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Investing in Blockchain Technology, Digital Currency, and Crypto Assets

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1. INTRODUCTION

1.1 THE STATE OF THE MARKET

Blockchain investing has experienced an incredibly eventful and volatile few years, marked by extreme highs and lows. 2021 saw the crypto market soar to record heights, with Bitcoin hitting an all-time high of nearly \$69,000 in November 2021, while Ethereum also reached a new peak above \$4,800¹. This bull run was fueled by growing mainstream adoption, the NFT boom, and optimism around emerging sectors like DeFi.

However, the exuberance proved short-lived, as 2022 brought a series of catastrophic meltdowns that sent crypto markets into a tailspin. It began with the stunning implosion of the Terra ecosystem in May, which saw the UST stablecoin lose its peg and the LUNA token crash to nearly zero, erasing around \$40 billion in value². This debacle contributed to the downfall of major crypto hedge fund Three Arrows Capital (3AC), which defaulted on over \$3 billion in loans and went bankrupt.

The contagion spread as crypto lenders Celsius and Voyager, which had exposure to 3AC, also went bankrupt. But the biggest bombshell was yet to come, as top-tier crypto exchange FTX suddenly unraveled in November, revealing a massive fraud. Around \$8 billion in customer funds went missing as FTX and over 130 affiliates filed

for Chapter 11. Disgraced founder Sam Bankman-Fried was arrested and now faces a lengthy prison sentence³.

The industry was further rocked by continuous thefts of crypto exchanges and DeFi protocols. All told, the 'crypto winter' erased nearly \$2 trillion in market value. However, the storm clouds began to lift in 2023 as markets stabilized and regulators cracked down on bad actors. In a surprise twist, Bitcoin surged to a new all-time high above \$70,000 in March 2024, ahead of the historical pattern centered around the Bitcoin halving.

This resurgence has been bolstered by the long-awaited approval of Bitcoin ETFs in the U.S., a fresh wave of institutional investment, and the April 2024 halving, which slashes the Bitcoin mining reward and puts deflationary pressure on the supply. Meanwhile, the number of unique cryptocurrencies has exploded to over 2 million⁴. It remains uncertain whether this uptrend will persist, as geopolitical volatility involving Iran, Israel, Palestine, Ukraine, Russia, and other regions has been wreaking havoc on broader markets, including the cryptocurrency space, and only time will tell if crypto can weather these storms and experience the typical post-halving bull run once again.

1.2 WHAT IS BLOCKCHAIN?

Advancements in cryptography, computing, and consensus-based algorithms led to the breakthrough that is blockchain in 2008 – a replicated ledger with the promise to distribute trust⁵, potentially disrupting industries such as finance, health care, and the supply chain by removing long-standing intermediaries. These replicated ledgers record and verify transactions using various consensus algorithms, the most well-known of which are Proof of Stake (PoS) and Proof of Work (PoW). In the early days of the market space, this technology was applied with new financial payment methods, such as Bitcoin.

However, second-generation blockchains such as Ethereum⁶ soon emerged, enabling code to be stored on the blockchain, such that any application could be dis-intermediated.

Third-generation “blockchains” are emerging that solve some of the inherent restrictions with common blockchain architectures, such as scalability and inefficiency. Some examples are IOTA⁷ and Nano⁸.

1.3 WHAT IS DIGITAL CURRENCY?

A digital currency is a currency that only exists electronically. Using the analysis⁹ of money in terms of four functions as defined by William Stanley Jevons, a currency, including digital currency, may act as a medium of exchange, as a common measure of value, as a standard of value, and as a store of value. Given the many risks of digital currencies, as well as their high volatility, they may not satisfy these functions particularly well, but they satisfy these functions nonetheless.

1.4 WHAT ARE CRYPTO ASSETS?

Crypto Assets are a combination of new payment systems with

new currencies not issued by central banks. Crypto Assets are more broadly encompassing than digital currencies, and include assets such as utility tokens, security tokens, and payment (or exchange) tokens.

The explosion of Ethereum-based projects, using “utility tokens” to power their networks, coupled with market immaturity and a lack of regulatory understanding, led to a subsequent bust and failure of most projects. The current state of United States Securities and Exchange Commission regulations leaves most supposed “utility tokens” to be considered securities, and without proper regulatory compliance, many Ethereum-based projects are by default in violation of strict financial regulations. However, the ICO and cryptocurrency market has not made any definitive moves to adhere to regulations, causing much of the corporate and enterprise level to shy away from anything “crypto”-related.

A new use-case is emerging, more reminiscent of the first application of blockchain—to finance, known as security tokens, alongside Security Token Offerings (STOs). Security Tokens aim to achieve regulatory compliance and be functionally similar to traditional securities, with several potential advantages. These advantages center around higher operational efficiency.

Payment tokens are the traditional and long-standing crypto-payment instruments such as Bitcoin. Tokens arising from Token Generation Events such as ICOs are launched to create crypto-payment tokens, as the issued tokens function as a means of exchange, a unit of account, or a store of value¹⁰.

2. INVESTMENT SECTORS AND THESESES

2.1 OVERVIEW

In a nutshell, there are three main layers of opportunity for value creation and capture in blockchain:

1. **Infrastructure**
2. **Protocols**
3. **Applications**

Infrastructure enables the operation of protocols and high-level applications, using hardware, software, and services. Protocols exchange information about applications securely, using software allowing blockchain nodes to communicate. Finally, applications leverage trustless protocols to exchange value between entities, using utility software.

Just as in web2, where most companies build applications on top of a relatively small number of core internet protocols (like HTTP and SMTP) and cloud infrastructure providers (like AWS, Azure, and Google Cloud), the blockchain space is converging around a few dominant Layer 1 protocols and infrastructure players.

