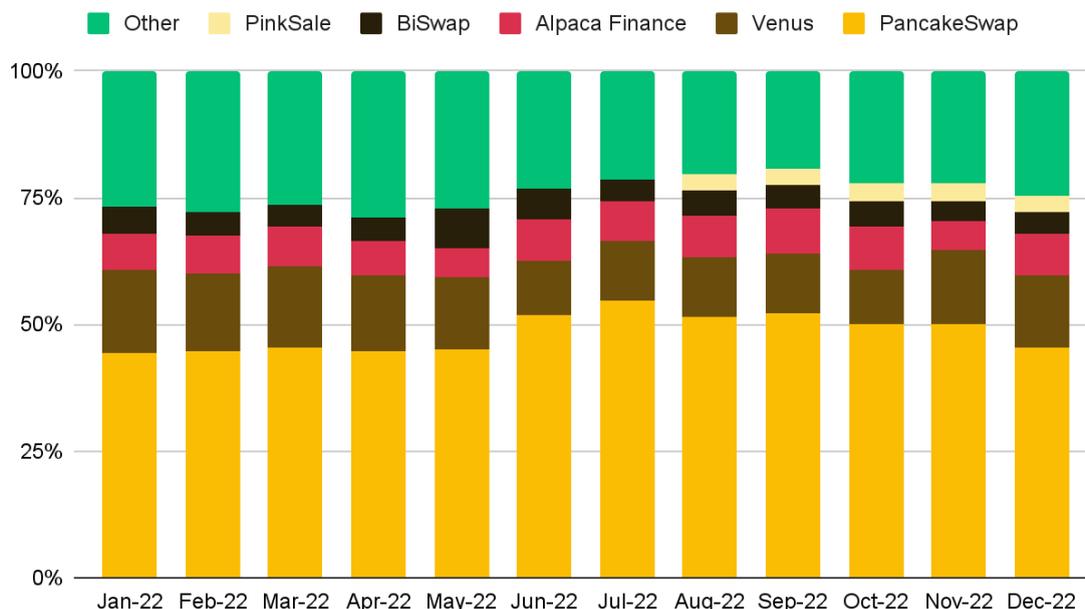
Figure 40: DeFi applications per Chain



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

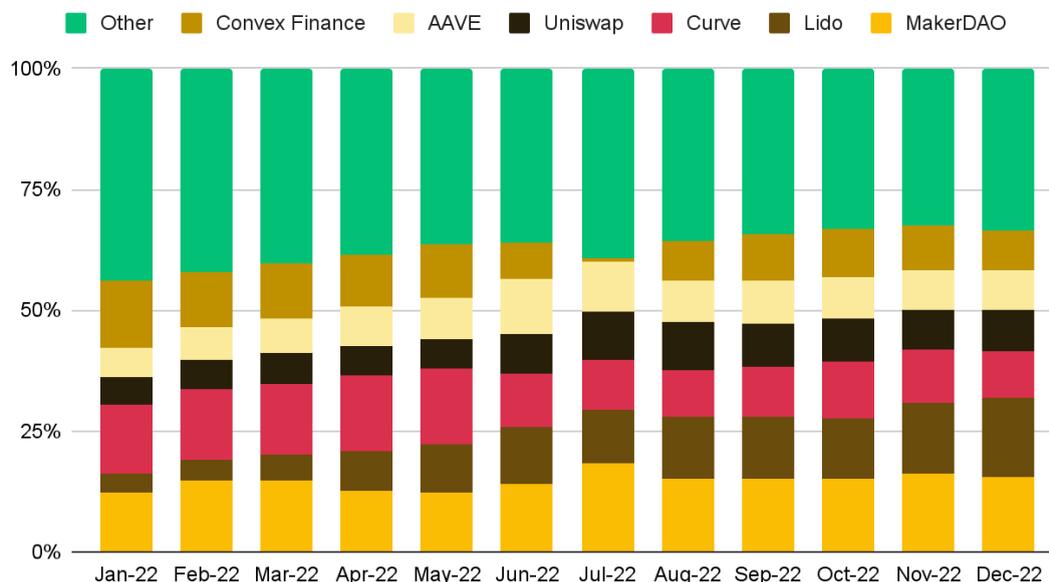
As such, Ethereum, BNB Chain, and numerous L2 solutions such as Arbitrum and Polygon seem to have the healthiest DeFi ecosystem in terms of the number of projects. That being said, looking at the project dominance of both, BNB Chain and Ethereum, we can see that in both cases, a handful of projects are accounting for most of the market share.

Figure 41: BNB Chain project dominance



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

Figure 42: Ethereum project dominance

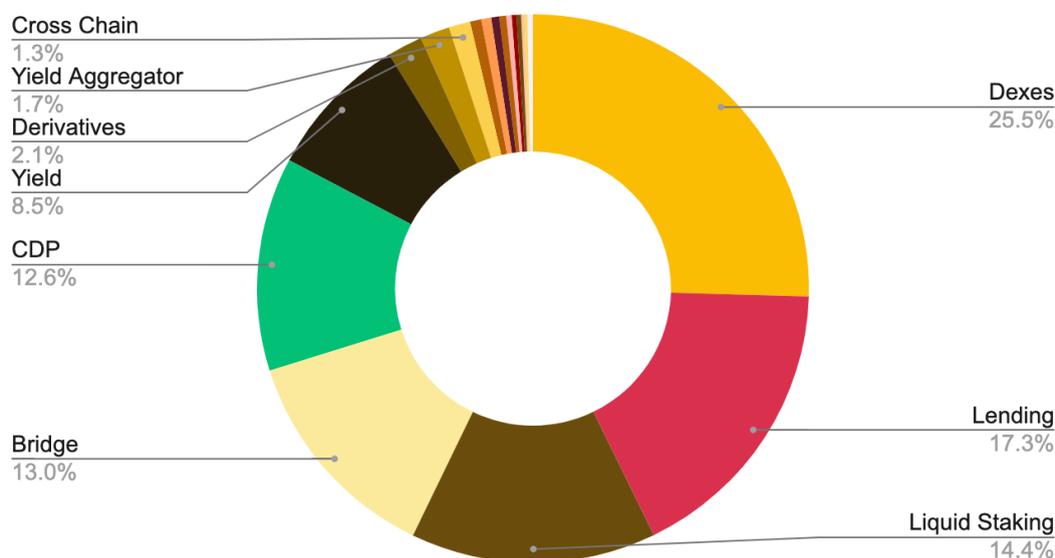


Source: Binance Research, DeFiLlama
As of 31 Dec 2022

In both cases (Ethereum and BNB Chain), we have seen a “flight to quality” throughout 2022. Smaller projects have lost market share (represented here by the “Other” segment). At the same time, the top projects have gained market share. This, while being present in both cases, has been more pronounced for Ethereum.

Having a closer look at the sector performance, it should be noted that **DEXs and Lending markets are still dominating, though Liquid Staking and Bridges are catching up.**

Figure 43: DeFi sector TVL percentages



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

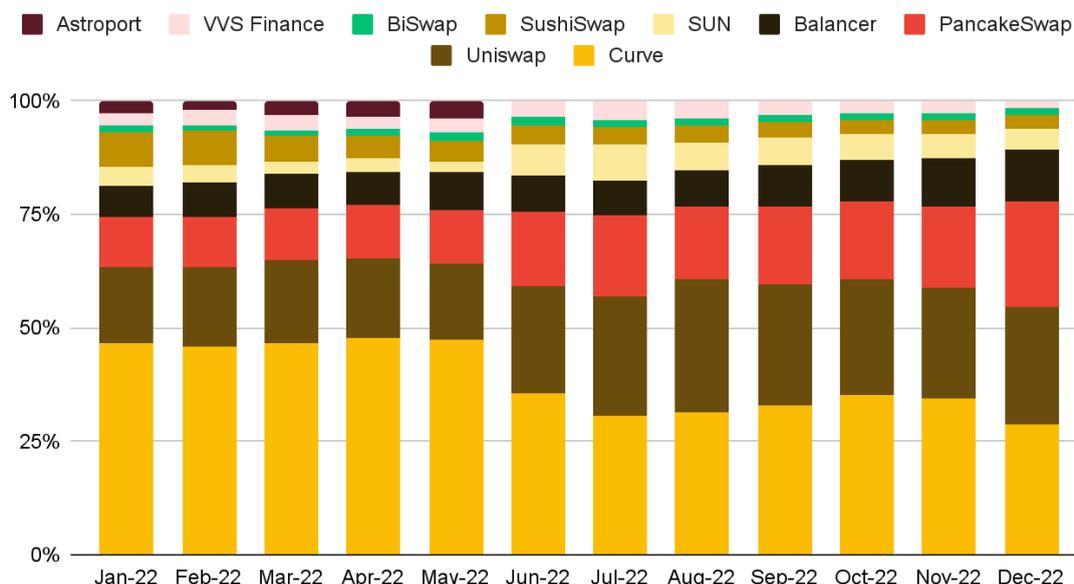
In order to get a better understanding of what has been happening within the DeFi space in 2022, we can look at a few of the major sectors.

Decentralized Exchanges

Decentralized Exchanges (“DEXs”) accounted for the majority of TVL within the DeFi space at the end of 2022 (and continue to do so in early 2023). They represent the backbone of DeFi by employing smart contracts to facilitate the settlement of crypto asset transactions without the need for an intermediary. [DEXes are pivotal in any healthy DeFi ecosystem.](#)

Based on TVL at the end of the year, Curve is still the major decentralized exchange, designed for extremely efficient stablecoin trading. Outside of Curve, Uniswap remains the key DEX for ERC-20 tokens and has gained market share throughout the year. With 2022 being a strong year for BNB Chain, PancakeSwap has gained market share in the overall DEX landscape and within BNB Chain itself. Other competitors outside of Uniswap and PancakeSwap have lost share, further underlining the trend we’ve seen of “flight to quality”.

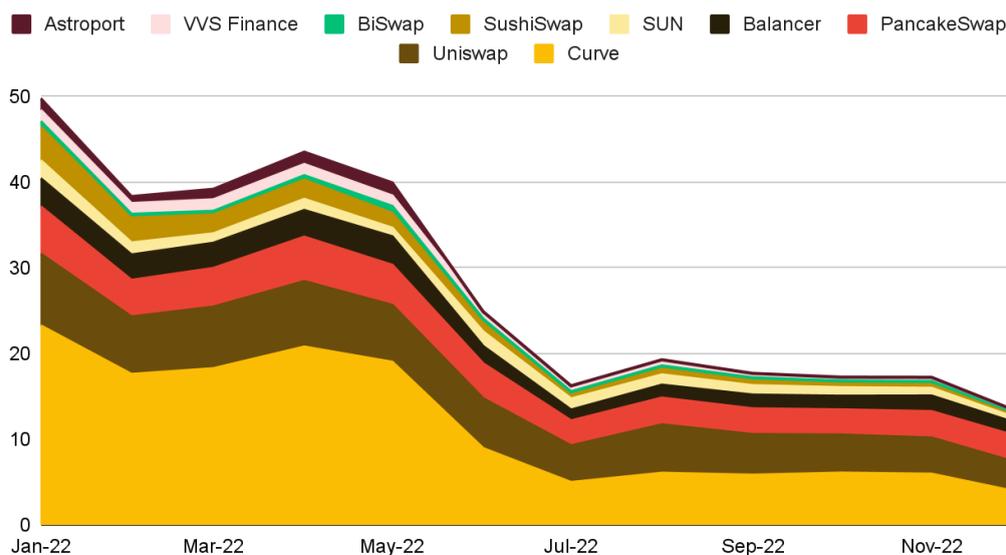
Figure 44: Decentralized exchanges top 10 relative market share by TVL



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

Looking at the absolute value locked in decentralized exchanges, we can observe that despite market share gains of key players, the overall directionality has been the same for most applications.

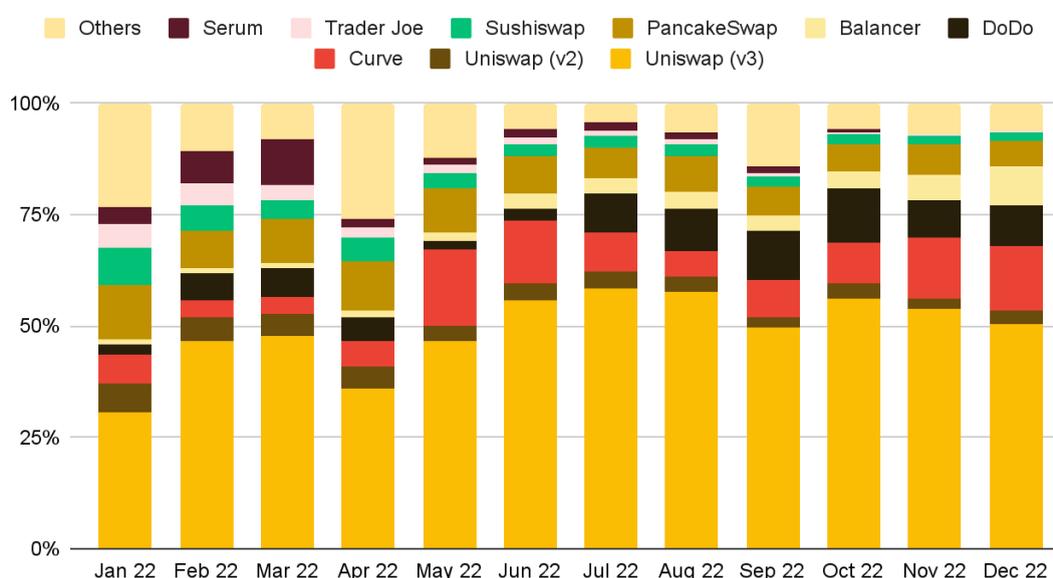
Figure 45: Decentralized exchanges top 10 absolute TVL (US\$B)



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

Based on trading volume at the end of the year, Uniswap and Curve are the leading DEXes. Both DEXes combined facilitated more than half of the total trading volume.

Figure 46: Decentralized exchanges market share by trading volume



Source: Binance Research
As of 31 Dec 2022

Following the downfall of FTX, the tokens of decentralized exchanges have gained some momentum, though the overall TVL within DEXes has stayed stable and continued its overall trend. In one of our recent pieces, we looked at the differences between [centralized and decentralized exchanges](#). While we believe that decentralized exchanges will gain in importance in the coming years, as of now, they're equally impacted by the recent bear market as most digital assets. **Today, while DEXes have their fair share of adoption, CEXes continue to command the lion's share of the total trading volume.**

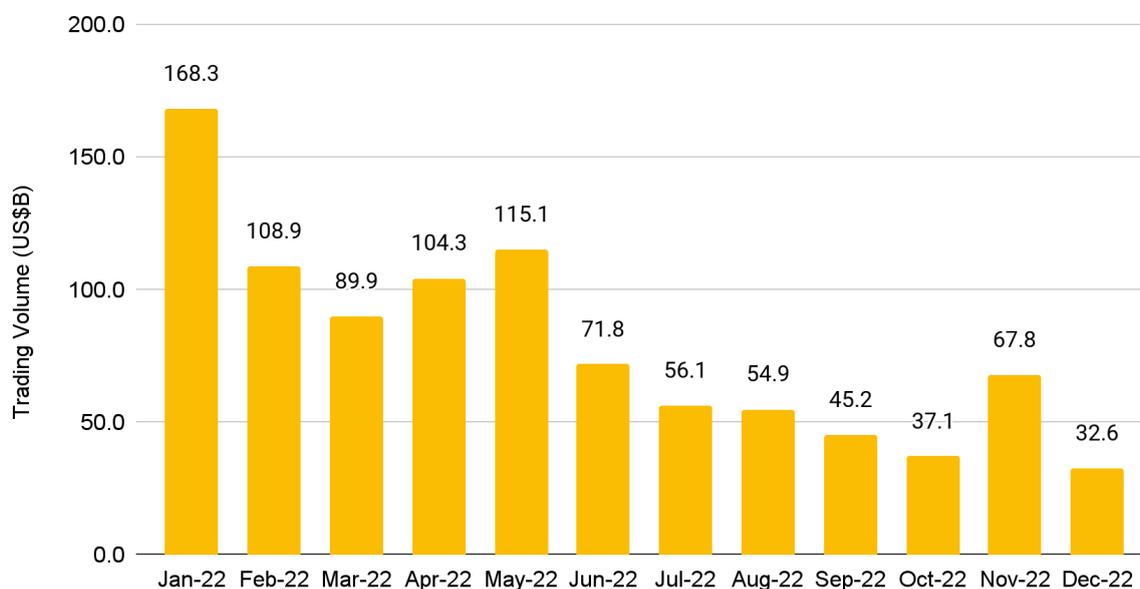
NFTs and ERC-20 tokens have largely existed as two separate ecosystems within crypto. The launch of NFTs on Uniswap in November marks one major milestone for the company to diversify its business by offering more composability between asset classes. Uniswap continues to be the leading DEX in terms of trading volume, and the new services make it well-positioned to maintain its lead. They will also integrate NFTs into developer APIs and widgets and thereby make "Uniswap a comprehensive platform for users and builders in web3" ⁽⁴⁹⁾.

Curve is equally well set for future growth and market share gains with their announcement of a crvUSD stablecoin, which will leverage an overcollateralized design known as "Lending-Liquidating AMM Algorithm" ("LLAMMA"). Curve has been actively deploying across chains and is currently active across both L2 and alt-L1 chains.

PancakeSwap, the third biggest DEX, has used this bear market as an opportunity to continue building. **PancakeSwap announced teaming up with LayerZero Labs (the team behind Stargate) to launch the Aptos-PancakeBridge.** Using an Omnichain Fungible Tokens (“OFT”) standard from LayerZero Labs, the CAKE token has thus gone multi-chain and expanded beyond the universe of BNB Chain and Ethereum. Another key milestone achieved by PancakeSwap is in terms of tokenomics. Over the past few months, **PancakeSwap has introduced several changes to its tokenomics model**, including a cap to the maximum supply of CAKE at 750M tokens. CAKE is currently inflationary, but the end goal is to make CAKE emission-neutral or deflationary. The DEX also improved the utility of its native ‘CAKE’ token by adding additional use cases for locked CAKE in the form of weighted voting, boosted farm yields, and boosted initial farm offerings (“IFO”) allocation.

In line with the decrease in TVL, we have also seen a decline in the overall trading volume of DEXs. While this number was on a steady decline throughout the year, recent events surrounding the collapse of FTX and innovations in both Uniswap and Curve have led to a slight increase in trading volumes toward the end of the year.