On the protocol side, Bitcoin's Proof-of-Work and Ethereum's Proof-of-Stake are the two best-known consensus mechanisms, with al-

ternatives like Cardano's Ouroboros still trailing in adoption. These base-layer protocols provide the foundational security and decentralization that higher-level applications require.

When it comes to blockchain infrastructure, node-as-a-service providers like Blockdaemon, Alchemy, QuickNode, and Ankr are emerging as the AWS or Azure of the decentralized world. By offering reliable and scalable node infrastructure, these companies allow developers to build blockchain applications without worrying about the underlying plumbing.

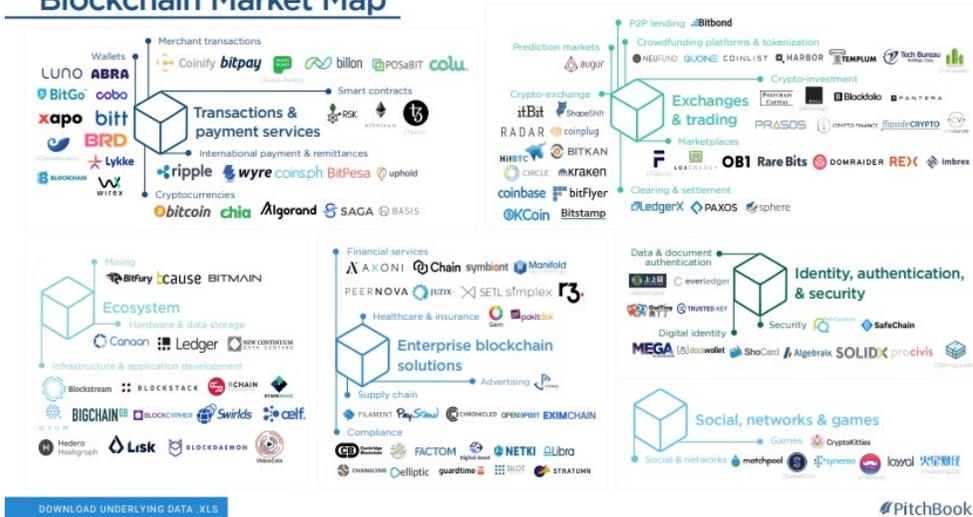
However, the vast majority of blockchain projects and startups are focused on the application layer, building consumer-facing products on top of these infrastructure and protocol layers. From DeFi lending platforms to NFT marketplaces to supply chain trackers, most of the innovation and value capture is happening at the application level.

This mirrors the evolution of the web2 world, where protocols like HTTP and infrastructure like cloud computing enabled the rise of application-layer giants like Facebook, Google, and Amazon. In the coming years, we can expect to see a similar dynamic play out in web3, with a few core protocols and infrastructure providers supporting a vibrant and diverse ecosystem of decentralized applications.

2.2 LEADING PLAYERS

The blockchain market is turning out to be highly competitive, but not so much on the institutional front – startups and unicorns are fighting for market domination, with many institutions on the sidelines waiting for an entry point.

Blockchain Market Map



2.2.1 STORAGE (INFRASTRUCTURE) LEADERS

The main elements of the infrastructure layer are storage, processing, and communication¹¹.

As a fundamental computing element, storage includes token storage, databases, file systems, and data marketplaces.

Token storage systems are needed to issue and transfer tokens, which have different variants such as ERC-20 or ERC-721, as well

as to prevent double-spending. Well known examples on the storage side include Bitcoin, IPFS, BigchainDB, and IOTA.

Databases are needed to store structured metadata, like tables and key-value stores, and then retrieve the data via queries. Well known traditional databases include MongoDB with query languages like SQL. Decentralized databases include BigchainDB, which have benefits such as tamper resistance and token support.

File systems are needed to store large files, which blockchain is not adept at due to its lack of scalability, and the fact that it replicates data across all nodes. Decentralized file systems include IPFS and Storj.

Finally, data marketplaces connect data owners and consumers. Perhaps the most well-known example is Ocean Protocol, which enables the building of data marketplaces.

2.2.2 PROCESSING (INFRASTRUCTURE) LEADERS

The fundamental computing element of processing is done with smart contracts – essentially code on the blockchain. Smart contracts are either stateless or stateful.

Stateless logic does not retain state internally, which makes it easier to build large, secure systems. Stateless logic is supported by Ripple, Bitshares, EOS, and others.

Stateful logic does retain state internally, akin to an input-output Turing machine. Stateful logic is supported by Ethereum, Lisk, and DFINITY, among others.

2.2.3 COMMUNICATION (INFRASTRUCTURE) LEADERS

The final infrastructural element is communications, which connect networks in terms of data, value, and state. An example of data communications includes the Tor Project (not blockchain-based), an example of value communications includes Interledger Protocol, and an example of state communication includes Polkadot.

2.2.4 LEADING APPLICATIONS

There are a wide-variety of active blockchain applications across governments and industries. Here, we will name just a few prominent examples¹².

Two use-cases in cybersecurity are REMME and Guardtime. REMME is a decentralized authentication system aiming to replace logins and passwords with SSL certificates stored on the blockchain. Guardtime is a keyless signature application and is currently being used to secure the health records of one million Estonian citizens.

On the financial services side, large players have already entered. Maersk is a shipping and transport consortium planning to use blockchain to streamline marine insurance. Barclays has launched a number of blockchain initiatives to track financial transactions and help combat fraud.

On the government level, Dubai is the world's first blockchain-powered state, with representatives from 30 government departments forming a committee to investigate blockchain opportunities. South Korea enlisted Samsung to create blockchain solutions in public safety and transport applications.