Figure 47: DEX trading volume throughout 2022 (US\$B)



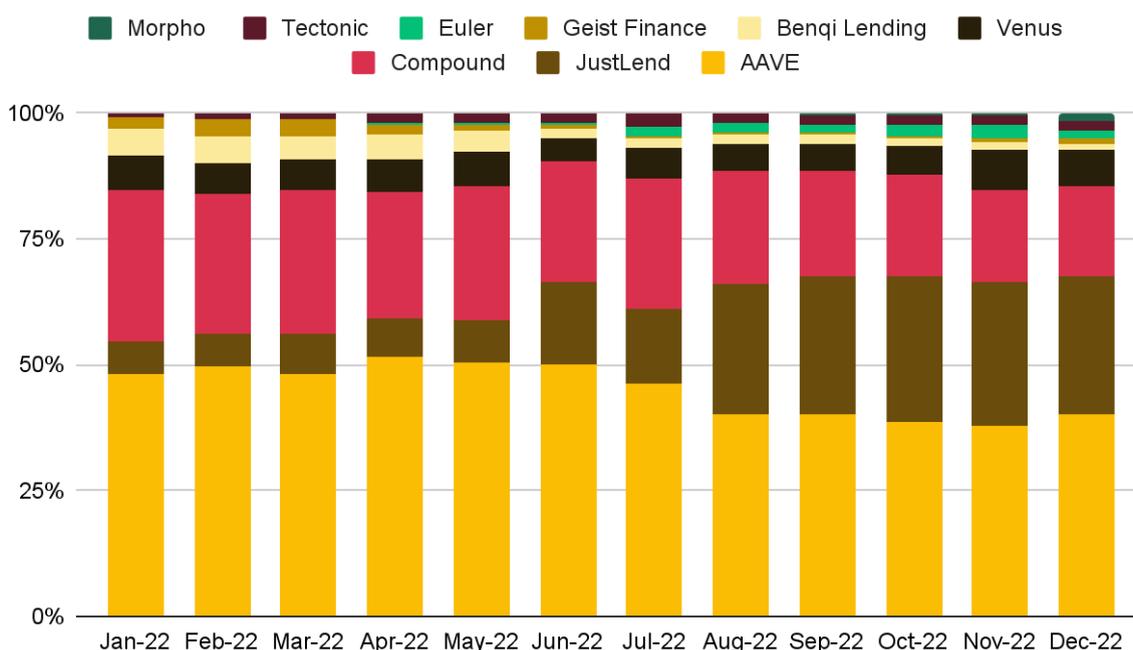
Source: Binance Research
As of 31 Dec 2022

Lending

DeFi lending platforms facilitate crypto loans in a trustless manner without intermediaries. Unlike traditional financial institutions that may have tedious and manual loan approval processes, DeFi lending platforms administer loans following pre-specified rules encoded in smart contracts. Loans are disbursed in a permissionless and almost instantaneous manner, providing benefits to DeFi users in terms of efficiency, accessibility, and transparency.

Coming in second in terms of TVL, lending is another key part of the DeFi ecosystem. Lenders are incentivized to supply assets as loans in return for earning a variable interest rate that typically adjusts based on the utilization of funds on the lending platform.

Looking at pure-play lending protocols, we can see that the market is clearly dominated by **Compound and AAVE on Ethereum, JustLend on Tron, and Venus on BNB Chain.** Ethereum is the clear winner in terms of the chain with the most lending activity. While this list does not include MakerDAO as we categorize it as a Collateralized Debt Position Protocol (“CDP”) protocol, it should still be discussed here. Launched in 2017, MakerDAO was one of the original DeFi protocols and the first Ethereum project to issue loans. At the beginning of 2022, MakerDAO also branched out into the space of real-world assets (“RWAs”) and further expanded this capability throughout the year (See [Dai section](#)). MakerDAO remains one of the top DeFi protocols and while they have seen some competition in recent years, their embrace of Layer 2 solutions in the form of Arbitrum, Optimism, and StarkNet, as well as their foray into the integration of RWAs, means that they are staying updated with the rapidly evolving market while also looking to the future. We will touch on CDPs in a later part of this section.

Figure 48: Lending protocols top 10 TVL

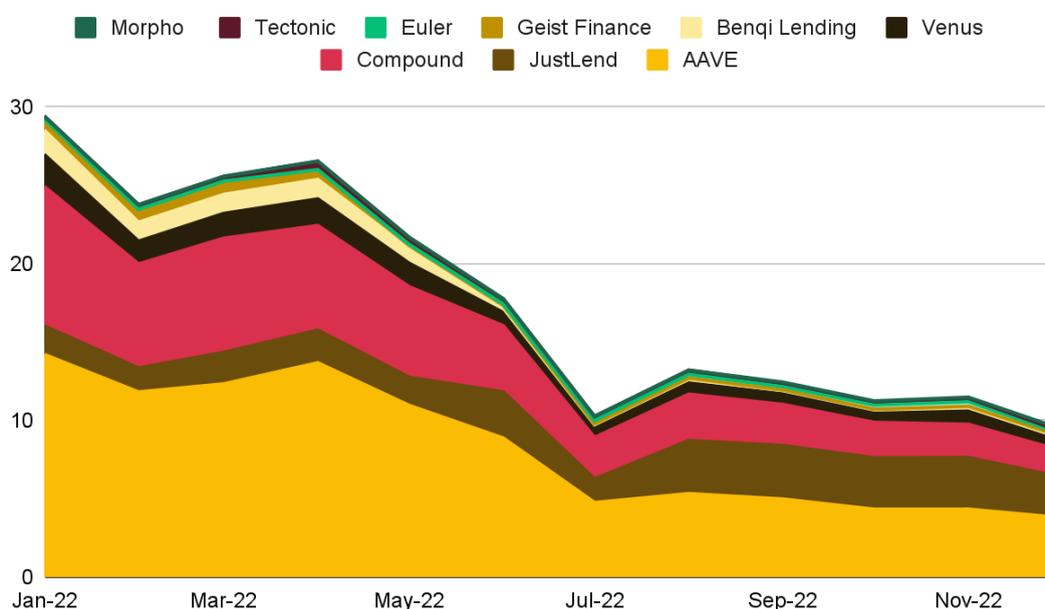
Source: Binance Research, DeFiLlama
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Aave, largely credited with pioneering the usage of flash loans, has consistently led the lending business across the year. However, Aave has faced emerging competition in the lending space. Following the introduction of Tron’s USDD stablecoin, we have witnessed the growth of the Tron ecosystem, including the lending business JustLend and CDP protocol JustStables. **Compound had a more challenging year, moving from second to third place.** Already in our H1 report, we pointed out how metrics for loans and deposits are diminishing, and this trend has continued. Close competition for third place is currently coming from BNB Chain’s Venus protocol.

Throughout the year, most lending protocols focused on innovating and improving their businesses. **Aave, for example, launched its V3**, which included Portals (allowing for cross-chain transactions), a high-efficiency mode for larger borrowers, an isolation mode for new assets, and gas optimization. V3 is deployed on six chains, including Polygon, Avalanche, Fantom, Harmony, Arbitrum, and Optimism. While the majority of assets still sit on [V2](#) (US\$3.5B on V2 vs. US\$460M on V3), we still see V3 as an important milestone for the project. **Aave also recently launched Lens Protocol**, which hopes to pioneer web3 social media and allow users to build their own unique ecosystems. Looking at the space of [Web3 Social](#), we believe that currently, web3 Social cannot directly compete with web2 Social in terms of user experience, and to succeed, it needs to provide unique and innovative utilities.

Looking at the absolute change in TVL, the picture is very similar to that of most DeFi applications, with a clear downtrend throughout the year.

Figure 49: Lending protocols top 10 TVL (US\$B)



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

As mentioned above, **JustLend has shown the most impressive growth this year among the leading lending protocols.** JustLend is a TRON-powered lending and wealth management platform aimed at establishing fund pools whose interest rates are determined by an algorithm based on the supply and demand of TRON. Part of the success comes from the overall growth in Tron's ecosystem. Earlier this year, JustLend announced it had formed a strategic partnership with TRON DAO Reserve. JustLend's additional adoption of USDD as a mining option helped to fuel additional growth.

Venus Protocol as the challenger to JustLend's podium place is currently focused on improving the protocol by incorporating better risk management and increasing robustness. Specifically, Venus is planning to support multiple price feeds and looking at introducing stable-rate borrowings for users.

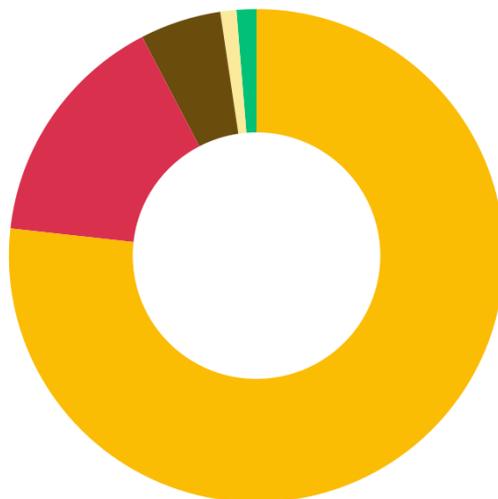
Liquid Staking

In contrast to DEXs and lending protocols, **liquid staking solutions saw an increase in TVL across 2022.** Liquid staking allows users to stake their tokens without having to lock up the assets or maintain staking infrastructure. With the Merge being a key event this year, liquid staking has gained a lot of attention and traction. Lido, the leading liquid staking solution, is

currently also the biggest DeFi protocol in the market, having more than US\$6B in TVL at the time of writing.

Figure 50: Ethereum liquid staking market share distribution (ETH)

● Lido (ETH) ● Coinbase Wrapped Staked ETH ● Rocket Pool ● StakeHound ● StakeWise

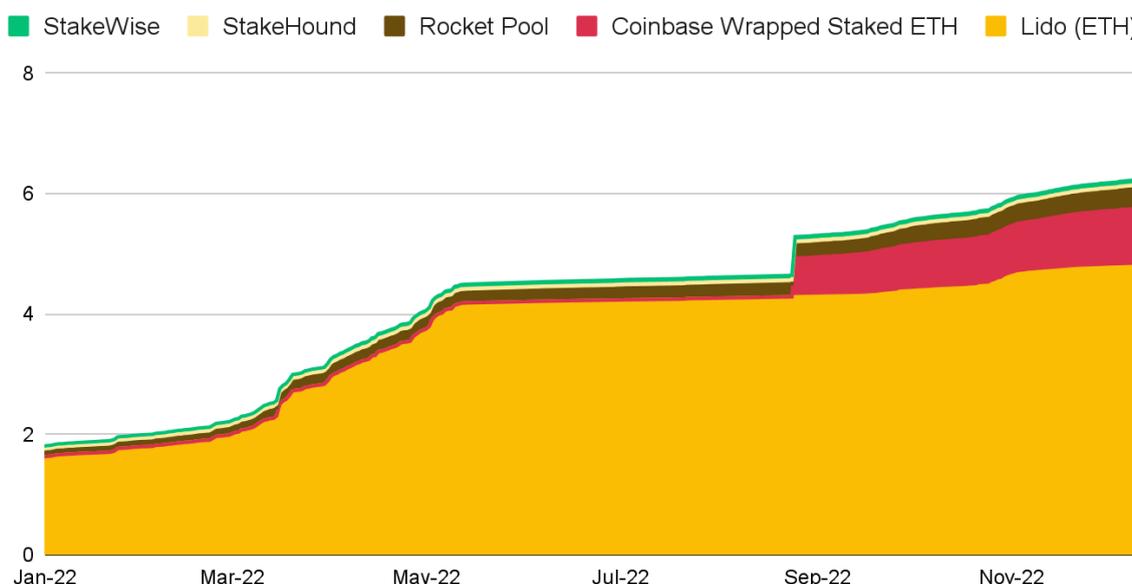


Source: Binance Research, DeFiLlama
As of 31 Dec 2022

The staking service offered by Lido has gained popularity as the first protocol to implement a liquid staking derivative on Ethereum through the minting of the stETH token. Contrary to popular belief, stETH is not meant to be pegged to ETH. Staked ETH issued by Lido is backed 1:1 with ETH, but the exchange rate isn't pegged. It can fluctuate and trade at a premium or a discount as the secondary market forces dictate the price. This doesn't affect the underlying backing of stETH. Lido's first mover advantage to launch a liquid staking product has helped the protocol move ahead with more DeFi integrations for stETH as well as other multichain-staked products for Solana, Polygon, and Polkadot.

In an [article](#) published earlier this year, Danny Ryan, an Ethereum researcher, argued that Lido's dominance of staking has the potential to put the entire blockchain at risk of a centralized attack. This brought a lot of attention to the debate around centralization, leading to Lido providing more transparency on validators who are responsible for the staking. While competitors such as Coinbase and Rocketpool have seen some traction, the trend remained, with Lido still gaining the most ETH staked post-Merge.

Figure 51: Ethereum liquid staking TVL (B, ETH)



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

Liquid Staking, while being core to Ethereum at this point, is also commonly taking place elsewhere. BNB Chain operates on a Proof of Staked Authority (“PoSA”) consensus where users can participate in securing the network by staking their BNB to become validators or by delegating their BNB to a validator. Liquid Staking on BNB Chain has picked up speed since August, with the launch of pSTAKE and Stader, with Ankr, still accounting for the majority share.

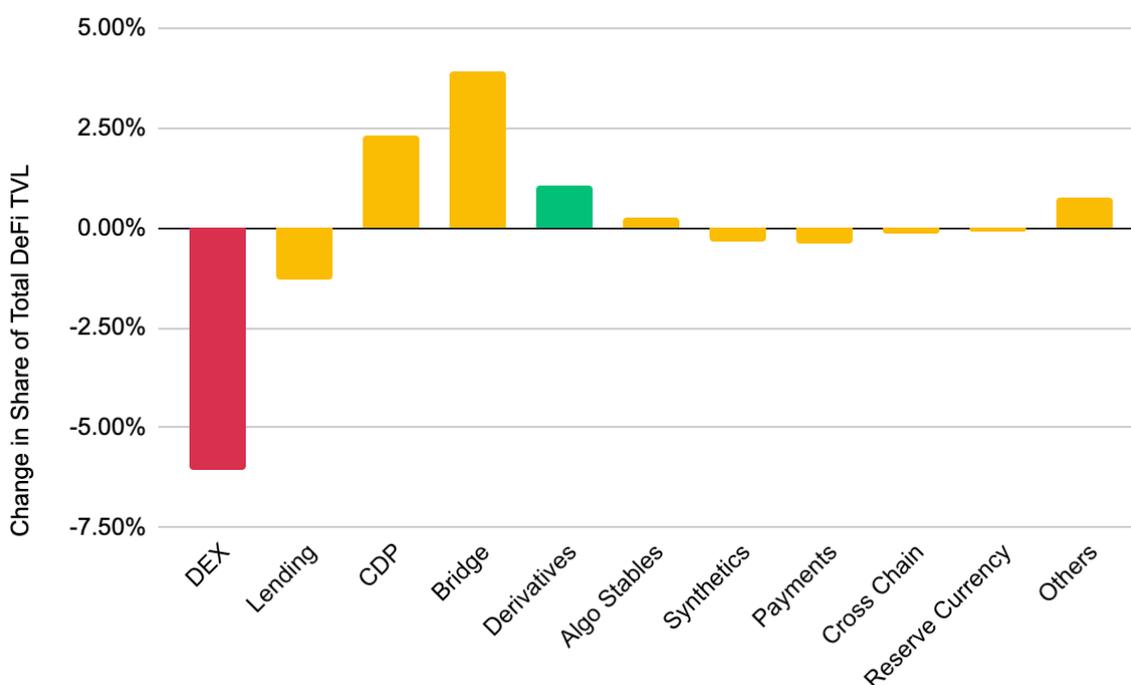
Derivatives

The derivatives space has been impacted by the market downturn as well. Since the start of 2022, the derivatives sector in DeFi has lost US\$1.88b in TVL. That being said, they have weathered the recent FTX collapse with TVL staying in a close range since July. Currently, derivative protocols hold around US\$1B in TVL, compared to US\$16B in DEXs and US\$40B in DeFi as a whole. It should be noted that compared to the more established sectors in DeFi such as lending or DEXs, derivatives are in a more nascent stage of growth. In fact, the key players in the space, the products offered, and the overall market share seem to be changing constantly.

At the start of 2022, derivatives made up only 1.65% of the TVL across DeFi. However, by the end of 2022, derivatives grew to make up 2.70% of the TVL across DeFi. Interestingly, **while derivative markets’ share of TVL in DeFi grew, spot markets share of TVL fell.**

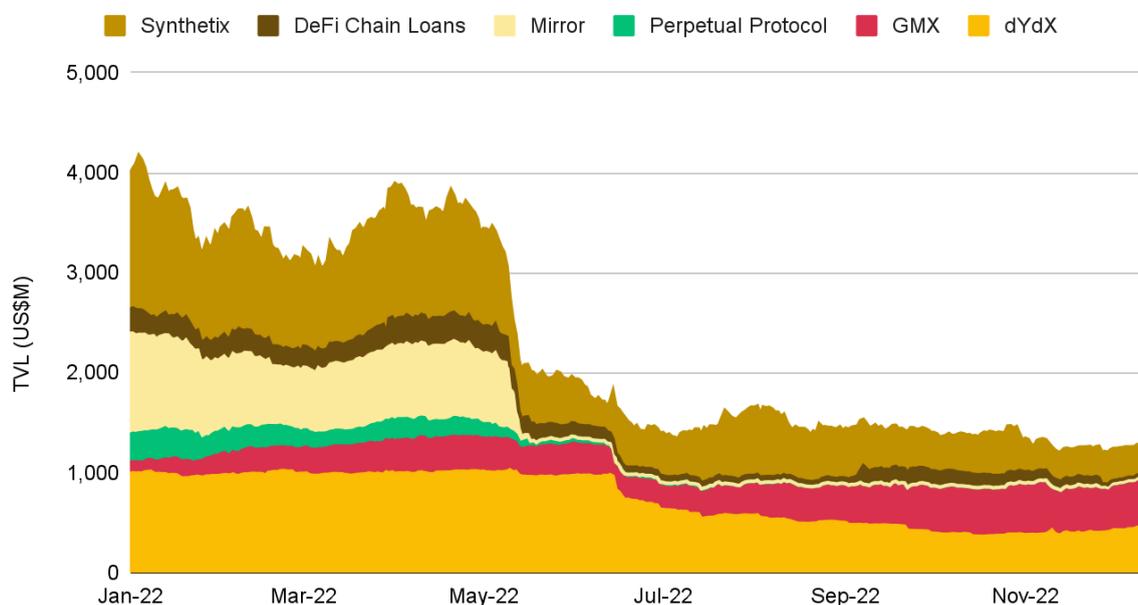
Over the course of 2022, DEXs went from making up 39.17% of TVL across DeFi to making up 33.09%. **As derivatives are growing in market share in DeFi, spot is falling in market share of DeFi. This seems significant given that in TradFi, the derivative market is much larger than the spot market in almost every asset class.** Perhaps, the market structure within DeFi will similarly trend towards derivatives over spot, which comparatively offer higher capital efficiency, often more liquidity, and easier hedging.

Figure 52: Over the course of 2022, Derivatives increased in share of DeFi TVL whereas, DEXs fell in share of DeFi TVL



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

When looking closer at the derivatives sector, it is clear on an absolute basis that the sector faced a steep fall in TVL after the fall of Terra Luna at the end of May. Different protocols within the DeFi sector also diverge in terms of relative performance.

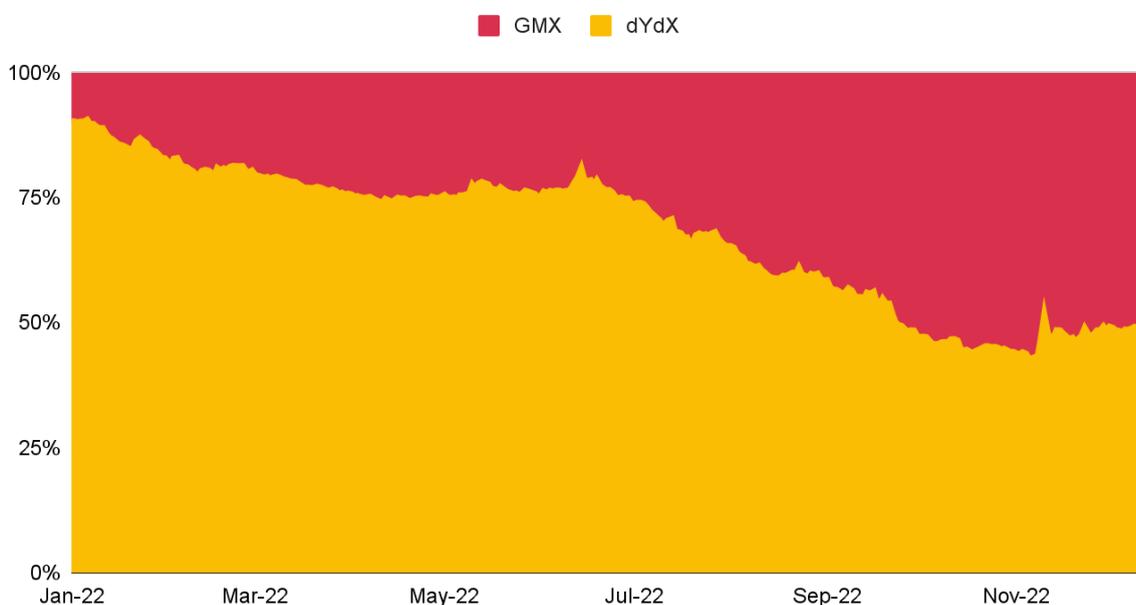
Figure 53: Derivatives TVL (US\$M)

Source: Binance Research, DeFiLlama
As of 31 Dec 2022

For the longest period, dYdX was the leading derivatives exchange due to its low fees and fast execution environment. Starting off with Ethereum-based margin trading, dYdX started trading perpetuals in 2019 and further improved the experience with the implementation of StarkEX Layer 2 Rollups last year. In June of 2022, dYdX announced the launch of the dYdX Chain. dYdX V4 is being developed as a standalone blockchain based on the Cosmos SDK and Tendermint Proof-of-stake consensus protocol and features a fully decentralized, off-chain orderbook, and matching engine.

Once a shining star, Synthetix appears to have lost a lot of its former glory. While being synthetic and not a derivative per se, we include the project here to avoid introducing too many subcategories. Synthetix is a protocol that allows users to issue synthetic assets on Ethereum, and Optimism for Ethereum accounts for around $\frac{2}{3}$ of the total TVL in the protocol. “Synths” track and provide the returns for an underlying asset without requiring you to hold that particular asset. The introduction of the V3 governance module marks a key evolution of Synthetix’s governance structure this year. While losing a majority of shares due to market conditions, Synthetix’s overall focus is to survive and thrive in the long term.

The third player that is worth mentioning within the derivatives space is GMX. GMX is a decentralized spot and perpetual exchange that allows slippage-free trades on its platform. **While most derivative platforms have lost share this year, there has been one clear winner - GMX.**

Figure 54: GMX vs. dYdX (TVL)

Source: Binance Research, DeFiLlama

GMX, first launched on Arbitrum, has become the best performer among its peers. During one point in November, GMX even beat Uniswap in terms of fees for the first time. Most recently, GMX saw a [proposal](#) in its governance forum in order to deploy the protocol on BNB Chain. While the space so far seems to be dominated by GMX and dYdX, we expect that considering the novelty of the derivatives market as a whole, there is no reason to assume that the two behemoths will continue to dominate the market in the future. That being said, constant innovation and user focus could set them up for further success.

Beyond the perpetual futures markets that GMX and dYdX primarily tend to, other decentralized derivative products such as options, interest rate swaps, and structured products have also begun to find some market fit. In the options market, Hegic has reported that it has now processed over US\$1.3B in trading volume since its foundation. There has also been a number of fundraising rounds for up and coming options protocols such as Primitive and Panoptic. In the interest rate swap market, Voltz has entered into the top 10 derivative protocols by TVL. Additionally, Voltz has reported to have processed over US\$1B in notional traded. Lastly, in the structured products market, trading firms such as Paradigm have used protocols like Ribbon to diversify its structured products exposure away from centralized counterparts.

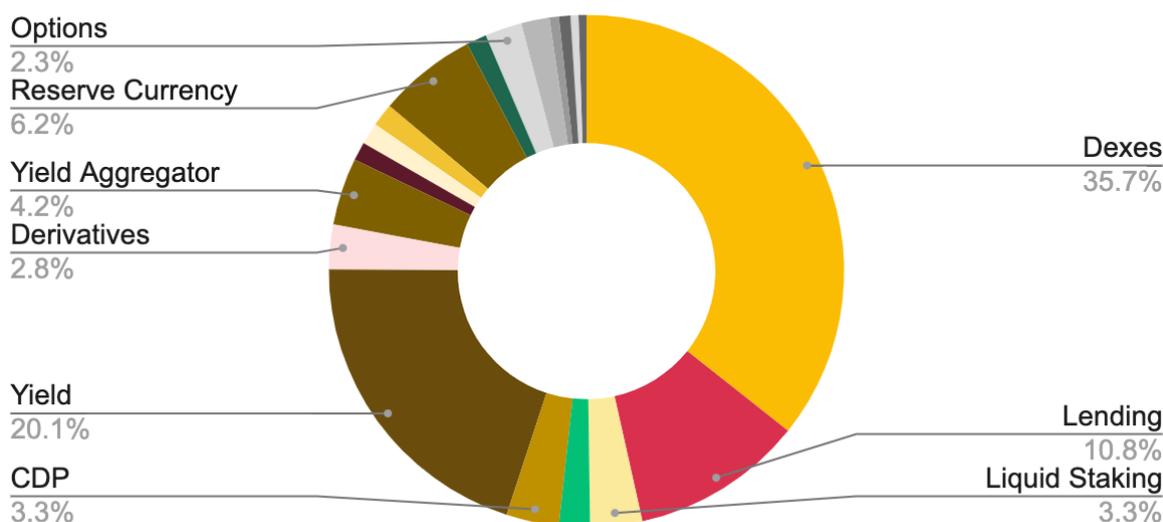
Overall, it will be interesting to watch the derivatives space develop into 2023. CeFi, in general, is simpler in terms of being able to just mimic TradFi orderbooks at a very basic level. DeFi has more constraints and requires a lot of compatibility with the blockchain,

resulting in the building of derivatives and primitives to be more difficult. As the space matures, the following questions should be considered: Will decentralized derivatives ever be preferred over centralized contracts with counterparty risk? Will derivatives be used more frequently than the spot market? Will emerging derivative products be successful in the derivatives market?

Other Noteworthy Mentions

The DeFi market is very broad, and innovations are reaching beyond DEXs and lending protocols. Reserve Currencies, Options, real-world assets, Insurance protocols, as well as CDP and Synthetics, could all be seen as sub sectors within DeFi. While DEXs have the clear majority in terms of number of projects ending the year 2022, Yield protocols come in second with around 20% market share in terms of number of projects. Liquid staking, as well as derivatives, are dominated by just a few players instead.

Figure 55: Number of projects for each major category



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

Convex, the Curve-reward-boosting platform that helps to maximize yields, is the current leader among yield platforms due to its high utilization among Curve users. Arrakis Finance and Alpaca come in second and third within the space of yield protocols. Looking at yield aggregation, we can see that Yearn Finance is still leading the market, closely followed by Beefy protocol.

Nexus Mutual remains the leading protocol amongst Insurance products, a market that has yet to see growth and adoption. The same can be said for the payments space, which yet

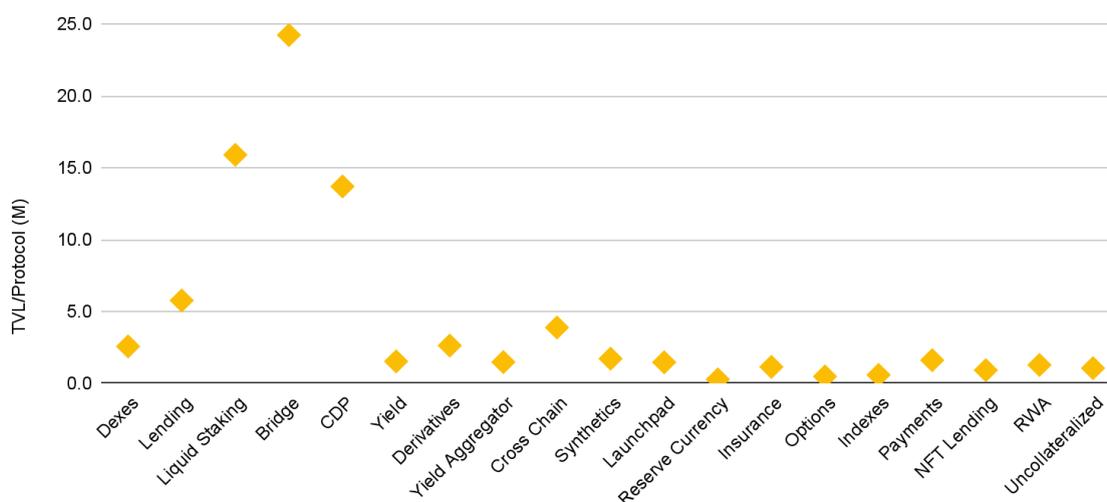
needs to see growth and adoption, with the only two solutions with noteworthy TVL being Lightning Network and Flexa.

Stargate and Synapse remain the leading protocols within the Cross Chain space, with Hop protocol, a protocol that has gained a lot of traction and attention this year, only coming in fourth. Maple Finance and Ribbon continue to lead the space of undercollateralized lending, while BendDAO is the clear leader within the NFT Lending space at the end of the year. Prediction markets, as well as Exotic options, remain some of the smallest areas within DeFi.

New applications for DeFi such as Gearbox Protocol have emerged as well. Gearbox protocol allows users to attain leverage on any protocol through their credit accounts which are essentially smart contract wallets. The credit accounts are non-custodial and have parameters such as liquidation thresholds and approved tokens. The benefit behind protocols like Gearbox is its high composability. It's deployable on any DeFi protocol, thereby bringing DeFi a step closer towards the multichain thesis. As we see the rise in modular blockchains and other initiatives related to blockchain scalability, it's likely we'll also see the emergence of more projects like Gearbox.

Not just looking at the number of projects and the leading players in each category but also considering the **TVL per number of projects (Figure 56)**, we can see that **bridges, liquid staking, as well as CDPs stand out as the most concentrated areas within DeFi**. Multichain, WBTC, as well as JustCryptos, dominate the bridge space, while Lido is the clear leader within liquid staking and MakerDAO within CDPs.

Figure 56: TVL/Number of projects



Source: Binance Research, DeFiLlama
As of 31 Dec 2022

Looking back at the DeFi space at the end of 2022 encourages us that crypto is here to stay. Despite entering the year in bear market territory and battling through various trials and tribulations, we still see continuous development and innovation in the space. Most projects have focused on building and improving their protocols throughout the year, bringing vast amounts of new innovations that set the space up for long-term success. However, we cannot end up talking about DeFi without having touched on one key area of concern - Hacks. While we welcome the innovation, we should not neglect that there is still a lot of work to be done and the number of hacks this year made it clear that security and risk management have to be at the center of attention going forward.

Figure 57: Overview of major DeFi categories, their TVL and number of protocols

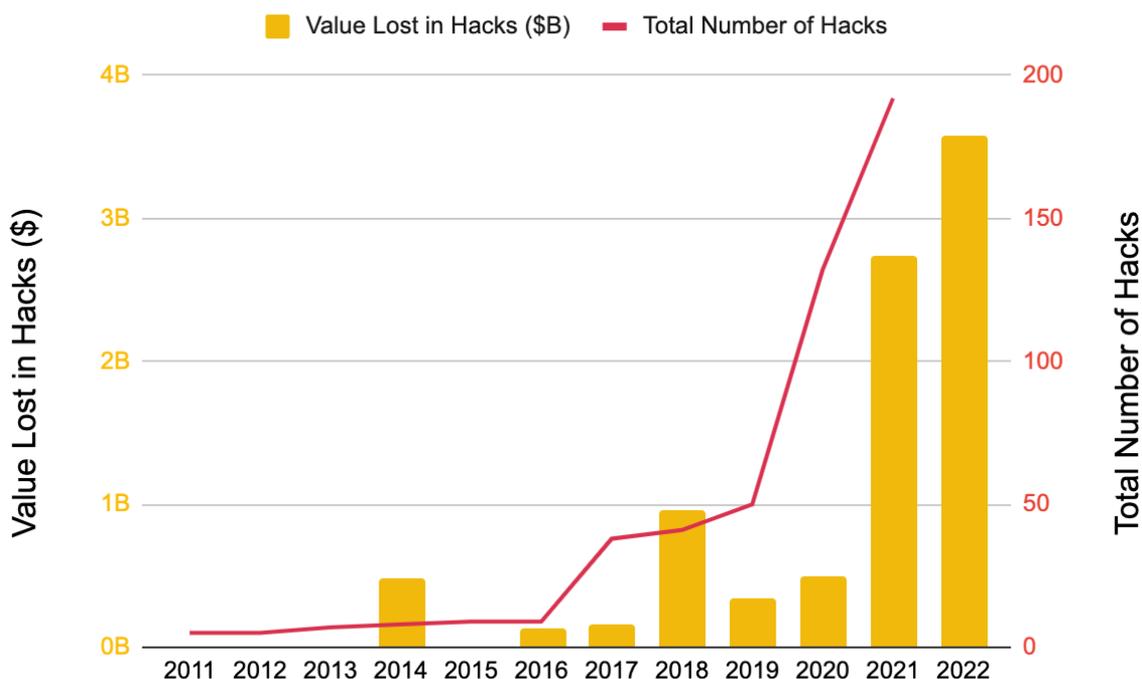
Category	Protocols	TVL (US\$B)	TVL/Protocol (US\$M)	Description
Bridge	35	8.48	24.2	Bridge tokens from one network to another
Liquid Staking	59	9.38	15.9	Stake assets in exchange of a reward
CDP	60	8.22	13.7	Mint stablecoin using collateralized lending
Lending	196	11.3	5.8	Borrow and lend assets
Cross Chain	21	0.816	3.9	Interoperability between different blockchains
Dexes	647	16.62	2.6	Swap/trade cryptocurrency
Derivatives	51	1.34	2.6	Usage of leverage and advanced financial instruments
Yield	364	5.56	1.5	Reward for staking/LP on their platform
Yield Aggregator	77	1.14	1.5	Aggregate yield from diverse protocols
Synthetics	25	0.429	1.7	Tokenized derivative that mimic another asset
Launchpad	26	0.381	1.5	Protocols that launch new projects and coins
Reserve Currency	112	0.31	0.3	Uses a reserve of valuable assets acquired through bonding and staking
Insurance	23	0.263	1.1	Provide monetary protections
Options	42	0.201	0.5	Right to buy an asset at a fixed price
Indexes	32	0.187	0.6	Track the performance of a group of related assets
Payments	11	0.177	1.6	Pay/send/receive cryptocurrency
NFT Lending	13	0.119	0.9	Collateralize NFTs for a loan
RWA	9	0.115	1.3	Real World Assets, such as house tokenization
Uncollateralized Lending	9	0.095	1.1	-

Source: Binance Research, DeFiLlama

Hacks

Across the entirety of crypto, 2022 has marked an unprecedented year for hacks; **Not only has 2022 witnessed the most recorded hacks on record, but also the greatest value lost to hacks.**

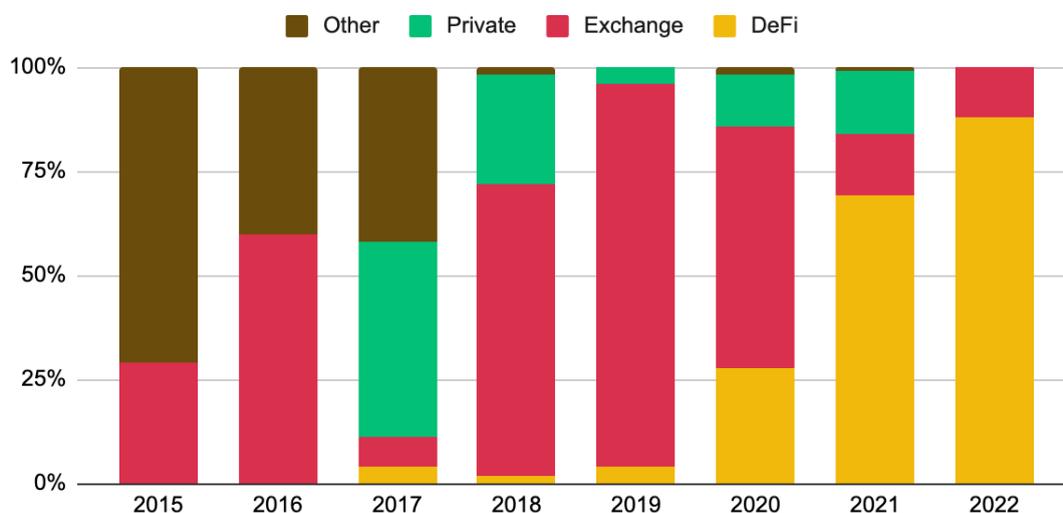
Figure 58: Value lost in hacks & total number of hacks YoY



Source: Binance Research, Comparitech
As of 31 Dec 2022

Notably, DeFi-related hacks have made up an overwhelming majority of the 2022 total. Out of the 192 significant hacks recorded in 2022, DeFi-related hacks have made up 169 of those hacks (88%). Out of the ~US\$3.57B lost in hacks across all of crypto in 2022, DeFi-related hacks accounted for ~US\$2.57B (72.5%). **DeFi has increasingly contributed to the number of total hacks across crypto YoY. Over time, DeFi has gained a reputation as being hack-prone.**

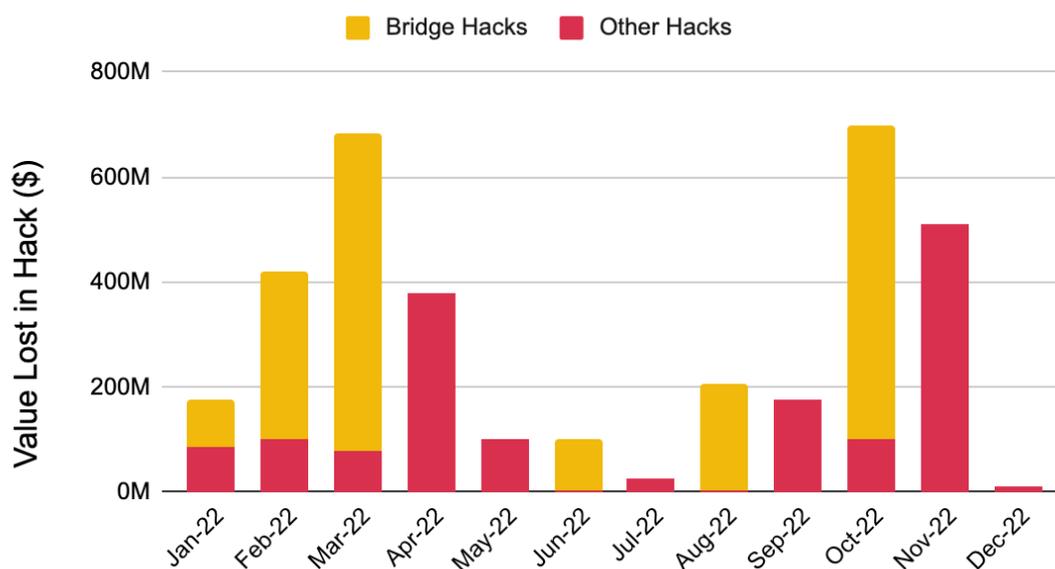
Figure 59: Hacks by platform type



Source: Binance Research, Chainalysis, Comparitech
As of 31 Dec 2022

By taking a closer look at the granularity of DeFi hacks in 2022, **it becomes apparent that cross-chain bridges were the most frequent attack vector.** Bridges accounted for 54% of all DeFi hacks this year. The top three bridge attacks in 2022 included the US\$625M Ronin bridge hack in March, the US\$566M BNB Chain bridge hack in October, and the US\$326M Wormhole bridge hack in February.