2.3 BLOCKCHAIN INVESTMENT THESIS

The blockchain sector investment thesis revolves around the technology bringing transformational change¹³, akin to the level of change the Internet brought to business over the past two decades, or the microprocessor brought in the two decades before the Internet. As explained in an MIT Sloan article¹⁴, "blockchain is hard to understand and predict, but could become ubiquitous in the exchange of digital and physical goods, information, and online platforms."

As a result, corporations and governments far and wide are investing in blockchain technology. In fact, Statista statistics¹⁵ indicate that blockchain spending is expected to reach \$19 billion by 2024. Further, revenues are set to reach \$291 billion by 2030¹⁶.

Within blockchain, we also see microtrends relevant for investors. The first wave in blockchain was with cryptocurrency, which revolutionized payments. The second wave in blockchain was ICOs, which revolutionized capital formation. Security Tokens enable a new wave of innovation in blockchain, by unlocking the liquidity premium, offering an easier compliance solution, and making sophisticated financial services available to everyone.

2.4 INSTITUTIONAL BUY-IN THESIS

Since the birth of blockchain and crypto assets in 2008, institutions have approached blockchain with more than a healthy degree of skepticism.

Major institutions typically buy-in when the technology is (a) de-risked, including proven technology and adoption, and (b) the competitive threat has reached a tipping point. At this stage, the institutional buy-in is limited primarily to the most obvious investments, such as Bitcoin.

The reason for the slow pace of institutional buy-in is rooted in institutional aversion to scandal. Given the numerous security, legal, and other risks in the blockchain industry, the financial risk of associated scandal is currently too high for many institutions. Even modestly negative impacts on stock price would collapse tremendous amounts of shareholder value for large corporations.

One of the biggest blockers to institutional buy-in is a lack of high-quality crypto exchanges, as discussed later in this report. The most likely scenario is that larger institutional entities like the NYSE and NASDAQ will create their own crypto exchanges or add functionality to their exchanges in order to accommodate crypto assets such as Security Tokens.

In fact, as explained in a Fortune article¹⁷, “various parties—including Intercontinental Exchange, parent company of the NYSE—are vying to get such venues up and running.”

Until such exchanges come into play, institutional investors will primarily trade using OTC desks¹⁸, which “serve as market makers and provide liquidity for trades,” discussed in greater depth later in this report.

3. INVESTMENT OPPORTUNITIES IN BLOCKCHAIN

3.1 REVOLUTIONARY IMPLICATIONS

Given the potentially revolutionary implications of blockchain technology, the massive growth of the industry, and other appeals, these are important alternative investment classes to consider.

3.2 LOW BETA ASSETS

One of the greatest appeals of an asset like Bitcoin is that it is a low beta asset. It is very difficult to reliably predict the value of crypto assets, or to find alpha. However, it is much easier to achieve greater diversification by investing in crypto assets, as these are low beta assets. An investor does not need to bet on crypto assets appreciating significantly, if at all, for crypto assets to be a valuable part of the risk/return strategy of their portfolio.

A portfolio full of correlated assets is extremely risky, so smart money is interested in uncorrelated returns, such as Bitcoin, as seen below¹⁹. In 2023, Bitcoin had a weak correlation of just 0.2 to the S&P 500.

Chart 6. Correlation matrix (data from January 1 to November 30, 2023)

	BTC/USD	Copper	CRY	DXY	ETH/USD	Gold	MOVE	S&P 500	US10Y	US2Y	US Bond	VIX
BTC/USD	1.00	0.07	0.12	-0.12	0.84	-0.05	-0.02	0.20	0.07	0.09	0.08	-0.19
Copper	0.07	1.00	0.26	-0.40	0.11	0.40	-0.17	0.25	-0.03	-0.01	0.01	-0.20
CRY	0.12	0.26	1.00	-0.50	0.12	0.11	0.02	-0.02	0.48	0.53	0.46	0.15
DXY	-0.12	-0.40	-0.50	1.00	-0.12	-0.17	0.17	-0.25	-0.43	-0.40	-0.46	0.19
ETH/USD	0.84	0.11	0.12	-0.12	1.00	0.01	-0.09	0.19	0.02	0.02	0.04	-0.19
Gold	-0.05	0.40	0.11	-0.17	0.01	1.00	-0.07	0.15	-0.09	-0.13	-0.07	-0.10
MOVE	-0.02	-0.17	0.02	0.17	-0.09	-0.07	1.00	-0.25	-0.21	0.08	-0.27	0.40
S&P 500	0.20	0.25	-0.02	-0.25	0.19	0.15	-0.25	1.00	0.03	-0.15	0.15	-0.74
US10Y	0.07	-0.03	0.48	-0.43	0.02	-0.09	-0.21	0.03	1.00	0.79	0.98	0.03
US2Y	0.09	-0.01	0.53	-0.40	0.02	-0.13	0.08	-0.15	0.79	1.00	0.76	0.28
US Bond	0.08	0.01	0.46	-0.46	0.04	-0.07	-0.27	0.15	0.98	0.76	1.00	-0.06
VIX	-0.19	-0.20	0.15	0.19	-0.19	-0.10	0.40	-0.74	0.03	0.28	-0.06	1.00

Based on daily changes. Sources: Bloomberg and Coinbase.

Source: [Coinbase](#)

Cryptocurrency Correlation Matrix, 90-Days

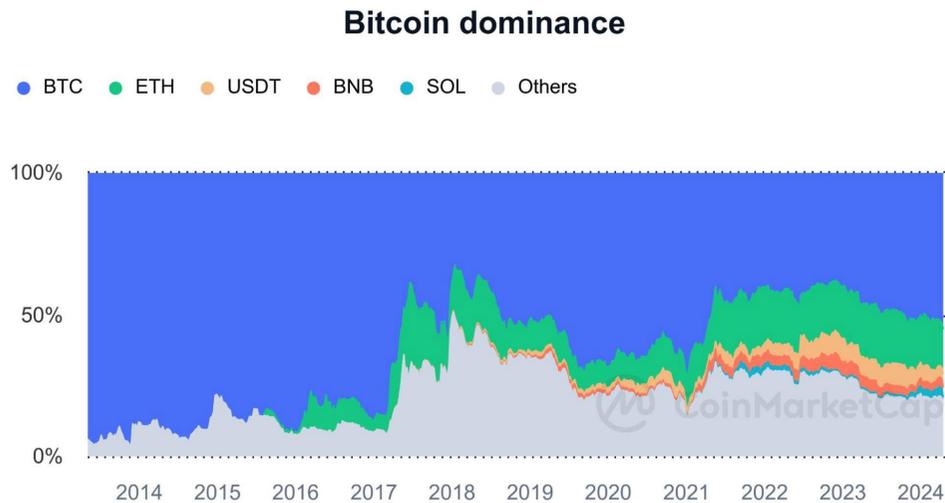
	BTC	ETH	XRP	BCH	XTM	LTC	XMR	DASH	ETC	XEM	ZEC	LSK	SC	REP	NXT	FCT	^SPX	^VIX	^GLD	^TNX
BTC	1	0.87	0.86	0.8	0.76	0.88	0.8	0.8	0.68	0.86	0.7	0.81	0.74	0.45	0.83	0.77	-0.23	0.21	-0.08	-0.05
ETH	0.87	1	0.9	0.84	0.73	0.91	0.78	0.82	0.69	0.83	0.72	0.81	0.75	0.51	0.8	0.74	-0.19	0.16	0.02	-0.08
XRP	0.86	0.9	1	0.84	0.81	0.91	0.79	0.83	0.69	0.87	0.71	0.87	0.76	0.36	0.85	0.78	-0.19	0.15	0.07	-0.09
BCH	0.8	0.84	0.84	1	0.73	0.85	0.78	0.84	0.69	0.75	0.62	0.79	0.72	0.36	0.75	0.71	-0.18	0.17	0.01	-0.05
XTM	0.76	0.73	0.81	0.73	1	0.79	0.67	0.76	0.63	0.79	0.65	0.76	0.78	0.27	0.8	0.66	-0.11	0.12	0.01	-0.11
LTC	0.88	0.91	0.91	0.95	0.79	1	0.77	0.83	0.7	0.87	0.72	0.83	0.73	0.41	0.83	0.72	-0.25	0.22	0	-0.13
XMR	0.8	0.78	0.79	0.78	0.67	0.77	1	0.74	0.54	0.78	0.67	0.79	0.71	0.43	0.74	0.72	-0.27	0.2	-0.09	-0.03
DASH	0.8	0.82	0.83	0.84	0.76	0.83	0.74	1	0.71	0.77	0.79	0.79	0.64	0.35	0.76	0.64	-0.24	0.23	-0.03	-0.14
ETC	0.68	0.69	0.69	0.69	0.63	0.7	0.54	0.71	1	0.58	0.56	0.63	0.57	0.35	0.71	0.59	-0.3	0.23	-0.1	-0.07
XEM	0.86	0.83	0.87	0.75	0.79	0.87	0.78	0.77	0.58	1	0.71	0.84	0.74	0.36	0.83	0.74	-0.16	0.13	0	-0.06
ZEC	0.7	0.72	0.71	0.62	0.65	0.72	0.67	0.79	0.56	0.71	1	0.69	0.6	0.33	0.65	0.56	-0.25	0.21	-0.17	0
LSK	0.81	0.81	0.87	0.79	0.76	0.83	0.79	0.79	0.63	0.84	0.69	1	0.69	0.41	0.86	0.72	-0.27	0.2	-0.08	-0.04
SC	0.74	0.75	0.76	0.72	0.78	0.73	0.71	0.64	0.57	0.74	0.6	0.69	1	0.4	0.74	0.68	-0.01	-0.01	0.05	-0.04
REP	0.45	0.51	0.36	0.36	0.27	0.41	0.43	0.35	0.35	0.36	0.33	0.41	0.4	1	0.38	0.36	-0.15	0.07	-0.06	0.06
NXT	0.83	0.8	0.85	0.75	0.8	0.83	0.74	0.76	0.71	0.83	0.65	0.86	0.74	0.38	1	0.73	-0.25	0.18	-0.05	-0.02
FCT	0.77	0.74	0.78	0.71	0.66	0.72	0.72	0.64	0.59	0.74	0.56	0.72	0.68	0.36	0.73	1	0.13	0.13	-0.06	0.05
^SPX	-0.23	-0.19	-0.19	-0.18	-0.11	-0.25	-0.27	-0.24	-0.13	-0.16	-0.25	-0.27	-0.01	-0.15	-0.25	-0.13	1	-0.75	0.28	0.38
^VIX	0.21	0.16	0.15	0.17	0.12	0.22	0.2	0.23	0.23	0.13	0.21	0.2	0.2	0.01	0.07	0.18	-0.75	1	-0.12	-0.49
^GLD	-0.08	0.02	0.07	0.01	0.01	0	-0.09	-0.03	-0.1	0	-0.17	-0.08	0.05	-0.06	-0.05	-0.06	0.28	-0.12	1	-0.16
^TNX	-0.05	-0.08	-0.09	-0.05	-0.11	-0.13	-0.03	-0.14	-0.07	-0.06	0	-0.04	-0.04	0.06	-0.02	0.05	0.38	-0.49	-0.16	1

Source: [Sifr Data](#)

As seen in the correlation matrix above, other crypto assets are highly correlated to Bitcoin, making Bitcoin the best bet among crypto assets from the perspective of seeking a low beta asset.