Figure 60: Bridges-related hacks vs. other hacks MoM



Source: Binance Research, Chainalysis, DeFiLlama
As of 31 Dec 2022

This begs the question, what characteristics of the 2022 environment have made DeFi so susceptible to hacks as compared to other years? This could be explained by a few factors. One consideration is that active developers have [decreased](#) YoY, implying fewer developers are maintaining the codebases of DeFi protocols.

Additionally, there has been a depletion of TVL in DeFi, which translates to less economically secure protocols. Furthermore, in hopes of achieving higher levels of interoperability, capital efficiency, and product flexibility, many DeFi protocols continue to test innovation and add complexity. All of these factors combined could lead DeFi to be more susceptible to hacks.

In conclusion, the DeFi space in 2022 has shown that with great opportunity comes great risk. DeFi can challenge an entrenched traditional financial industry, and offer economic freedom, decentralization, and equal access. Promising innovations during 2022 such as revised AMM models, liquid staking protocols, real yield, and new crypto derivatives, offer the feeling that DeFi is continuing to move towards this goal. However, it is clear that this goal does not come without obstacles. As shown in 2022, DeFi has faced significant trials and setbacks, such as extreme drops in TVL, decreased trading volume, and increased hacks. The DeFi ecosystem has begun to recognize the two-sided nature of high ambitions; More and more users have engaged in the “flight to quality”, choosing to support projects which are building, and have moved away from less substantive counterparts. However, it seems important to note that for any emerging application, growing pains are inevitable. Time will tell whether DeFi will be able to incorporate lessons from 2022, become more resilient, and reach its ambitious goals in the future.

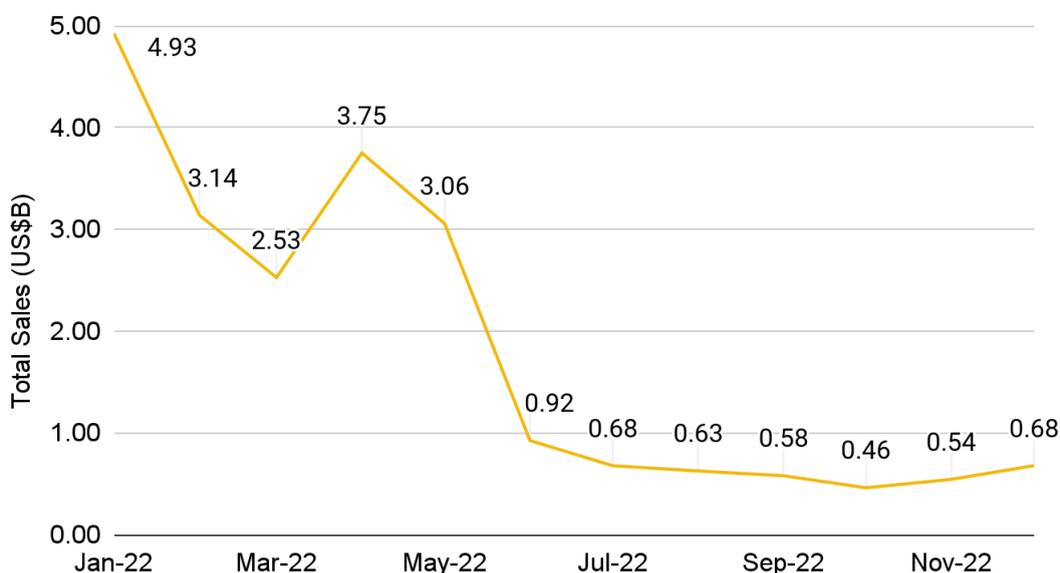
Non-Fungible Tokens

Non-Fungible Tokens (“NFTs”) revolutionized the way we think about ownership and value in the digital world. They have been used to sell digital art for millions of dollars, and have even made their way into the music industry with artists releasing NFT versions of their music. Following a surge in interest and media coverage last year and in the early part of 2022, NFTs had a relatively muted second half in terms of trading activity. In this section, we will take a closer look at the current state of the NFT market and explore the key highlights in 2022.

NFT Market Review

NFTs recorded US\$21.9B in sales in 2022 compared to US\$19.8B in 2021, an increase of 10.6% YoY. This is primarily contributed by strong sales in the first half of 2022 as NFT sales clocked US\$18.3B (~83% of total sales) from January to June. The NFT market witnessed a relatively quiet second half as sentiment turned negative and traders exited the market following a series of market events (e.g. UST Depeg, 3AC contagion).

Figure 61: NFT sales plunged in the second half of 2022

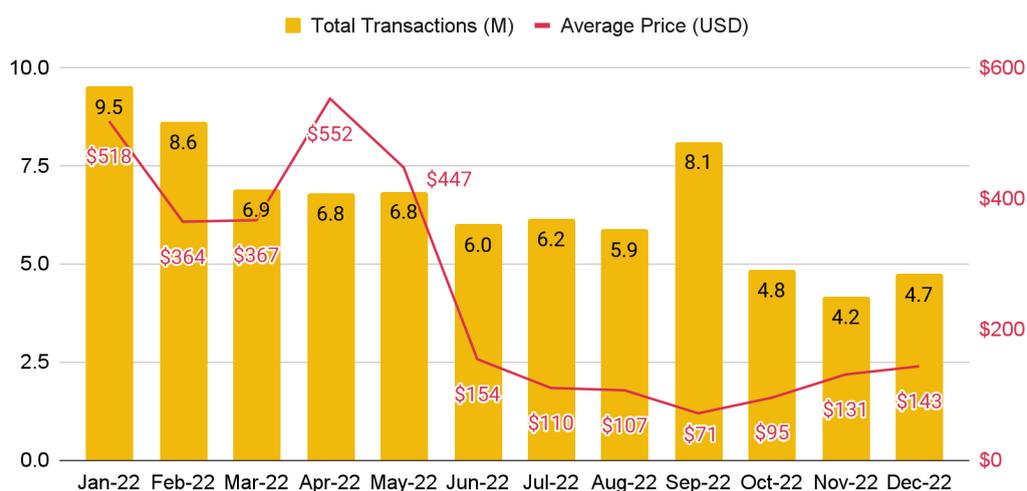


Source: *Cryptoslam, Binance Research*
As of 31 Dec 2022

Looking at the underlying drivers, the sharp fall in NFT sales in the second half was largely contributed by a steep decline in average NFT sale prices, and to a smaller extent, a fall in

the number of transactions. Average prices fell by 73% from \$400 in first-half 2022 to \$110 in second-half 2022. This is as compared to a 24% fall in total transactions over the same period. Such a trend is to be expected as NFTs are typically denominated in token prices (e.g. ETH/SOL/BNB etc.), which have generally fallen across the board in USD terms.

Figure 62: NFT prices have fallen to a larger extent than the number of transactions



Source: Cryptoslam, Binance Research
As of 31 Dec 2022

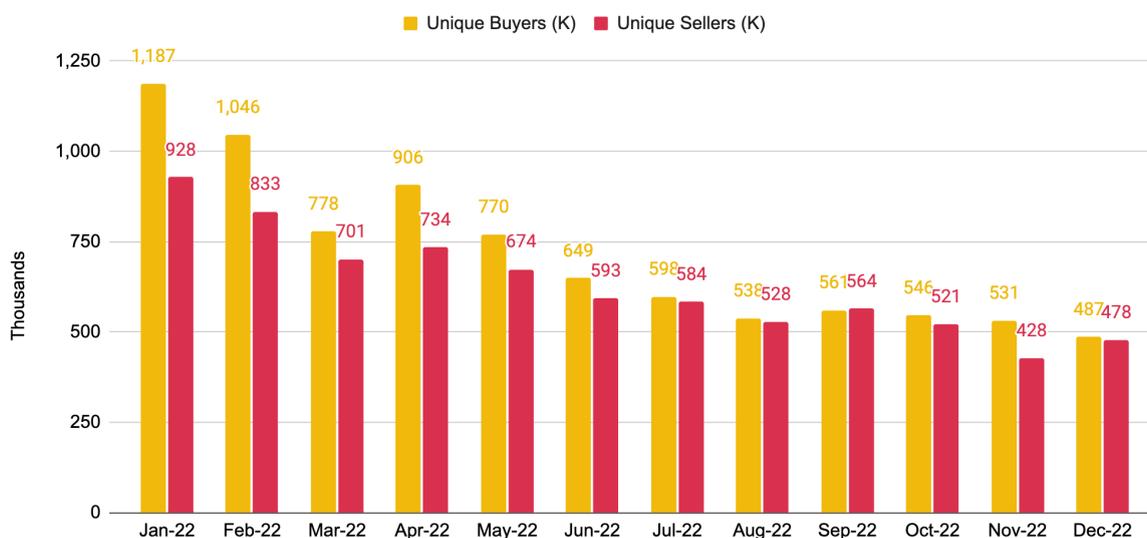
Retail interest has also waned. Using Google Trends as a proxy, interest in NFTs peaked in January before declining across the year. This is reflected in trading metrics as well. The number of unique buyers and sellers has approximately halved compared to the start of the year.

Figure 63: Google search interest of Non-Fungible Tokens has declined throughout 2022



Source: Google, Binance Research

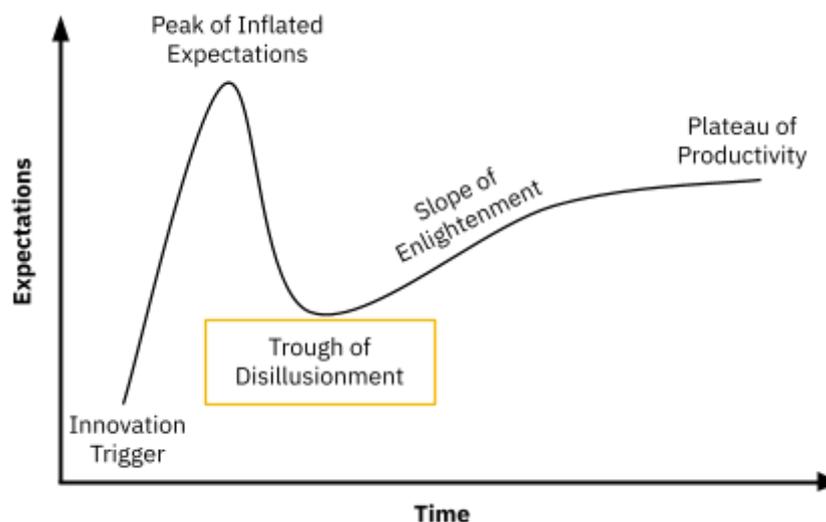
Figure 64: The number of unique traders has fallen in 2022



Source: Cryptoslam, Binance Research
As of 31 Dec 2022

The overall decline in the NFT market is unsurprising considering rising yields, challenging market conditions, and increasing fears of a recession. Traders and investors are less likely to deploy capital further down the risk curve. This includes NFTs, which take on a second-derivative impact based on both, NFT price and crypto token price. Additionally, the [Gartner Hype Cycle](#) is also helpful in visualizing where NFTs stand by providing a graphic representation of the maturity of the technology.

Figure 65: NFTs are in the “Trough of Disillusionment” phase



Source: Gartner, Binance Research

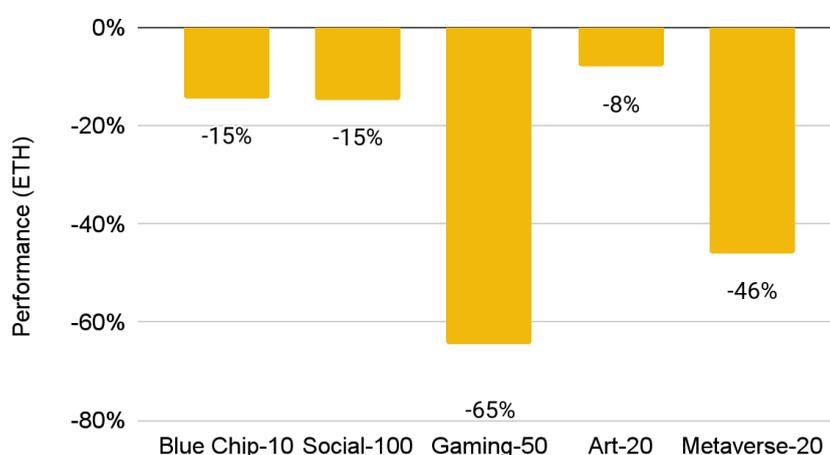
The NFT industry sped through the first two phases of the hype cycle, reaching the peak in late 2021 and early 2022. Since then, it has been downwards for the industry, with monthly NFT trading volumes in December 2022 down 86% since its peak in January 2022. Currently, the industry is in the “trough of disillusionment” phase of the hype cycle - **early excitement has worn off, early adopters report low investment returns, and numerous projects have been shaken out.** However, this phase generally marks the bottom or near-bottom of the hype cycle. The important takeaway is that this phase is crucial for building utility in the long-term and not just for delivering short-term hype around the technology.

NFT Price Performance

NFTs declined by ~76% in USD terms in 2022, as measured by the Nansen NFT-500 index. This is primarily contributed by the fall in ETH prices by ~68% in the same period. Isolating the effects of the fall in ETH price, the asset class declined ~23% when denominated in ETH.

Looking at performance by sectors, Art NFTs performed the best, whereas Gaming and Metaverse NFTs performed the worst.

Figure 66: All sectors are down in 2022



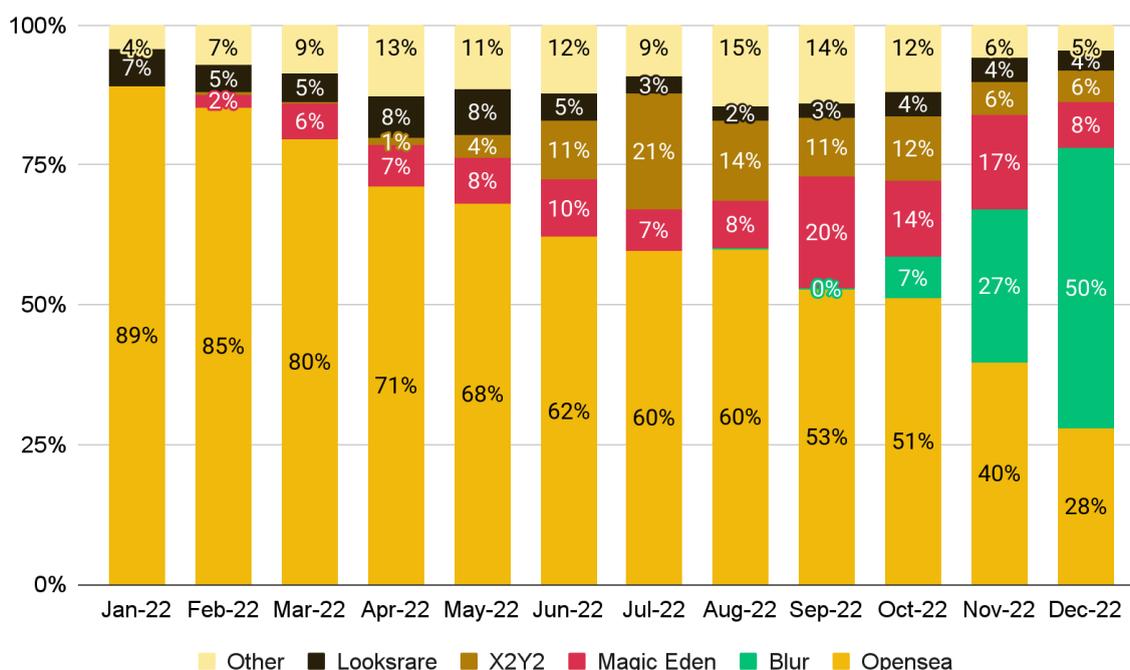
Source: Nansen, Binance Research
As of 31 Dec 2022

NFT Marketplace Competition

NFT marketplaces play an important role in facilitating trading activity by connecting buyers and sellers. **Competition is strong, and the launch of several new marketplaces during last year has posed a serious challenge to OpenSea’s market dominance as witnessed**

by the steady decline in market share by trading volume. Blur overtook OpenSea to take the top spot with 50% of the market share as of December 2022. However, as we shall explain, this may be temporary and is likely driven by Blur’s trading incentives.

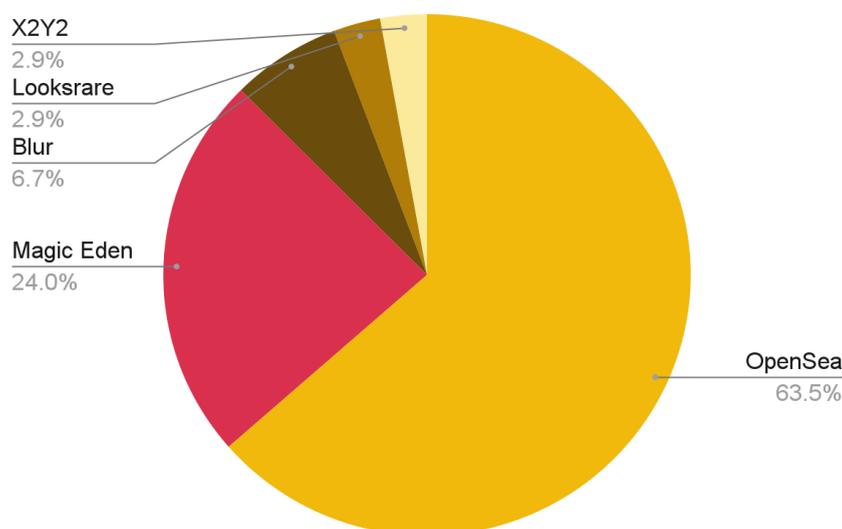
Figure 67: Blur overtook OpenSea in terms of trading volume



Source: Dune Analytics (@sealaunch, @ka_mo_ki), Binance Research
As of 31 Dec 2022

Blur, a new NFT platform that targets NFT power users, has risen to the top barely two months after their launch in mid-Oct. Helpful features such as rarity sniping and portfolio analytics tools, as well as incentives related to an upcoming airdrop and zero marketplace trading fees, have contributed to strong trading volume on the platform. That said, trading volume data on Blur is likely overstated and includes some element of wash trading as traders farm for the upcoming \$BLUR token airdrop.

All things considered, it is too early to tell if Blur will be able to continue its growth trajectory after the upcoming airdrop, and if/when the marketplace introduces trading fees. We suspect that we will likely see some form of a trend reversal if financial incentives on Blur are reduced. Looking at user metrics in the form of unique active wallets, we observe that OpenSea remained the top NFT marketplace by a large margin in December 2022. This further illustrates that a relatively small number of users account for Blur’s behemoth trading volume - a sign of either large deal sizes or wash trading by a small number of participants.

Figure 68: OpenSea has nearly 10x the number of unique active wallets (30 days) vs. Blur

Source: DappRadar, Binance Research
As of 31 Dec 2022

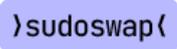
Overall, the entrance of new players will contribute to an increasingly fragmented NFT marketplace landscape. Considering that NFT marketplaces generally have strong cash flow generating ability, we will likely continue seeing new players enter the space to fight for a piece of the market in 2023. Depending on how the NFT royalties debate shapes out (discussed later), there could be more NFT-specific marketplaces (e.g. Cryptopunk marketplace) or vertical-specific marketplaces that could provide more tailored user experiences. Regardless, **constant innovation, new features, and attractive financial incentives will be key for NFT marketplaces to compete and differentiate** themselves from other platforms.