As of April 2024, Bitcoin has roughly a 55% market dominance among crypto assets, with greater volume across exchanges than any other asset²⁰.

In fact, Bitcoin has had a greater market dominance than every other crypto asset since its inception, and its dominance has remained largely unchallenged.



Source: CoinMarketCap

3.3 ALPHA OPPORTUNITIES

Although it is much easier to invest in crypto assets as part of risk-mitigation via uncorrelated asset returns, there is also the opportunity to make alpha bets.

Alpha bets are a zero-sum game²¹, which assume an inefficient market and asymmetric knowledge, and seek an “edge” to achieve returns.

There are generally three types of “edges” an investor can achieve:

1. Informational
2. Analytical
3. Behavioral

These edges are discovered episodically and disappear when the market corrects itself to a natural state.

4. CRYPTO ASSET INVESTMENT CONCERNS

4.1 OVERVIEW

In spite of the many investment opportunities in this emerging industry, investors face legitimate concerns in adding a new asset class like crypto assets to their portfolio, such as liquidity, legal concerns, custody, and staying power.

4.2 LACK OF LIQUIDITY

In traditional finance, even institutional investors will rarely face a liquidity problem on exchanges like NYSE and NASDAQ for major assets, while a retail investor may never face any liquidity problems. However, in cryptocurrency investments, it can be extremely difficult (if not impossible) to find sufficient liquidity in many cases.

While the well-known and widely reported tool CoinMarketCap claims daily crypto volume figures of roughly \$170 billion (as of April 2024), the reality is that many crypto exchanges fake their volume in order to charge crypto companies exorbitant listing fees, as uncovered in a Bitwise report to the United States Securities and Exchange Commission²³.

The real daily average volume figure is roughly \$273 million, or around 4% of the reported figure at the time of the report. Further, this volume is spread out over more than 250 competing crypto exchanges²⁴, rather than a few major consolidated exchanges. These problems make it quite expensive to make large trades without substantial slippage.

4.3 LEGAL UNCERTAINTY

4.3.1 TRADITIONAL ASSETS VS CRYPTO ASSETS

Given the onerous reporting requirements of institutional investors, institutions are highly concerned about the legal status of the assets they invest in.

Legal concerns when investing in a traditional asset listed on an exchange like NASDAQ are relatively low for several reasons: Investors know that these assets were subject to intense scrutiny upon listing, and that the entities behind these assets are subject to continued reporting requirements.

However, alternative investments like crypto assets are not subject to the same scrutiny or reporting requirements, resulting in hundreds of scams plaguing the industry. One website, 99bitcoins.com/dead-coins, lists 1,774 dead crypto assets to date, alongside events impacting market sentiment^{22, 25}. Reality is even worse, as these lists can't catch up fast enough with the ever-growing number of scams and fraudulent projects in the crypto space.

4.3.2 US SECURITIES REGULATIONS

Besides the legal concerns with the crypto assets themselves, investors are also concerned with the regulation surrounding crypto in general. Although over a million²⁶ "tokens" have been borne out of

the Ethereum blockchain calling themselves “utility tokens”, in hopes of avoiding securities regulations, the reality is that almost all tokens are considered securities, by default.

In the United States, “public offerings” must be registered with the SEC by the issuer, and failure to do so is unlawful. Traditionally this is called an Initial Public Offering, which is a tough process, especially for a startup.

After “going public,” whether through an IPO or otherwise, an issuer typically becomes an SEC “reporting company,” and is subject to great ongoing disclosure and compliance obligations. This may also occur when sufficient US investors acquire the securities, including security tokens, in secondary market trading.

There are three main techniques of avoiding SEC registration of token offerings.

1. **Sell non-security, or *utility* tokens**
2. **Prevent US investors from participating in the initial private sale, ICO, IEO, or other TGE**
3. **Engage in an “exempt” US offering (for instance through Reg D)**

Given the SEC’s no action letter and guidance, clearly not all tokens are securities. Nonetheless, issuers of utility tokens still have to be cautious, as the United States Securities and Exchange Commission fined the Canadian company Kik \$100 million for conducting a non-compliant ICO²⁷.

It is also possible for securities to evolve away from being a security. SEC Director of Corporate Finance, William Hinman, said²⁸ in an SEC

FinTech Forum that “digital assets may evolve into an instrument that no longer needs to be regulated as such.”

The second technique, of preventing US investor involvement, would be nearly impossible. On a practical level, a token offering may simply exclude US investors by looking at the addresses and locations of their KYC/AML data, and blocking them from the sale. However, this does not solve the problem with secondary market trading, which presents a big trap.

The third technique is to receive an exemption in order to avoid registration with the SEC, such as Reg D. Reg D includes Rule 506(c)²⁹, which allows issuers to sell securities to an unlimited number of verified accredited investors, and also allows for public advertising and online offering platforms, potentially without becoming a reporting company.

The big problem with Reg D Rule 506(c) is that under Rule 144, all Rule 506 securities are restricted, or not freely tradable.

Another technique is with Reg A+³⁰. Reg A+ handles several significant issues in relation to security tokens:

1. **General security token registration.**
2. **Issuing of pre-functional tokens.**
3. **Restricted, or not freely tradable, tokens.**
4. **Becoming an SEC reporting company.**

Therefore, Reg A+ is potentially the most superior technique for issuing tokens that US investors may have access to.

4.4 LONGEVITY

Crypto assets have been around for over 15 years³¹ --- since the launch of Bitcoin on January 3, 2009 -- a long history when looking at the micro-developments of the industry, but still in its nascency from a macro-outlook, relative to traditional investments like real estate or gold.

The Lindy Effect theorizes that the future life expectancy of non-perishable things like a technology is proportional to their current age. Adopting the idea of the Lindy Effect, Bitcoin would be likely to have the greatest staying power among crypto assets³². Bitcoin has market domination of consistently over 50% among crypto assets, and a die-hard community. However, this lengthy track record does not solve Bitcoin's problems, ranging from a lack of technological scalability, lack of legal clarity, and even market manipulation.

4.5 CUSTODY

Custody relates to the issue of how to store crypto assets. Contrary to the decentralization and disintermediation of crypto, institutions will likely be required to have third party custodians. After all, it wouldn't make much sense, for example, for a crypto exchange to be its own custodian as well, as it would place undue levels of responsibility on the exchange.

4.6 SECURITY AND EASE OF UNDERSTANDING

Compared to investing in traditional financial instruments, investing in crypto assets directly is a very complicated process.

First off, most crypto assets can only be purchased with either BTC

(Bitcoin) or ETH (Ether) as a trading pair. To acquire BTC or ETH safely and quickly is a hassle in and of itself, as fiat-to-crypto converters typically charge exorbitant fees and have a lengthy KYC/AML approval waiting period.

Further, in the event of sudden downward price movements, which are likely to occur at any time given crypto asset volatility, an investor may wish to "cash out." In this event, the investor would have to go back through a crypto-to-fiat converter, charging exorbitant fees again. Alternatively, one could hedge their positions with low beta assets, or convert to "stable coins," which present their own set of risks.

In order to acquire and hold any crypto asset, a "wallet" is needed, which is the equivalent of a physical wallet for transactions with crypto assets. From a technical perspective, a wallet stores digital keys, giving access to public addresses and the ability to "sign" transactions.

Whoever knows the "private key" of a wallet controls the wallet and all funds held within, which is why it's crucial to always maintain sole control of your private key.

However, many people keep their tokens on exchanges, in what is known as a "hot wallet." In the event of an exchange hack, such as the Mt Gox hack³³ where roughly \$3 billion of BTC (in October 2017 prices) was stolen, your funds can be stolen from the hot wallet. However, if you keep your funds on a "cold wallet," such as a flash drive, or even written on a piece of paper, an exchange hack will not impact you.

Besides crypto exchange vulnerabilities, investors must also consider the vulnerabilities in the crypto assets themselves. Unlike a tradi-

tional financial instrument, crypto assets are stored digitally as lines of code, and these lines of code are subject to flaws and vulnerabilities.

For instance, decentralized applications, colloquially referred to as DApps, use tokens, and many launch ICOs. Both of these are prime targets for hackers to steal massive amounts of funds or exploit vulnerabilities. One example of a DApps attack was the DAO hack³⁴ of July 2016, where roughly \$50 million was stolen due to faulty Smart Contract code (specifically, a reentrancy attack vulnerability whereby withdrawals can be made multiple times on the same funds). Developers decided to “hard-fork” Ethereum, reversing the loss of funds, and splitting the Ethereum community in half, irreversibly damaging the reputation of blockchain and breaking the trust of millions of users in the process.

The hard-fork fundamentally changed Ethereum’s development, disproving immutability, and users were failed by a misconception of trustlessness, as three separate parties are trusted in any network:

1. **Miners, to validate the blocks (cryptography)**
2. **Users, to participate in the network as light and full nodes (collaboration)**
3. **Developers, to write responsible Smart Contracts (code)**

Parties (1) and (3) in the network are the weak links for security, and the realization of a need to trust these parties almost destroyed a multi-billion-dollar industry. Any vulnerability in Smart Contracts may be exploited by miners and developers, forcing investors to take a hard look at Smart Contract security.

5. TRADING METHODS

5.1 EXCHANGE-TRADED FUNDS AND CLOSED-END FUNDS

A safer and altogether simpler method of investing in crypto assets and digital currencies is with a publicly-listed vehicle, such as ETFs and CEFs. In January 2024, the SEC approved 11 spot Bitcoin ETFs³⁵, which offer investors access to bitcoin (digital currency) through a traditional investment vehicle. These are as follows:

1. ARK 21Shares Bitcoin ETF (NYSE:ARKB)
2. Bitwise Bitcoin ETF (NYSE:BITB)
3. Blackrock's iShares Bitcoin Trust (NASDAQ:IBIT)
4. Franklin Bitcoin ETF (NYSE:EZBC)
5. Fidelity Wise Origin Bitcoin Trust (NYSE:FBTC)
6. Grayscale Bitcoin Trust (NYSE:GBTC)
7. Hashdex Bitcoin ETF (NYSEARCA:DEFI)
8. Invesco Galaxy Bitcoin ETF (NYSE:BTCO)
9. VanEck Bitcoin Trust (NYSE:HODL)
10. Valkyrie Bitcoin Fund (NASDAQ:BRRR)
11. WisdomTree Bitcoin Fund (NYSE:BTCW)

An exchange-traded fund, commonly referred to as an ETF, is an investment fund that tracks the price of an underlying asset, such as oil or gold, or in this case, Bitcoin. Like stocks, it is traded on exchanges. These ETFs open up the pool of potential investors to a much larger audience.

A Bitcoin ETF is a safer option for investing into Bitcoin than having to use crypto exchanges, for example, given the many legal, technical, and practical risks of using crypto exchanges as aforementioned.

5.2 OTC (Over-the-Counter)

OTC trading has become one of the most popular crypto trading methods. In traditional markets, OTC brokers facilitate the trade of securities that are not listed on major exchanges like NYSE or NASDAQ. In crypto markets, on the other hand, OTC desks provide an anonymous way to exchange large quantities of crypto assets without disrupting public markets. Some of the most well-known OTC brokers³⁶ include Cumberland, Genesis Trading, Enigma Securities, and Circle Trade.