2022 Highlights

NFT Royalties Debate

Should creator royalties be honored? Or should buyers be given the liberty to decide if they want to pay royalties? The issue of NFT royalties has been a topic of discussion among the NFT community over the past few months. **It is a common misconception that royalties are enforceable at the smart contract level, but in reality, marketplaces can decide whether they are enforced.** This has led to different marketplace policies and opposing schools of thought on this topic.

Figure 69: Overview of royalty fees policies

Marketplace	Royalty Fees
 OpenSea	Compulsory
 MAGIC EDEN	Optional for creators who don't adopt the Open Creator Protocol (OCP)
 BLUR	Compulsory
 X2Y2	Compulsory
LooksRare 	Optional
 sudoswap	Optional

Source: Marketplaces' websites, Binance Research

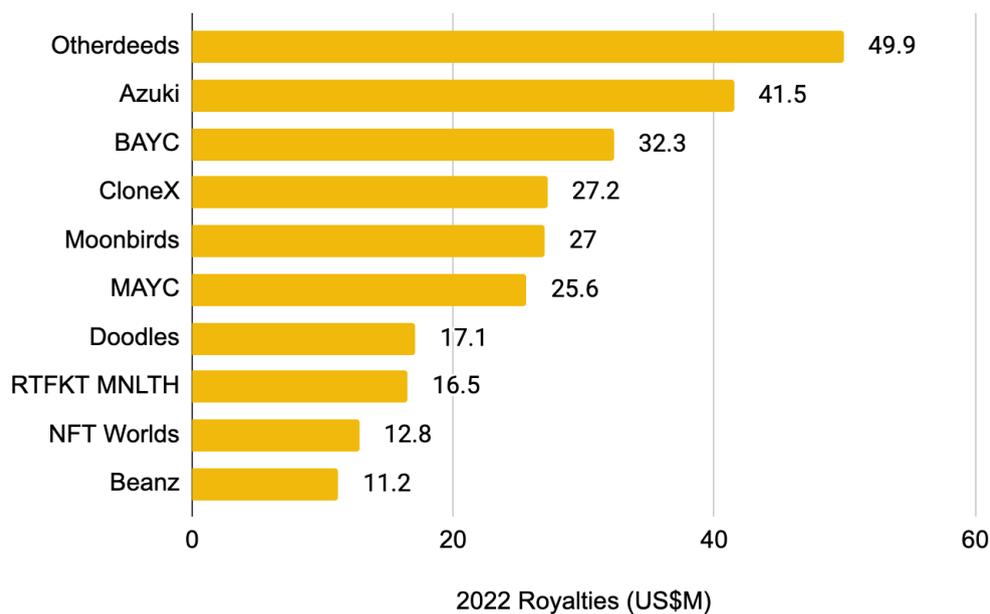
On the one hand, proponents of royalty enforcement have cited arguments relating to supporting creators for their work, and the potential consequence of higher primary mint prices which could serve as a barrier to mainstream NFT adoption, among others. On the other hand, NFT traders are financially inclined to avoid paying royalties which reduces their profit.

“An unfortunate consequence of this ecosystem shift is that the business model used by the vast majority of creators in this industry is now subject to enforcement discretion of marketplaces rather than code.”

- *Devin Finzer, Chief Executive Officer of OpenSea*

Considering the amount of royalties that was collected by top NFT collections in 2022 alone, it is clear that this is an important issue that has a direct impact on funding, as well as on traders' profits.

Figure 70: 2022 royalties collected by prominent NFT projects



Source: Twitter (@harry_forj), Definitive Intelligence
As of 31 Dec 2022

Our view is that there are several determinants of users’ behavior when it comes to their thoughts on paying creator royalties.

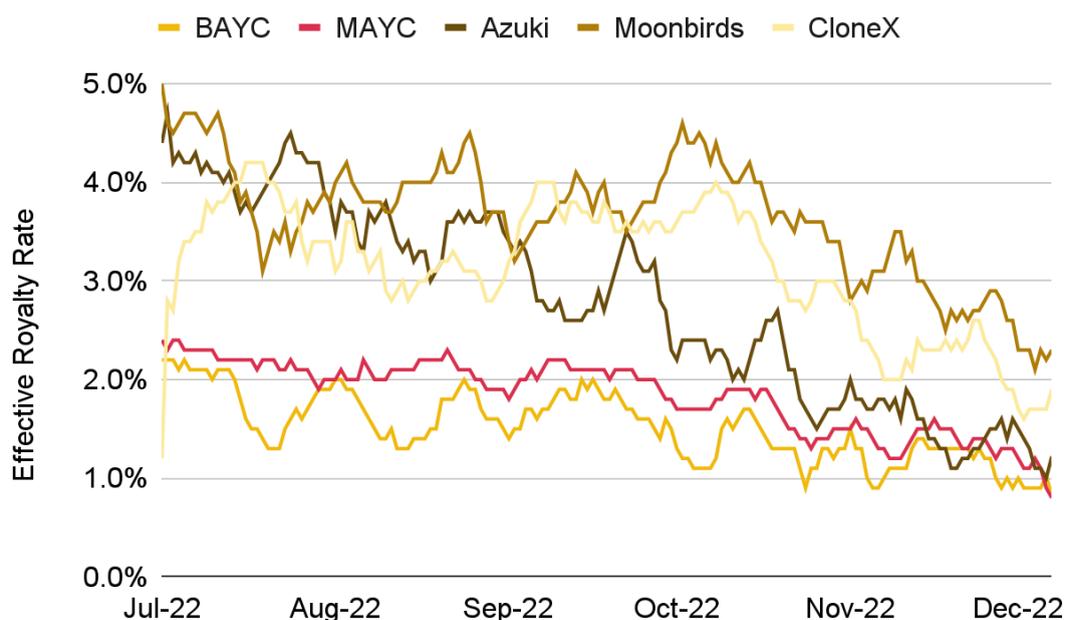
Figure 71: Determinants of users’ behavior

Determinants	Description
Traders vs. Collectors	Traders focused on short-term flips/gains will lean towards marketplaces that do not charge royalties. Collectors focused on collecting valuable or rare pieces will generally be more willing to pay royalties to support their favorite creators.
Size of Collection	Larger collection sizes (e.g. 10K PFP projects) have more owners. Consequently, a larger number of sellers will look for ways to circumvent royalties, compared to 1/1 collections.
Personal Beliefs	This is subjective and differs between individuals. Depending on personal circumstances, some are more inclined to honor creator royalties, while others look to maximize personal profits.

Source: Binance Research

Looking at some of the top NFT collections, it is evident that circumvention of royalties is commonplace. Effective royalty rates (total royalties collected / total volume transacted) have generally fallen across the board, with most collections ending the year with a decline of more than half compared to the middle of 2022. The launch of optional royalty fees marketplaces has contributed to this trend.

Figure 72: Effective royalty rates fell across the board



Source: Dune Analytics (@beetle), Binance Research
As of 31 Dec 2022

So where do we go from here? There are a few possible outcomes:

- ❖ Race to the bottom: New entrants or smaller marketplaces will have higher motivation to introduce optional royalties to capture more market share and compete with larger incumbents. So far, market leader OpenSea has reaffirmed its commitment to enforce royalties, but market share has eroded significantly over the year (though for a variety of reasons).
- ❖ Introduction of collection-specific marketplaces: NFT projects may be incentivized to create their own marketplaces (e.g. CryptoPunks marketplace) to facilitate secondary trades and enforce their own royalty policies.
- ❖ Change in creators' revenue strategy: We may see higher mint prices going forward as creators take into account lesser secondary royalties.

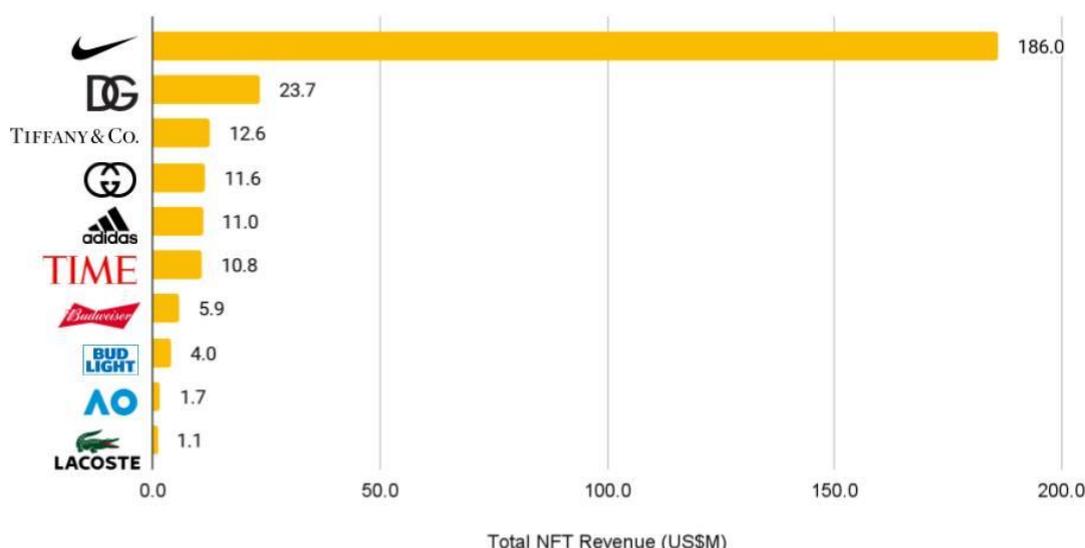
At the end of the day, it is a social contract. In its current form, enforcement of royalties is up to the discretion of marketplaces. Users can always find ways to circumvent paying royalties if there is strong motivation to do so. Until there is a clear consensus around this issue and infrastructure is more developed to help express such consensus, it is clear that **creators need to pursue additional means of monetization and foster a loyal base of collectors.**

The Year Big Brands Embraced NFTs

Once misunderstood by many to be just “jpegs”, NFTs have come a long way in terms of awareness and user adoption. What is somewhat surprising is the pace at which several big brands have educated themselves and figured out ways to integrate NFTs into their business strategy in one way or another. The companies that have successfully capitalized on the opportunities presented by NFTs have reaped significant monetary gains.

Based on a Dune Analytics dashboard, Nike comes in at the top by a huge margin, having collected US\$186M in total revenue (primary sales and secondary royalties combined). Nike’s foray into NFT was marked by its acquisition of RTFKT, a digital fashion collectibles company, in December 2021. The company doubled down on their web3 efforts with the launch of .SWOOSH, a web3-enabled platform. Users will be able to learn, collect, and eventually wear virtual collections in digital games and immersive experiences.

Figure 73: NFT revenue of big brands



Source: Dune Analytics (@kingjames23), Binance Research
 Note: Nike’s data includes revenue from projects pre-acquisition

Revenue-making opportunities aside, NFTs allow companies to connect with digital natives and form online communities around the brand. By integrating digital and physical elements (also termed “Phygital”), big brands have been able to tap into NFTs to reimagine consumer experiences. While digital assets can historically be easily replicated, **the non-fungibility feature of NFTs allows brands to introduce scarcity and enables customers to verify authenticity.** Such traits of scarcity and authenticity have appealed to luxury and fashion brands given the nature of their businesses.

In this aspect, Nike’s RTFKT is arguably at the forefront of NFTs integration and has incorporated NFTs to introduce scarcity and help users verify authenticity. It recently launched its first native web3 sneaker “Cryptokicks iRL” which uses blockchain technology to bridge the digital and physical worlds. Besides having different smart features, the physical sneakers are equipped with a NFC chip that allows users to verify the authenticity of their sneaker against its digital collectible twin.

On a side note, the growth potential of NFT projects and communities mean that brands are not restricted to single, one-off projects, and may reap long-term gains if their NFT strategy is executed well. For example, Yuga Labs’ Bored Ape Yacht Club which initially started out simply as a profile picture project has since evolved into an entire ecosystem consisting of the ApeCoin and the Otherside Metaverse. Importantly, Yuga Labs has built a community of strong supporters over the past couple of years. While not an easy feat, brands that have the necessary resources, expertise, and commitment could gain tremendously if they manage to replicate similar levels of success.

Overall, NFTs present potential monetary and non-monetary benefits for brands that are able to successfully leverage the technology. Considering the immense competition for consumers’ attention in traditional forms of marketing, **NFTs and web3 mediums provide a green pasture of opportunity for big brands to capture mindshare.**

The Rebranding of NFTs

It goes without saying that the term “Non-Fungible Tokens” can be confusing and may have negative connotations for some individuals. This is unsurprising given stories of failed projects and headlines of multi-million dollar sales of animal jpegs during the height of the NFT mania. When compounded with the lack of understanding of the underlying innovation, technology, and cultural aspect of NFTs, some may avoid the asset class as a whole.

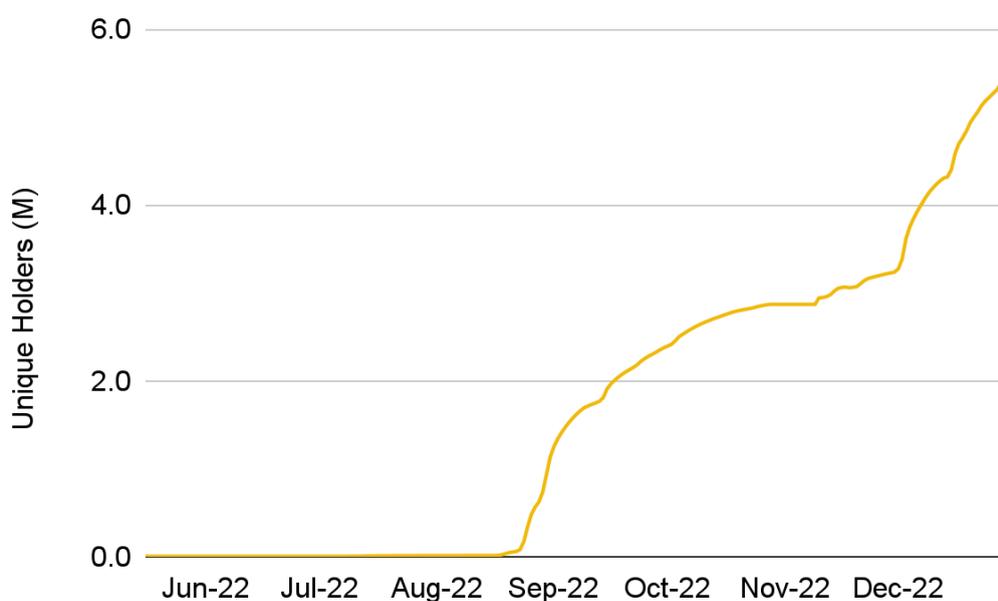
Big brain moment - what if NFTs were rebranded as “digital collectibles” instead? Does this help with the public’s impression of the technology? Besides being a neutral term with little association with crypto or NFTs, the term “digital collectibles” is self-explanatory - companies do not need to explain to users what “non-fungible” means. While not 100%

conclusive, there may be signs that this may have helped in driving NFT adoption. Two notable web2 firms that have done this are Reddit and Meta:

- ❖ Reddit launched “Blockchain-Backed Collectible Avatars” which are limited-edition profile pictures created by independent artists⁽⁵⁰⁾.
- ❖ Meta announced the introduction of “digital collectibles” to showcase NFTs on Instagram⁽⁵¹⁾.

Reddit has had commendable success in its foray into NFTs and there are now over 5 million unique holders of Reddit’s collectible avatars. For comparison, there are approximately 2.5M users on OpenSea⁽⁵²⁾. Notably, Reddit minimizes the use of crypto terms on their website - wallets are termed “vaults”, tokens are termed “coins”, and the term “NFT” is non-existent. Users can also purchase NFTs without crypto using credit or debit cards and make changes to their NFTs directly on the platform.

Figure 74: Number of unique holders of Reddit’s collectible avatars exceeded 5M



Source: Dune Analytics (@polygon_analytics), Binance Research

Given the numerous factors at play, it is likely that the success of Reddit’s NFT foray is attributed to a combination of different factors rather than just a rebranding of NFTs. Nonetheless, it will be interesting to see whether there will be a gradual shift in the industry towards using the term “digital collectibles” instead of “NFTs” in the future.

Closing thoughts

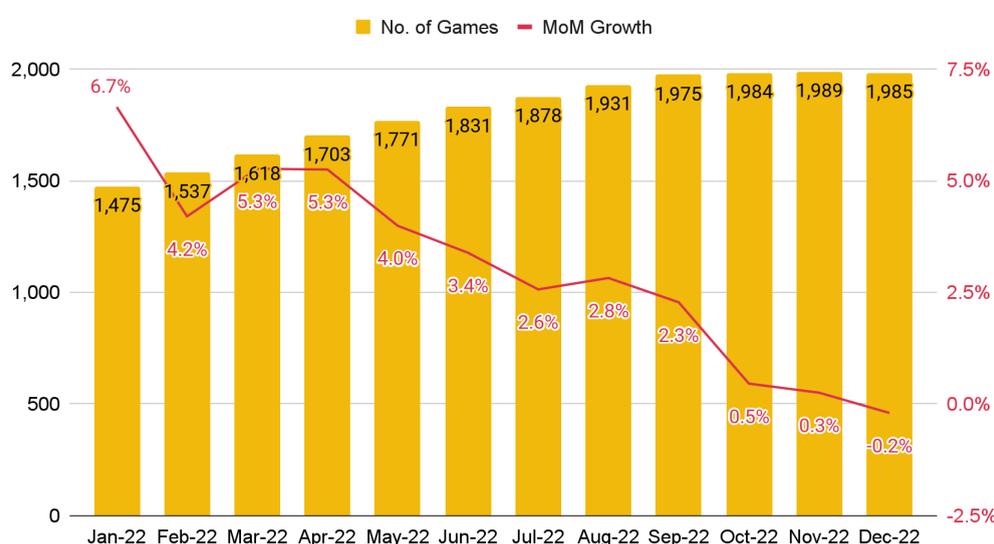
2022 had undoubtedly been a challenging year for NFTs considering muted trading activity and negative performance of the asset class. Nonetheless, the underlying technology and the ability of NFTs to revolutionize digital ownership is not going anywhere. We are encouraged by integration of NFTs by web2 brands, and the continued adoption of NFTs by the masses. In the long run, NFTs may even end up being part of our daily lives without us knowing that we are using them.

Gaming and Metaverse

State of the Blockchain Gaming Market

The blockchain gaming market had a challenging 2022. The number of games rose from 1,383 in December 2021 to 1,985 in December 2022 (an increase of 44% YoY) but there is evidence of slowing growth. Month-on-month growth has been on a decline and tapered to -0.2% in December 2022. This is unsurprising as overall market sentiment remained poor and spilled over to the blockchain gaming market.