Such trading desks – often with decades of prior experience in traditional markets, are held in better reputation than crypto exchanges that only have a single-digit year existence. For instance, Cumberland³⁷ has over 25 years of experience in traditional markets.

5.3 DARK POOLS

A dark pool³⁸ allows large traders to execute hidden orders, in somewhat similar fashion to OTC desks. Essentially, a dark pool is a private forum allowing opaque institutional trading such that public markets are not negatively affected.

5.4 EXCHANGES

As aforementioned, there are hundreds of competing crypto exchange to choose from, yet only a small handful of these have real volume, and even fewer are licensed. The leading crypto exchange, Binance, is in a legal grey-area at best.

In fact, Binance CEO Zhao Changpeng runs the exchange in a highly opaque³⁹ manner to avoid legal scrutiny. Binance has no bank account, no public address, secret office and server locations, and Zhao himself “never stays in one place for too long, living out of short-term rentals and hotels in Singapore, Taiwan and Hong Kong.”

There are over 700 crypto exchanges listed on CoinMarketCap. However, this is not a definitive list, because exchanges need to apply to be listed there, and there are many exchanges awaiting licensing that are yet-to-be launched. Investing through the medium of these exchanges is risky, on a legal, technical, and practical level.

Legally, many of these exchanges do not comply with necessary regulations. Depending on the exchange’s jurisdiction, it will most likely need to possess three or more licenses. For instance, one would need the following licenses for operating a crypto exchange in Estonia, a common head-quarter location for crypto exchanges:

1. The license of providing services of exchanging a virtual currency against a fiat currency. This license allows a crypto exchange to exchange fiat for crypto, crypto for fiat, and crypto for crypto legally.
2. The license of providing a virtual currency wallet service. This license allows a crypto exchange to provide hot and cold wallet services for cryptocurrencies.

3. The license to operate as a financial institution. This includes working in compliance with laws of prevention of money laundering and financing of terrorism.

A fourth license may be needed for the marketing of financial instruments.

Before investing in a crypto exchange, it would be prudent to search if the exchange possesses the necessary operating licenses, as in the example below.

Register of Economic Activities	
<i>Name of entrepreneur</i>	LIQNET
<i>Registry code</i>	14533361
<i>Address of entrepreneur</i>	Narva mnt 7, Kesklinna linnaosa, Tallinn, Harju maakond, 10117
<i>Telephone</i>	+790 28320150
<i>E-mail</i>	ceo@liqnet.com
<i>Website</i>	
Operating licence	
Subject field, area of activity	Financial services. Providing services of exchanging a virtual currency against a fiat currency
<i>Number</i>	FVR000351
<i>Start of validity</i>	28.08.2018
Subject field, area of activity	Financial services. Providing a virtual currency wallet service
<i>Number</i>	FRK000292
<i>Start of validity</i>	28.08.2018
Subject field, area of activity	Financial services. Operating as a financial institution
<i>Number</i>	FFA000281
<i>Start of validity</i>	28.08.2018
Web address of the register mtr.mkm.ee	

However, even having these licenses leaves crypto exchanges vulnerable to the secondary market. In the example above, the crypto exchange is licensed for activities in Estonia, but since the exchange allows trading of ERC-20 tokens, these tokens can be sent to someone in the United States, for example, in the secondary market, which

largely considers tokens to be securities. As a result, most crypto exchanges are technically non-compliant because of the secondary market.

5.4.1 SOLUTIONS TO EXCHANGE PROBLEMS

5.4.1.1 ORDER ROUTERS AND EXECUTION ALGORITHMS

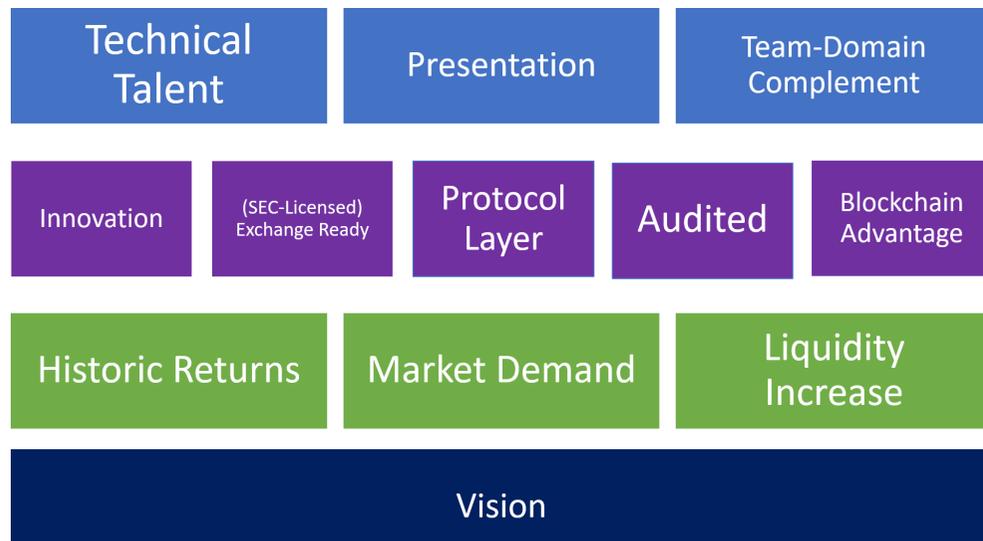
The typical institutional solution to the crypto exchange liquidity problem is with smart order routing. Essentially, orders are divided into smaller pieces, and then spread across multiple exchanges to account for optimal liquidity, prices, fees, and latency. SFOX, Coinigy, CoinRoutes, and TradeBlock are among the leaders in this space.

For example, SFOX offers better access and prices to institutional investors by connecting to over 20 exchanges and OTC providers, and using smart routing algorithms to get better pricing and benefits from volume discounts⁴⁰.