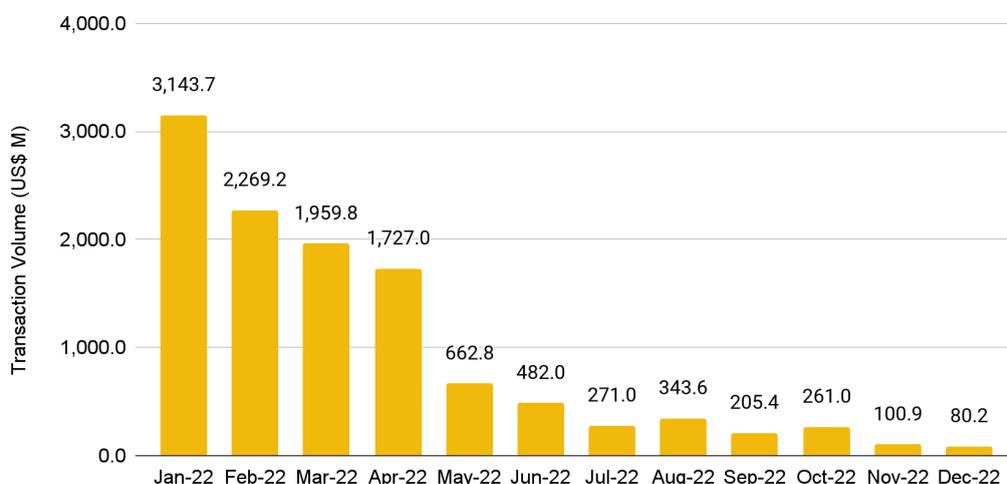
Figure 75: Growth in the number of games has tapered off



Source: Footprint Analytics (@Footprint), Binance Research
As of 31 Dec 2022

Total volume of gaming-related transactions was US\$11.5B in 2022, with the bulk of transaction volume front-loaded in the first half of the year. Transaction volumes experienced the largest month-on-month decline in May 2022 amidst the market turmoil contributed by the UST depeg and the Three Arrows Capital fallout. The overall fall in transaction volume (measured in U.S. dollars) in 2022 was also contributed by the decline in crypto prices across the board.

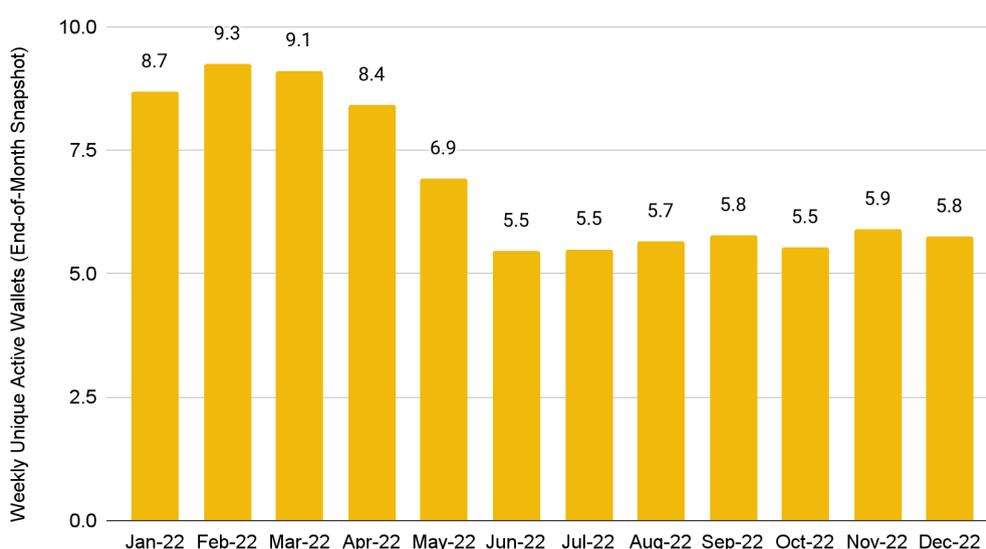
Figure 76: Gaming transaction volume in 2022



Source: Footprint Analytics (@Footprint), Binance Research
As of 31 Dec 2022

Under the surface, on-chain participation metrics paint a relatively more sanguine picture. Based on end-of-month snapshots, while the number of weekly unique active wallets has fallen by ~32% compared to the start of the year, it has maintained relatively stable at approximately 5+M since June 2022. Considering this data only represents on-chain activity and that not all actions on games require interactions with the blockchain, this data understates actual gaming activity.

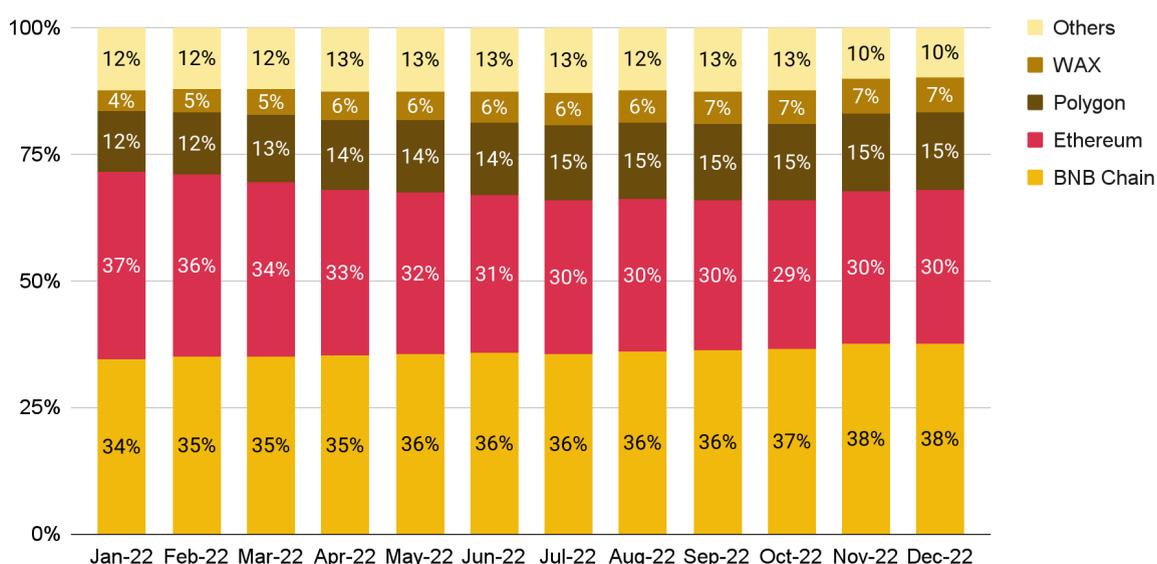
Figure 77: Weekly unique active wallets have steadied at approximately 5+M



Source: DappRadar, Binance Research
As of 31 Dec 2022

The gaming landscape is led by the top three blockchains. **More than 80% of games are built on BNB Chain, Ethereum, and Polygon.** Compared to the start of 2022, market share in terms of the number of games has increased for BNB Chain (34% to 38%), Polygon (12% to 15%), and WAX (4% to 7%), whereas market share for Ethereum decreased (37% to 30%). Given the large number of on-chain transactions for games, blockchains that have lower gas fees have a competitive advantage.

Figure 78: BNB Chain, Ethereum, and Polygon lead the blockchain gaming market

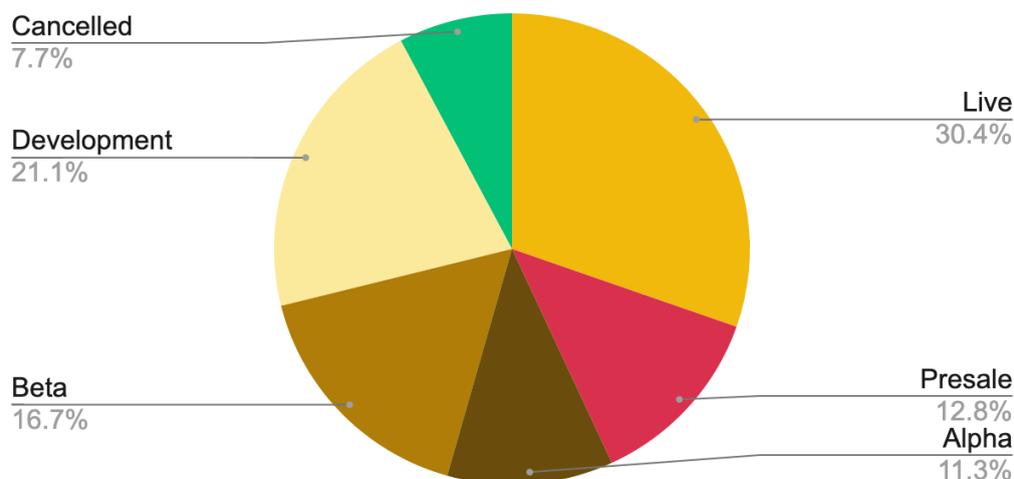


Source: Footprint Analytics (@Footprint), Binance Research
As of 31 Dec 2022

What about the status of game development? The blockchain gaming industry has often been criticized for the lack of quality games and subpar gameplay. However, **it is key to understand that AAA games take years to develop even for the largest traditional gaming studios with decades of game-making experience and a strong balance sheet.** Short development cycles are not effective enough to build AAA games. Rather, developers that put their heads down working on longer cycles may have a better shot as they are focusing on long-term growth rather than short-term results.

Currently, only 30% of all blockchain gaming projects are live, while the rest are still in different stages of development. This timeline makes sense given that the bulk of the funding was received in the past 1-2 years and more games should be launched over the next couple of years.

Figure 79: 30% of games are live while the rest are in different stages of development

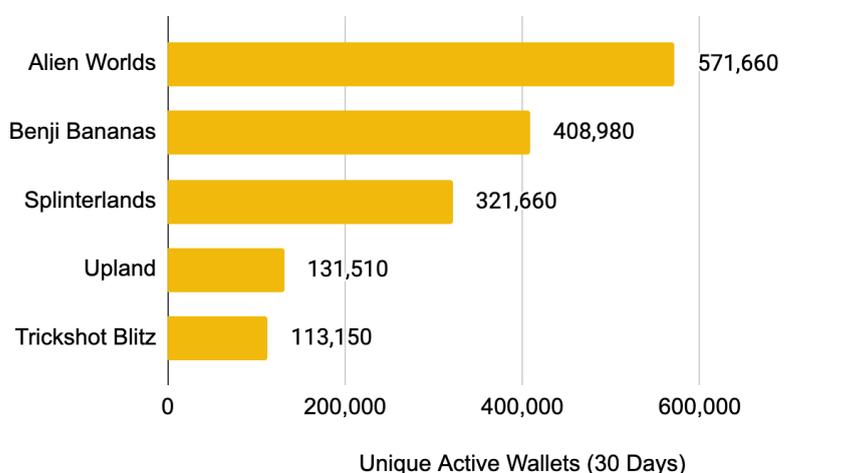


Source: Playtoearn.net, Binance Research
As of 31 Dec 2022

Hype behind X-to-Earn fizzled out

Games like Axie Infinity and STEP N made headlines in 2022 and were stars of the X-to-Earn narrative. However, as the year went by, user growth slowed down and the spotlight was cast on the quality of gameplay, as well as the tokenomics of X-to-Earn games. Axie infinity and STEP N are notably absent from the top spots in terms of unique active wallets. Instead, the year ended with games such as Alien Worlds, Benji Bananas, Splinterlands, Upland, and Trickshot Blitz on the leadership board.

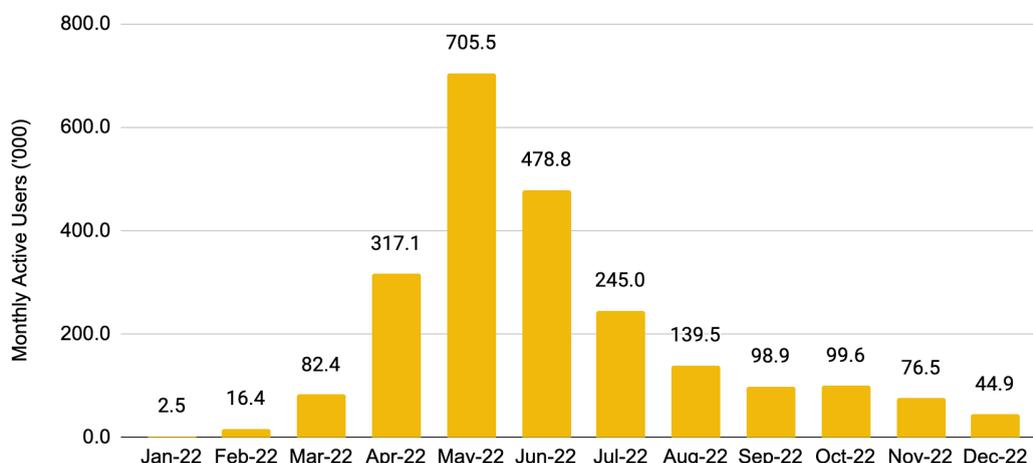
Figure 80: Top 5 games by unique active wallets in the past 30 days



Source: DappRadar, Binance Research
As of 31 Dec 2022

Monthly active users of STEPN peaked in May 2022 at 705K, before falling to less than 45K at the end of the year.

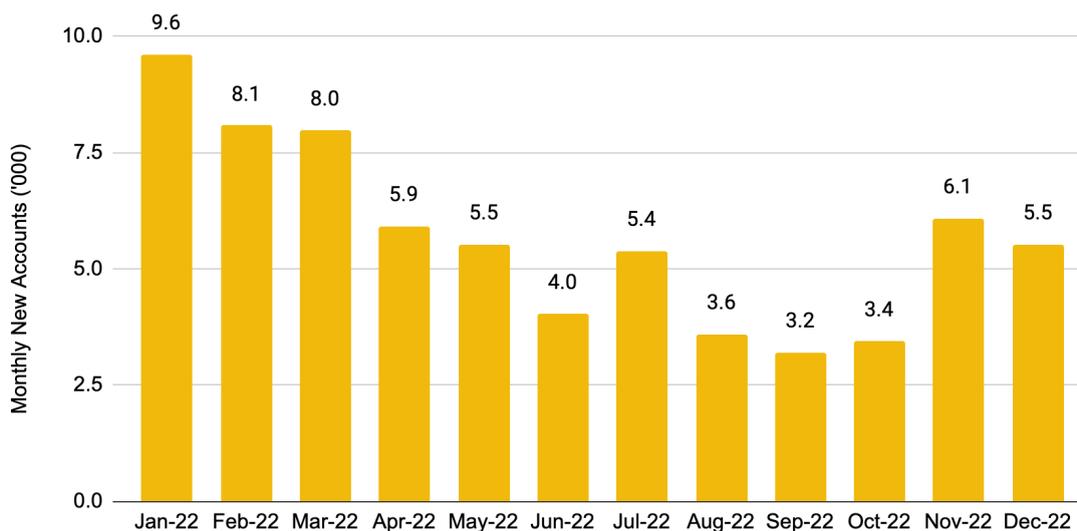
Figure 81: Monthly active users of STEPN in 2022



Source: Dune Analytics (@nguyentoan), Binance Research
As of 31 Dec 2022

Similarly, the number of new accounts created monthly for Axie Infinity has also been on a general downward trend throughout the year, ending the year at 5.5K, or approximately 42% lower than at the start of the year.

Figure 82: Monthly new accounts of Axie Infinity in 2022



Source: Dune Analytics (@Zhai), Binance Research
As of 31 Dec 2022

While the financialization of X-to-Earn games such as STEPN and Axie Infinity was a key driver of growth in the initial stages, it soon became apparent that **financialization by itself, is unlikely to be sufficient in driving sustainable growth in the long run**. Gaming studios and developers need to be extremely deliberate and consider all aspects of the game's tokenomics (demand, supply, emission schedules, utility, etc.). A game solely dependent on incentivizing user adoption through tokens will find it hard to sustain user growth if/when incentives dwindle.

Our stance remains the same and we would like to reiterate what we mentioned in our half-year report:

“When “earning” becomes the primary purpose of playing a game, the long-term sustainability of the game’s ability to attract and retain users is called into question during times of market volatility (e.g. if token falls significantly in value). Instead of a Play-to-Earn model, adopting a Play-and-Earn model might better address this.

In the Play-and-Earn model, earning is an additional value proposition that enhances the gaming experience. Rather than playing to reap financial rewards (likened to a job), designing gameplay that attracts gamers who enjoy the game and as a bonus, earn financial incentives is likely a more market-agnostic model.”

Given the nascency of the crypto gaming industry, we are optimistic and hopeful that there will be an increased number of successful games and diverse gaming models that would appeal to different groups of gamers.

For more details about GameFi Tokenomics, check out our report [here](#).

Metaverse - mass adoption is still some time away

Estimated to generate up to US\$5T in value by 2030⁽⁵³⁾, the metaverse is a virtual shared space that brings together physical and digital realities. The buzzword gained significant attention, especially after the announcement by Facebook to rename the company to “Meta” in October 2021. Subsequently, large institutions and brands like J.P. Morgan, HSBC, Gucci, and Burberry also ventured into the metaverse in 2022. However, general interest in the metaverse has declined steadily over the course of the year.

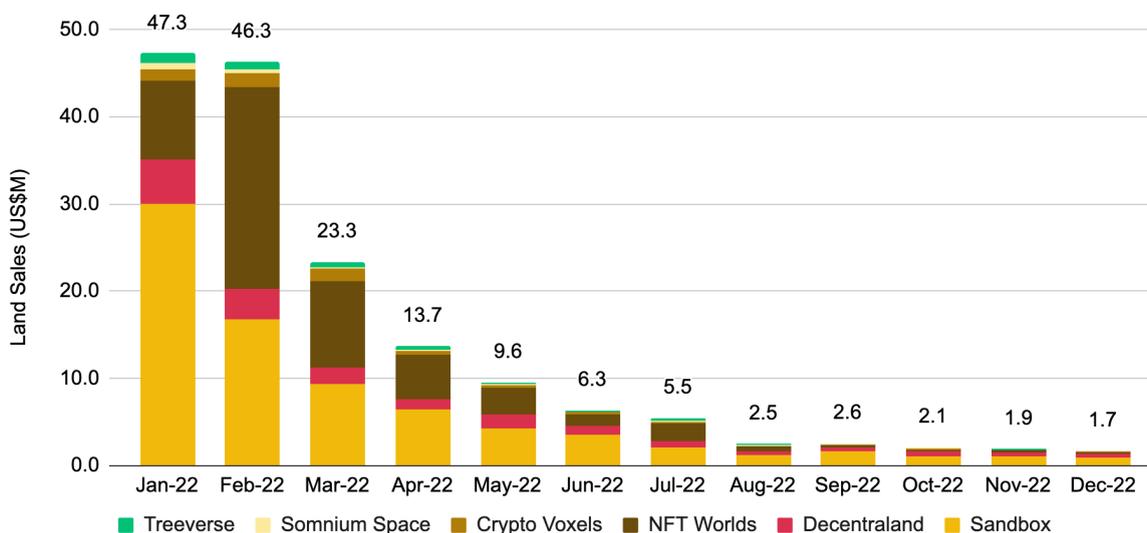
Figure 83: Google search interest has fallen from its peak at the start of the year



Source: Google, Binance Research

Alongside the decline in interest, metaverse land sales have also fallen significantly. Popular Metaverse projects raked in ~US\$1.7M in land sales in December, a decline of over 96% compared to the start of the year. Sandbox remains the dominant metaverse project by land sales, whereas NFT worlds experienced the largest decline in market share after the Minecraft-based game suffered a setback following Mojang Studio’s (Minecraft developer) announcement that they do not support NFT integrations.

Figure 84: Metaverse land sales have fallen over 96% since the start of the year



Source: Dune Analytics (@metaland), Binance Research
As of 31 Dec 2022

Market sentiment aside, key factors affecting land sales include the scarcity of virtual lands, as well as their utility. Unlike physical land, the supply of virtual lands is not constrained by

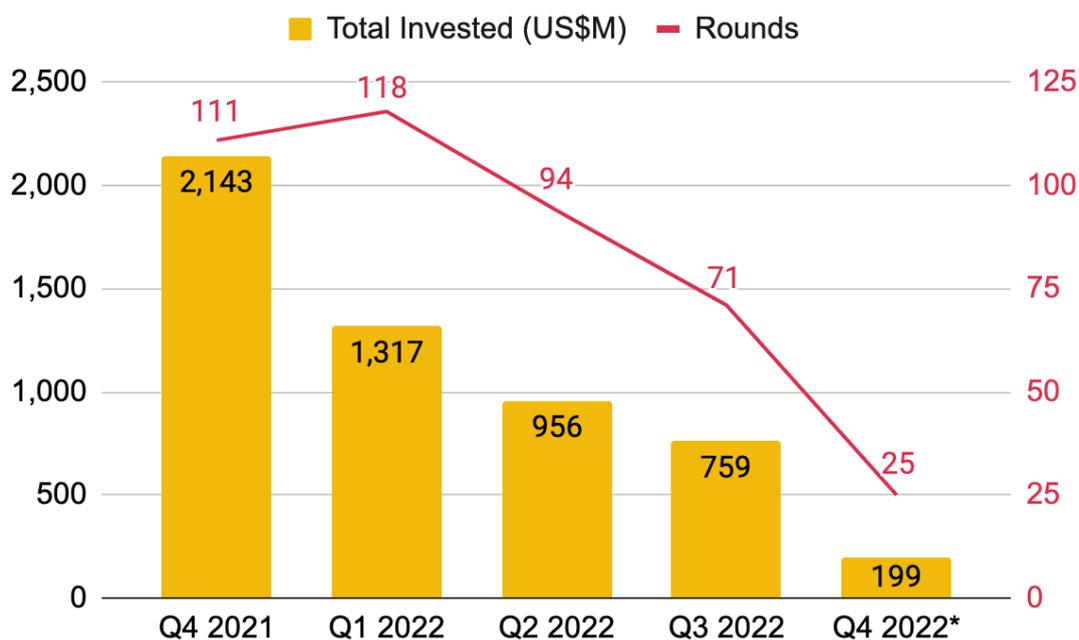
the availability of natural resources or other real-world factors. On the one hand, some argue that introducing a supply cap is positive for land prices. On the other hand, others believe that a supply cap limits long-term growth as users that enter the Metaverse later may not be able to afford land. Our view is that regardless of the decision made on land supply, the demand side of the equation cannot be neglected. Without intrinsic demand for the land, the proportion of speculative buyers would naturally be higher and sales would likely fluctuate depending on market conditions. In this regard, we believe that focusing on driving the utility of metaverse land will help.

Looking at user metrics, it is clear that **mass adoption is still some time away**. Meta had set an initial year-end goal of 500K monthly active users for its metaverse, Horizon World, but has reportedly revised this target down 44% to 280K⁽⁵⁴⁾. Separately, Sandbox and Decentraland previously reported 201K and 56.7K monthly active users respectively in October⁽⁵⁵⁾⁽⁵⁶⁾. For a sense of scale, Roblox, a web2 metaverse-like game, had 56.7M daily active users in Q3 2022.

This is reasonable. It takes time to pioneer new technological standards and building a successful virtual world is undoubtedly a herculean task. Besides having to figure out gameplay strategies, user growth plans, and technical requirements, a key challenge facing the development of the metaverse is the lack of standards and interoperability between different platforms and technologies. This makes it difficult for users to seamlessly move between different virtual environments and for developers to create content that can be accessed and used across multiple platforms.

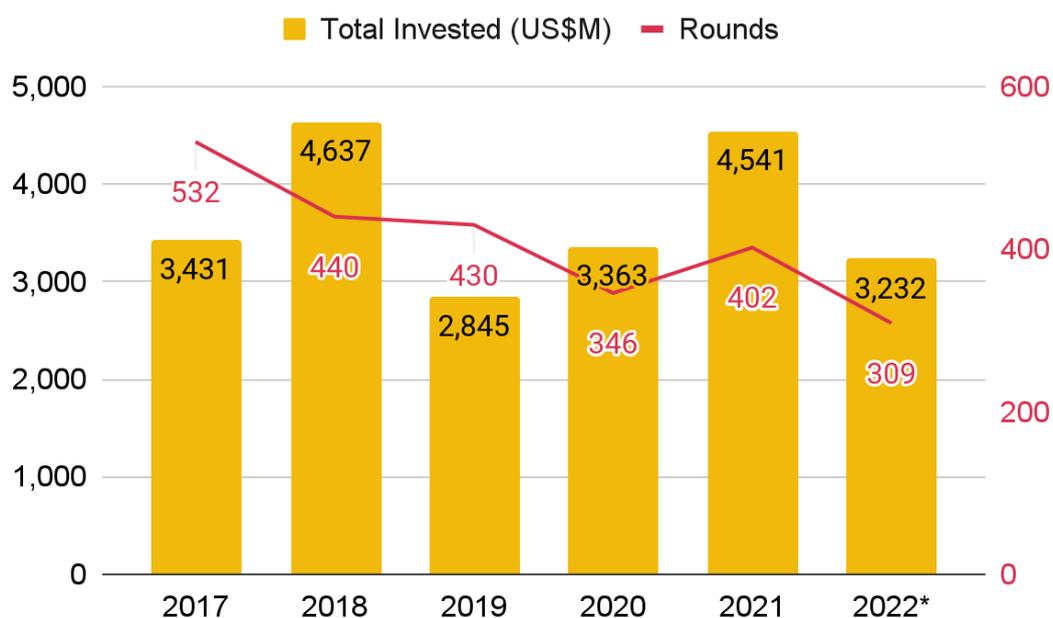
Fundraising activity has also slowed down. Venture investment in companies related to augmented reality (“AR”), virtual reality (“VR”), and virtual worlds has been on a constant decline, with total disclosed investments down over 90% YoY in Q4 2022⁽⁵⁸⁾.

Figure 85: Quarterly venture investment in companies related to AR, VR, and Virtual Worlds



Source: Crunchbase, Binance Research
Data as of 4 Nov 2022

Figure 86: Annual venture investment in companies related to AR, VR, and Virtual Worlds



Source: Crunchbase, Binance Research
Data as of 4 Nov 2022

Nevertheless, that's not to say that deal-making is dead. There were several notable deals that went through over the past year. Highlighting a few that happened in the second half of 2022:

- ❖ **August 2022:** Ready Player Me, a metaverse avatar platform that allows users to explore different metaverses with a consistent identity, closed a US\$56M funding round led by a16z⁽⁵⁹⁾.
- ❖ **September 2022:** LootMogul, an athlete-led sports metaverse firm, received a US\$200M investment from Global Emerging Markets (GEM)⁽⁶⁰⁾.
- ❖ **October 2022:** Improbable, a British metaverse technology company that partnered with Yuga Labs to build the Otherside metaverse, announced it's set to raise a new funding round of US\$111M at a \$3.6B valuation⁽⁶¹⁾.
- ❖ **November 2022:** Animoca Brands's co-founder, Yat Siu, announced plans to launch a US\$2 billion fund to finance businesses related to the metaverse⁽⁶²⁾.

Given the amount of funding received over the past couple of years, the runway for growth remains robust. There are numerous teams working on different aspects of the metaverse - some are working on AR hardware to augment the real world with digital elements, while others are focusing on creating immersive virtual reality experiences. 2022 also had its share of notable highlights. Just to name a few - banks such as J.P. Morgan and HSBC entered the metaverse through Decentraland and The Sandbox respectively⁽⁶³⁾⁽⁶⁴⁾; American rapper, Quavo, took the stage in SecondLive in the first-ever metaverse Hip-hop concert⁽⁶⁵⁾.

Closing Thoughts

Blockchain gaming and the metaverse are in the very early stages of development. Currently, they are still far from mass adoption and need to work through several key issues. Specifically, gameplay and user experience need to improve in order to attract and retain users in a more sustainable manner. Future adoption will also most likely require optimized tokenomics models.

Nonetheless, the long-term potential for blockchain gaming and the metaverse is vast. We are optimistic about the role they will play in the future of technology, entertainment, and communication. The entrance of traditional gaming studios such as Epic Games and Square Enix is a good sign for future growth and could be helpful in onboarding new users who previously had no exposure to blockchain gaming.

Crypto Policy

2022 will likely go down as the year of the crypto policy. While already at the center of attention of policymakers around the globe in previous years, numerous events this year - from the de-pegging of the undercollateralized stablecoin UST, to the uncovering of the ongoing fraud at FTX - have fuelled the policy debate. This has brought us an immediate and sharp focus from regulators. While the increased attention can be seen as positive for the space as regulation helps to bring much-wanted clarity that can drive further adoption, it is essential to make diligent decisions. The depth of crypto policy change is far-reaching and goes beyond the scope of this report. Therefore, we’ve decided to focus on key events only.

Europe - All about MiCA

On Jun 30, 2022, the EU reached a political agreement on **Markets in Crypto-Assets Regulation (“MiCA”)**, the second tranche of key EU crypto regulations alongside TFR and currently one of the first comprehensive and bespoke frameworks for crypto globally. Ending the year, we would name MiCA as a key development for the crypto ecosystem and the policies surrounding it. **While formally adopted, MiCA will only fully come into force in 12-18 months (Q1/Q2 2024).**

Figure 87: In-scope areas of MiCA

MiCA		
Asset-referenced tokens (ART)	Electronic Money Tokens (EMT)	Other crypto-assets
Tokens aiming to maintain a stable value by referencing one or several assets, including fiat currencies, crypto-assets or commodities.	DLT equivalents for coins and banknotes and used as payment tokens. EMTs must be backed by one fiat currency which is a legal tender.	Tokens with a digital representation of value or rights which may be transferred and stored electronically. Utility tokens which provide access to a good or service and only accepted by the issuer of that token. Payment tokens which are not EMTs or security tokens

Source: Binance Research, PwC

We are cautiously optimistic about MiCA and see it as a good first attempt at creating comprehensive regulation for digital assets. Looking closer at some key components, it is encouraging to see that the initially feared proof-of-work (“PoW”) ban did not end up being part of MiCA. Instead of outright banning PoW blockchains, Crypto Asset Service Providers (“CASPs”) will have to disclose information on the sustainability of the crypto-assets and

their consensus mechanisms. CASPs are now required to separate client funds in cases of insolvency. Additionally, CASPs must establish presence in the EU to ensure they can be held liable for losses derived from hacks or other exploits.

The current regulation is differentiating between asset-referenced tokens (“ART”), e-money tokens (“EMT”), utility tokens, and other crypto assets. ARTs encompass stablecoins that reference other assets, including fiat currencies, whereas EMTs mainly focus on stablecoins that references one single fiat currency. In contrast, utility tokens intend to provide access to a good or service. Interestingly, utility tokens that relate to services already in existence have “lighter” requirements than those related to services not yet in existence.

Stablecoins deserve a standalone category within MiCA, and the current regulation is relatively strict. The fact that the algorithmic stablecoin UST de-pegged just months before the regulation was announced definitely didn’t help. Under current regulation, issuance is expected to be restricted to “credit” or “electronic money institutions”. MiCA regulation introduced further supervision, with the European Banking Authority (“EBA”) having supervisory authority over “significant” stablecoins. Additionally, stablecoin issuers now need a presence in the EU and have to ensure that the reserves are protected in case of insolvency. This includes algorithmic stablecoins, effectively banning them from the EU.

Areas such as NFTs and DeFi will be addressed in a later consultation as they are currently not in scope. This is beneficial for DeFi as there is no rush and they prioritize internal education of the sector before deeming regulation. As of now, regulation covering DeFi is expected for 2023. Also out of scope are so-called central bank digital currencies (“CBDCs”) as well as digital assets which cannot be transferred and are offered for free.

“If we can harness the benefits of digital technology, we may hope to see a more democratized, even more inclusive, financial sector. But there are serious risks that investors will be subject to misinformation, and that the lines between regulated and unregulated products become blurred”

Verena Ross - Chair of the European Securities and Markets Authority

The compromise text published on 5 October 2022 is currently expected to be the final version of MiCA subject to Parliament's agreement. After some initial confusion regarding the interactions between EMTs under MiCA and the Electronic Money Directive (“EMD”), the compromised text, published at a later date, clarified that e-money tokens are deemed e-money under the EMD. Another key change coming with the compromised text is that the overall scope has been narrowed, stating that a crypto-asset must use cryptography for security. The text further confirms the above that crypto-assets that are unique and not

fungible are outside the scope. In the current version, an asset being an NFT does not exclude the asset also being a financial instrument. As of now, the compromise text does not provide guidance on what would count as “unique” and “fungible”. We expect more clarity on this in 2023.

US - Between SEC and CFTC

MiCA, while core for developing further regulation and clarity in Europe, is just one element of crypto policy this year. Regulatory developments have also happened in other jurisdictions - e.g., the Central African Republic making Bitcoin a legal tender. To get a better view of the developments within the policy space this year, let us look further at the United States.

Zooming into the regulatory framework in the US, it is encouraging to see developments despite the overlaps and differences in viewpoints between the two leading agencies, the **Security Exchange Commission (“SEC”) and the Commodity Futures Trading Commission (“CFTC”)**. In addition to those two, we have the **Treasury’s Financial Crimes Enforcement Network (“FinCEN”) and the Federal Reserve Board making it clear that there are different actors all pulling at the same string.**

With a lot of ongoing confusion entering 2022 about who is responsible for what, an executive order on “Ensuring Responsible Development of Digital Assets” was signed by President Joe Biden to direct the different agencies regarding regulatory efforts. With the additional acknowledgment of the potential of the cryptocurrency industry, the importance of digital assets for the future became clear.

“We must reinforce United States leadership in the global financial system and in technological and economic competitiveness, including through the responsible development of payment innovations and digital assets.”

- White House - Executive Order on Ensuring Responsible Development of Digital Assets

Looking closer at the March order, we can see how the US took a holistic approach to address risks. The six key priorities emphasized in the report include:

- ❖ Consumer and investor protection
- ❖ Financial stability

- ❖ Illicit finance
- ❖ U.S. leadership in the global financial system
- ❖ Financial inclusion
- ❖ Responsible innovation

Thus far, regulators in the US have focused mainly on enforcement efforts of unregistered securities offerings and scams. However, considering the uncovering of the ongoing fraud at FTX, it is likely that stricter advertising regulations could come into place through this year to drive further investor protection. Many major questions about how the U.S. will regulate digital assets remain in the air.

Another key policy development in the US this year has been the **Digital Commodity Exchange Act (“DCEA”)**, which provides clarity to the digital commodity marketplace by creating a regulatory framework for digital commodity developers, dealers, and exchanges. The DCEA fills the gaps between the CFTC’s and SEC’s regulation of the digital asset marketplace and is complementary to the existing regime. This bill, if passed, will establish a reporting regime for cryptocurrency exchanges in the country. More importantly, this bill will further signal that the US is taking the growth of its cryptocurrency space seriously.

Figure 88: Personnel changes from Trump to Biden

	Trump	Biden	Current
Treasury	Steven Mnuchin	Janet Yellen	Janet Yellen
SEC	Jay Clayton	Gary Gensler	Gary Gensler
CFTC	Chris Giancarlo, Heath Tarbert	Rostin Behnam	Rostin Behnam
OCC	Joseph Otting, Brian Books		Michael Hsu (act.)
FinCEN	Kenneth Blanco		Himamauli Das (act.)
OFAC	Andrea Gacki		Andrea Gacki (act.)
Federal Reserve	Jerome Powell	Jerome Powell	Jerome Powell
FDIC	Jelena McWilliams		Martin Gruenberg (nom.)
CFPB	Kathy Kraninger	Rohit Chopra	Rohit Chopra
NCUA	Rodney Hood	Todd Harper	Todd Harper

Source: Binance Research, Coindesk

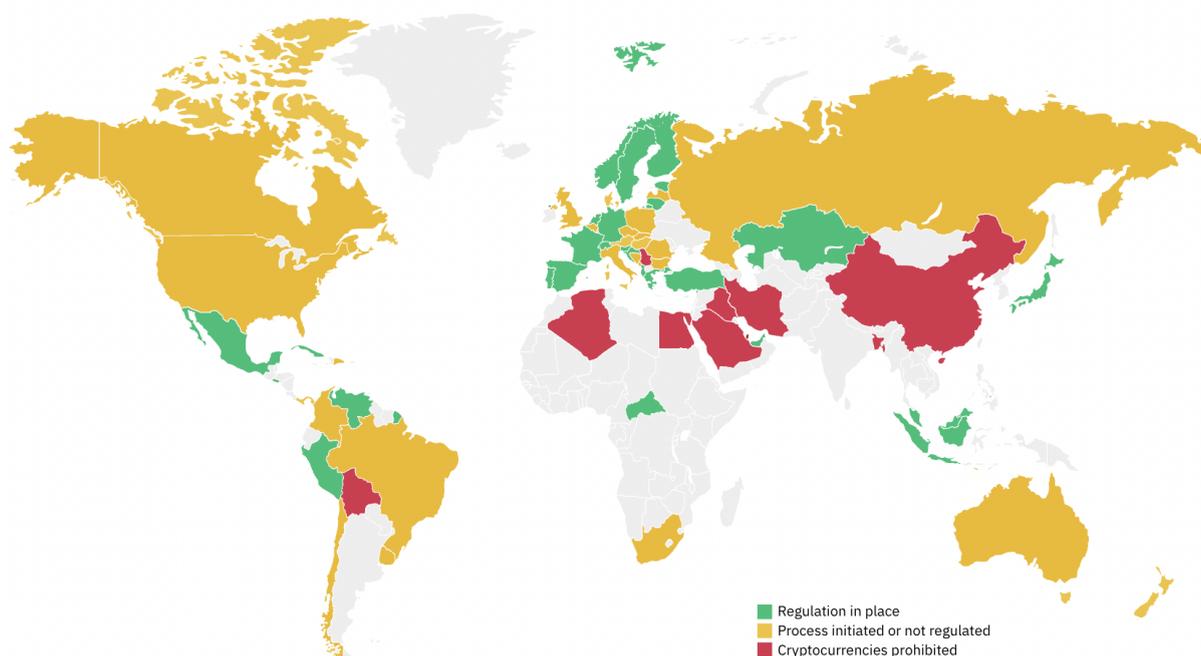
Following the March order, the White House published a follow up document summarizing the takeaways of nine follow-up reports. The “Comprehensive Framework for Responsible Development of Digital Assets” suggests a federal regulatory regime for nonbank payment

providers. In addition to that, the report calls for measures to mitigate the downside risks, like increased enforcement of existing laws and the creation of common sense efficiency standards for cryptocurrency mining. It further recognizes the potential benefits and risks of a US CBDC, encouraging the Federal Reserve to continue its ongoing CBDC research.

Outlook

In many countries, crypto appears to be at a legal and regulatory tipping point. Concerns about financial stability and vulnerable customers, coupled with persistent misperceptions about financial crime are driving policymakers to consider significant action. At this important juncture, it is crucial that policymakers balance all considerations in order to allow for healthy adoption and growth of the space. Looking at the ongoing developments under consideration of regulation in place or ongoing, we can observe that **in most jurisdictions, no final regulation is in place yet, and most processes have only been initiated.** Even in those jurisdictions that have regulations in place, it is likely that we will see a change in the future with overarching regulation guiding countries.

Figure 89: Overview of key locations and the existence of a regulatory framework



Source: Binance Research, PwC, www.globallegalinsights.com

As of now, many existing policies, standards, and jurisdictional regulatory frameworks covering traditional financial assets are still relevant for crypto assets. However, the extent to which authorities can effectively apply these international standards across jurisdictions depends on the extent to which these standards and policies are reflected in their domestic legal and regulatory frameworks.

“The objective should be to provide a comprehensive and coordinated approach to managing risks to financial stability and market conduct that can be consistently applied across jurisdictions, while minimizing the potential for regulatory arbitrage, or moving activity to jurisdictions with easier requirements”

- IMF - IMF Blog by Tobias Adrian, Dong He, Aditya Narain

The current opportunities and risks extend well past crypto-assets themselves encompassing a rapidly expanding range of financial services. The future of crypto will depend critically on the regulatory response to new activities and how fast the traditional financial system modernizes. As regulation develops and regulators gain powers, enforcement under these new regimes is inevitable. Financial stability and integrity are two elements that are at the center of the attention of many regulators around the world. During the year, it became clear that identification, monitoring, and management of risks are key elements that need to be addressed to create a sustainable environment for further crypto adoption. The aspects of financial integrity have reached almost every aspect of the crypto ecosystem, reaching from exchanges to wallets, to investor protection. Thus, while crypto-assets account for only a small portion of overall financial system assets with a total market capitalization of less than US\$1T, their rapid growth requires more attention from regulators.

Figure 90: Overview of regulation in key locations



Source: Binance Research, PwC

Fundraising Activity

While the first half of the year showed resilience in terms of venture capital investments, it became obvious as the year came to a close that fundraising activities have not been unaffected by the decline in crypto prices and the turmoil caused by exogenous events.

Looking closer at the top funds that raised capital this year, the first half of the year was the most pronounced in terms of activity. Following the downfall of the Terra blockchain, the collapse of FTX, and the overall downward trend in crypto asset prices, activities in terms of fundraises have slowed down. Andreessen Horowitz stands out, having raised the highest amount of capital this year. **The top 10 funds raised a record US\$12.5B in 2022.** With the exception of the Epic Games Metaverse Fund, most funds focus on DeFi, Infrastructure, and overall web3 opportunities.

Figure 91: Top 10 raises by web3-focused funds

Fund	Amount raised	Date	About
Andreessen Horowitz Crypto Fund 4	US\$ 4.5B	05/25	Of that, approximately US\$1.5B will be dedicated to seed investments and US\$3B to venture investments. This brings the total crypto/web3 funds raised by a16z to over US\$7.6B.
FTX Ventures Fund	US\$ 2B	01/14	Impacted by FTX bankruptcy.
Epic Games Metaverse Fund	US\$ 2B	04/11	Fortnite creator Epic Games has raised \$2 billion from Sony Group Corporation and Kirkbi, the investment company behind The Lego Group. The funding will support Epic Games' efforts to build the metaverse.
Haun Ventures	US\$ 1.5B	03/22	Katie Haun broke away from Andreessen Horowitz (a16z) to form Haun Ventures, raising US\$1.5B to focus on web3 - the largest debut fund ever by a female VC.
Ivy Blocks	US\$ 1B	06/10	Ivy Blocks is part of Huobi's newly formed investment arm and will focus on DeFi and web3 ventures.
Brevan Howard Digital	US\$ 1B	08/04	Brevan Howard Digital ("BH Digital") was launched in September 2021 and is the dedicated crypto and digital asset division of Brevan Howard.

Fund	Amount raised	Date	About
Flow Ecosystem Fund	US\$ 725M	05/10	With a focus on enabling more distributed and equitable web3 opportunities, the Ecosystem Fund will support existing and future developers in building applications on the Flow blockchain.
Dragonfly Capital Fund 3	US\$ 650M	04/27	In Fund III, Dragonfly aims to double down on crypto infrastructure, DeFi, smart contract scaling, consumer products, crypto games, and DAOs.
Sequoia Capital Token Fund	US\$ 600M	02/17	The Sequoia Crypto Fund is focused primarily on liquid tokens and digital assets as a complement to their ongoing crypto investments, serving as a subfund of the firm's flagship Sequoia Capital Fund.
Electric Capital	US\$ 600M (Tokens) US\$ 400M (Ventures)	03/01	US\$400M vehicle for making equity investments in startups and a US\$600M fund intended to invest directly in crypto tokens.
Andreessen Horowitz Gaming Fund One	US\$ 600M	05/19	a16z's inaugural fund dedicated to building the future of the games industry.
Bain Capital Ventures	US \$ 560M	03/08	The capital will be invested mainly in crypto-focused infrastructure and DeFi.

Source: Binance Research

2022 had not only been a year of staggering fundraises by venture capitalists, but also by companies in the space who had raised record-breaking amounts, with the first half of the year especially standing out. Throughout the second half of the year, we saw valuations come down, so despite ongoing raises, the amounts were considerably lower than during the first half. Compared to 2021, the average deal size of Series A investments was down, with investors shifting their focus towards early-stage growth.

The Luna Foundation Guard, the non-profit organization behind the Terra blockchain, and Citadel Securities, raised the highest amount of capital at US\$1B and US\$1.15B at the beginning of the year. The top 10 biggest raises by web3-focused projects account for close to US\$6B.

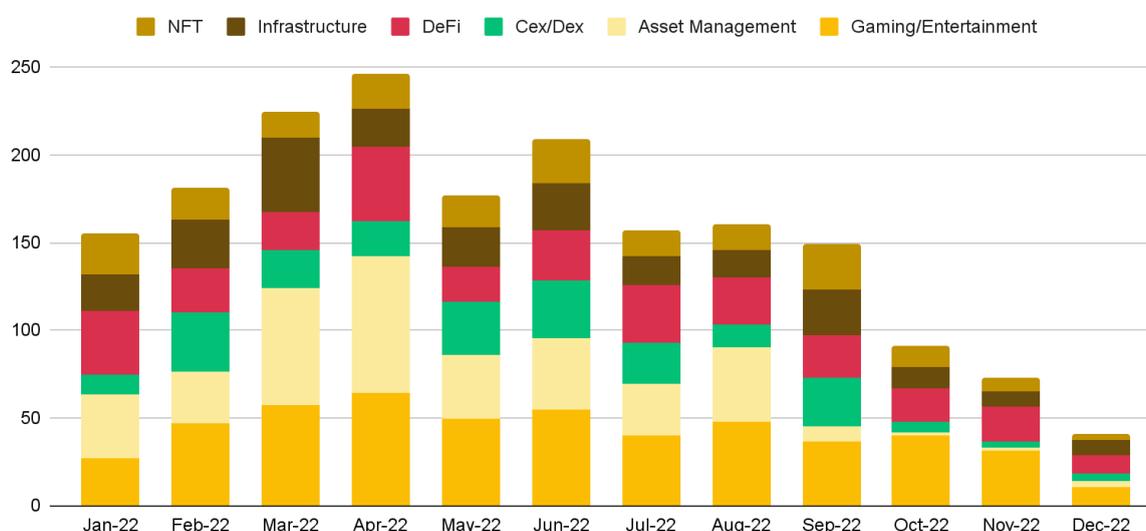
Figure 92: Top 10 raises by web3-focused projects

Fund	Amount raised	Date	About
Luna Foundation Guard	US\$ 1B	02/22	The capital was supposed to be used to create a new reserve that can act as a “release valve” for UST redemptions during selloffs in crypto markets. Jump Crypto and Three Arrows Capital led the raise. UST de-pegged earlier this year.
Citadel Securities	US\$ 1.15B	01/11	The partnership with Paradigm, a web3-focused investor, signaled Citadel Securities’ shift toward new asset classes such as crypto.
Cross River	US\$ 620M	03/30	Cross River, a provider infrastructure for embedded financial solutions, received US\$620M to expand its crypto solutions, along with payments, cards, and lending tools.
Fireblocks	US\$ 550M	01/27	Fireblocks, a platform that provides custody, staking, and crypto solutions for institutions, saw a Series E round of US\$550M to expand its protocol support to further blockchains.
Yuga Labs	US\$ 450M	03/22	Yuga Labs, best known for creating Bored Ape Yacht Club, raised US\$450M in a seed round to help scale its operations.
ConsenSys	US\$ 450M	03/15	ConsenSys, one of the biggest creators of Ethereum-centric decentralized protocol software, raised a series D of US\$450M to help align the company's treasury strategy by rebalancing its ETH to USD ratios.
Polygon	US\$ 450M	02/07	Polygon, an Ethereum scaling platform that allows decentralized applications to operate with low fees, raised US\$450M to invest in zero-knowledge (“zk”) technology to expand the reach of web3 further.
Circle	US\$ 400M	04/12	Stablecoin issuer Circle raised US\$400M headlined by BlackRock and Fidelity. This follows a US\$440M raise last May.
FTX	US\$ 400M	01/31	FTX raised US\$40M in a Series C funding round that gives the cryptocurrency exchange a mammoth US\$32B valuation.
FTX US	US\$ 400M	01/26	In a Series A funding FTX US, valued at US\$8B, after raising US\$400M from investors including Japan's SoftBank Group Corp and Singapore's Temasek Holdings.

Fund	Amount raised	Date	About
Animoca Brands	US\$ 359M	01/18	In January this year, Animoca Brands raised US\$359M at over US\$5B valuation. In September, Animoca Brands raised an additional US\$110M in funding led by Temasek, Boyu Capital, and GGV Capital.
Near Protocol	US\$ 350M	04/06	Near Protocol raised a new funding round of US\$350M led by Tiger Global.
Mysten Labs	US\$ 300M	09/08	In September, Mysten Labs raised a US\$300M funding round to boost the adoption of web3. FTX led the round, with the participation of a16z crypto, Apollo, Binance Labs, Franklin Templeton, and Coinbase Ventures, valuing the company at US\$2B.
Amber Group	US\$ 300M	12/16	Amber Group, a digital asset services company, raised US\$300M in a Series C funding round led by Fenbushi Capital.
OpeaSea	US\$ 300M	01/04	OpenSea, the leading player in the NFT space, has raised a new round of US\$300M, valuing the company at US\$13.3B, doubling its valuation from the last round in July 2021.

Source: Binance Research

Looking at 2022 as a whole, we saw a year of record-breaking VC investment and fundraising activities. In more than 2,000 deals this year, a lot of capital has been deployed in areas such as Gaming and DeFi. Zooming into key events, we can see that 2022 had been a very front-loaded year with funds raising high amounts of capital that they're now looking to deploy. Throughout H2 2022, dealmaking activities had generally decreased, which is in line with our understanding of the market sentiment. **As such, we expect further volatility before the full impact of some major bankruptcies in H2 2022 will be visible.** Considering the amount of capital available to be deployed in this year and the talent available in the space, we remain cautiously optimistic for 2023. However, a slowdown in hiring and higher interest rates are likely to leave a significant impact and could cause activities to slow down with a focus on "BUIDL"ing rather than growing. As such, 2023 might be a foundational year that sets up the crypto space for future growth in the long term.

Figure 93: Number of Venture Capital crypto investments

Source: Binance Research, Binance Labs
As of 31 Dec 2022

Gaming and Entertainment stand out across 2022 as the sector with the majority of investments in terms of the number of deals. This isn't surprising given the high raises we've seen with companies like Epic Games and Animoca Brands. Asset Management ranked second, with a lot of activity in the first half of the year. DeFi and NFTs saw consistent numbers throughout 2022. Infrastructure experienced a decline in investments over the course of the year but witnessed an increase in the overall monthly investments on a percentage basis. For example, NodeReal, raised US\$16M in a Series A funding led by Sky9 Capital. NodeReal is a blockchain infrastructure provider that aims to offer scalable, reliable, and efficient blockchain solutions to support the growth of the web3 ecosystem. Overall, the total number of investments had declined throughout H2 2022. Considering the extreme volatility in the last two months, Q4 recorded considerably lower numbers.

We believe there are still traditional financial institutions finding ways to gain crypto exposure and capital that was raised but not yet deployed. Following the ongoing volatility and the collapse of FTX, we believe that traditional institutional investors and venture capitalists will be more cautious going forward, likely bringing down valuations further and potentially leading to a slowdown in investments throughout 2023.

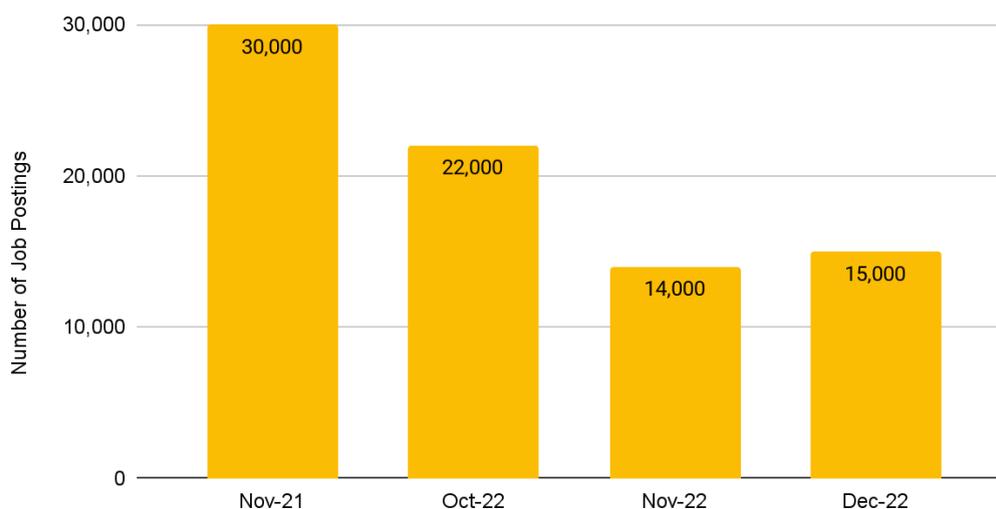
“Fundamentals and profitability rather than growth will be key aspects for investors in 2023”

Since blockchain-focused companies still continue to show signs of high pre-money valuations with deal sizes that are above traditional technology companies, we will likely see valuations come down in 2023 with a newfound focus on fundamentals and profitability rather than growth. Compared to 2021, there had already been declines in median pre-money valuations through 2022, although all VC pre-money valuations are down. Additionally, the median deal size for crypto increased over the first three quarters of 2022, while the median deal size for all of VC was much lower than the crypto industry.

In addition to that, we will **likely see an increased number of crypto financings and restructuring situations that acquisitions and divestments will likely accompany.** Companies forced to sell off assets could drive overall valuations lower for the space, which could be the deciding factor that could cause a new wave of investments. Just ending 2022, we have seen how traditional financial companies like Goldman Sachs got ready to deploy tens of millions of dollars to invest in crypto companies after witnessing the collapse of FTX. According to Goldman's head of digital assets, Mathew McDermott, "FTX's implosion has heightened the need for more trustworthy, regulated cryptocurrency players".

As highlighted in our [half-year report](#), there have been underlying issues that the space is still fighting. A general slowdown in hiring signals that those companies that received investments earlier this year prepared themselves for a longer-than-average bear market. **The current number of outstanding jobs on LinkedIn for "Crypto" is at a low of 15,000 results**, while general "Tech" jobs account for more than 590,000 job advertisements on the platform. Throughout the year, we saw layoffs in a number of companies.

Figure 94: Number of crypto job postings on LinkedIn



Source: Binance Research, Yahoo, LinkedIn
As of 31 Dec 2022

The next few months could provide a better picture given the current challenging market conditions. As such, the best is to keep your eyes open and to continue observing where the money is flowing.

Our Top Pieces of 2022

Before we touch on what we are excited for in 2023, check out our top research reports in 2022 by clicking on the images below. For other analysis, visit us at our [website](#).



Tokenomics - Deep Dive

Learn about the Supply and Demand dynamics that drive Tokenomics



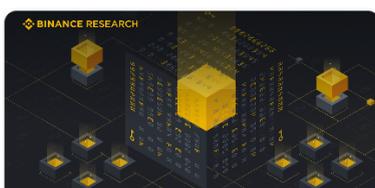
Move - The Next Step in Smart Contract Programming?

What is the Move programming language and its unique features? Do we need a new smart contract programming language?



Interoperability Solutions: Connecting Worlds

An analysis of the interoperability landscape



Aptos and Sui - The New Kids on the Block

Introduction to the alternative Layer 1 solutions Aptos and Sui



GameFi Tokenomics - Deep Dive

Learn about the key elements of GameFi Tokenomics



zkEVM and the Future of Ethereum Scaling

Learn everything you need to know about zero-knowledge Ethereum Virtual Machines

Key Themes in 2023

Looking ahead, we are excited about the developments in this BUIDL market and are actively monitoring the following trends in 2023.

- ❖ **Macroeconomics matter:** The macro environment is key in driving returns of risk assets. Central bank policies, global growth data, and recession risks will set the stage for whether macro factors serve as a tailwind or headwind for crypto in 2023. As crypto matures and more institutional players enter the space, correlation between traditional and crypto markets could increase.
- ❖ **Real-world assets as an alternative source of growth:** Certain DeFi and NFT projects may look outside of the crypto ecosystem to find additional growth opportunities given muted crypto activity. Integration with real-world assets could be in the form of assets tokenization or the acceptance of real-world assets as collateral.
- ❖ **Liquid staking narrative gains steam:** As we get closer to the date that staked ETH can be withdrawn, there will be greater awareness, understanding, and willingness to participate in staking. Liquid staking protocols as a whole may benefit from this narrative although market share shifts are also likely.
- ❖ **Utility is key for NFTs:** To drive the next phase of adoption and move beyond profile picture NFTs, we look forward to more innovation on the front of soulbound tokens, integrations with blockchain games, partnerships with web2 companies, and other real world use cases.
- ❖ **Improvement in gameplays:** Given the spotlight on quality of games, we expect more focus by developers to improve the gameplays of the next generation of blockchain games. Teams that are able to successfully create quality AAA games will have a higher chance of attracting gamers.
- ❖ **Greater regulatory clarity:** In the last year and a half, we've seen substantial progress in creating greater regulatory certainty for the cryptocurrency space. Regulators are, understandably, going to be much more skeptical, and regaining public trust will be challenging for crypto. However, more regulatory clarity will prove beneficial for the blockchain space in the long run.

Conclusion

2022 served as a reality check for many in the crypto space. Challenging macro conditions, black swan events, and the implosion of notable companies brought to the fore the importance of factors such as fundamentals, valuations, and tokenomics, among others. That said, a bear market is the perfect time to BUIDL. 2022 may have seen some down signals in terms of price action, but it seems as though industry goals have never been stronger. The year has brought forth much promise in various sectors and the solutions that came forward were the result of learning from the failures over the past cycle.

Since many reflected upon 2022 with Warren Buffett's famous quote regarding the swimming and the tide, we thought it made sense to look further into the future with a Warren Buffett quote as well: "Uncertainty is the friend of the buyer of long-term values." While it may be hard to see the light at the end of the tunnel in times of uncertainty, such market environments can provide opportunities for investors and project teams that have a long-term vision. Regardless of whether uncertain market conditions prevail in 2023, time is undoubtedly on the side of the builders and settlers. We look forward to a host of innovations across sectors and the overall advancement of technological frameworks to ensure the sustainable growth of the ecosystem. When building an industry like crypto that has the potential to change the way we think, interact, and build, we are bound to face challenges and failure. However, these challenges will only strengthen the industry and make us more resilient in the quest for monetary freedom.

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About Binance Research

Binance Research is the research arm of Binance, the world's leading cryptocurrency exchange. The team is committed to delivering objective, independent, and comprehensive analysis and aims to be the thought leader in the crypto space. Our analysts publish insightful thought pieces regularly on topics related but not limited to, the crypto ecosystem, blockchain technologies, and the latest market themes.



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