6. QUALITATIVE MATRIX FOR IDENTIFYING INVESTMENTS

6.1 OVERVIEW

We propose a holistic system for identifying high quality blockchain technology, digital currency, and crypto asset investments, considering the following factors for analysis.



Our reasons for selecting these factors are outlined below.

6.2 TECHNICAL TALENT

In such a hyped industry as blockchain, it is vital to vet projects based on the strengths of their team. ICO scams and other low-quality projects are marked by teams lacking sufficient professional experience

and talent. High quality projects are marked by technical teams with significant blockchain development talent, leadership with previous senior roles on projects of merit, and a sufficient team size for the project.

6.3 PRESENTATION

Blockchain projects often rely on what's known as the "network effect," or achieving a sufficient number of users to create a meaningful ecosystem, generating value for the cryptocurrency or token at hand. This makes the presentation of the project extremely important. The same holds true, of course, for Token Generation Events such as ICOs, IEOs, and STOs. High quality projects are marked by high efficacy communication, in a way that furthers the issuer's stated objectives.

6.4 TEAM-DOMAIN COMPLEMENT

It is of utmost importance to discern between projects that are "riding the wave" of industry trends (and therefore most likely lacking the passion and relevant professional background needed) and projects with teams that strongly complement the problem they attempt to solve. High quality projects have teams that align well with the problem in terms of leadership, expertise, capacity, and structure.

6.5 INNOVATION

In using an immature and not-thoroughly-tested technology such as blockchain, there are many hurdles to business success, not the least of which are problems with the technology itself. If the business model at hand does not bring significant benefits over the traditional solutions, then these barriers to success would make it quite difficult to succeed. High quality projects offer an original application, technology, or approach, with outsized thinking.

6.6 SEC-LICENSED EXCHANGE READY (ST-SPECIFIC)

If the crypto asset at hand is not ready to be listed on exchanges, preferably exchanges that currently have or are soon awaiting SEC-licensing, then the value of the crypto asset drops dramatically. High quality projects are ready to be listed on numerous high quality, licensed exchanges.

6.7 PROTOCOL LAYER

There are a number of blockchain protocols to choose from, so it is important to analyze why a certain project chose the protocol that they did, and if there may have potentially been a better protocol to select. Further, protocol-level design and changes are indicative of a higher quality project. High quality projects provide extensive technology level design in their documentation.

6.8 BLOCKCHAIN ADVANTAGES

When analyzing a potential investment in the space, it is very important to ask how much the project benefits from using blockchain

technology, and if there may be alternatives that would be sufficient instead. Given the technological limitations of current blockchains, such as scalability, complexity, and inefficiency, it is important to make a cost-benefit analysis of using blockchain. High quality projects have a very strong use-case for blockchain technology that would be unmet by other database technologies.

6.9 HISTORIC RETURNS

While no guarantee of future outcomes, history is the best predictor for the future. High quality projects tend to have historic financial returns that are significantly better than average projects.

6.10 MARKET DEMAND

Another important consideration is whether people want to own, invest in, or use the crypto asset now, or in the future. High quality projects have significantly better than average market demand.

6.11 LIQUIDITY AVAILABILITY

Different kinds of crypto assets will face varying amounts of liquidity. For example, in the current market, security tokens are severely lacking liquidity, which may pose impediments to their financial value, while widely known cryptocurrencies such as Bitcoin have relatively deep liquidity. High quality projects offer much more liquidity than their analog.

6.12 VISION

Nearly all verticals in the blockchain market -- from infrastructure, to exchanges, payment, ecosystems, identity, and so on -- have become extremely crowded. Therefore, it is important to analyze if the project demonstrates a meaningful vision for the future of the market. High quality projects show a strong point of view, with a complementing strategy and structure.

6.13 AUDITED (SECURITY)

Given the security concerns as discussed earlier in this report – including smart contract vulnerabilities – it is important that projects have conducted a smart contract audit, whereby all known vulnerabilities are checked and penetration-tested. High quality projects have received one or more verifiable smart contract audits from leading auditing agencies.

7. QUANTITATIVE INVESTMENT METHODS

7.1 OVERVIEW

In this section, we introduce numerous quantitative investment methods, to be used in conjunction with the qualitative matrix proposed in the previous section.

7.2 PARAMETRIC MODELING

A parametric model essentially offers probabilities on future values based on (a finite number of) parameters.

In the context of algo-trading crypto assets, the problem is that most parametric models make false assumptions about the distribution of the underlying crypto data. It is extremely difficult to make correct assumptions about the distributions of crypto data, primarily because of their high volatility and constantly changing trends. Even if a current assumption is correct, the model will become unprofitable as soon as the market trend shifts, and the underlying distribution assumption becomes untrue, ultimately making parametric models unsuitable for algo-trading crypto assets, at least as an isolated effort.

Simple parametric models tend to underfit crypto price data, while complex parametric models will overfit the data, and models in-between are not profitable in the long-term due to their false distribution assumptions.

7.3 NON-PARAMETRIC MODELING

On the other hand, non-parametric models, especially complex networks, may be used to accurately model cryptocurrency trends and predict prices.

One example of non-parametric modeling is known as Deep Q. Deep Q is a form of complex Neural Networks that feeds in continuous data, called Reinforcement Learning, using a variation of Reinforcement Learning called Q-learning.

Feeding in continuous price data may allow you to make better price predictions while reducing the risk of overfitting, which parametric models are more prone to. Further, Q-learning does not actually model the market, but rather focuses on the benefit (or the Q-value) associated with investor actions. Finally, Q-learning focuses on long-term gains as opposed to maximizing each trade in isolation, which is another benefit over many parametric models.

For these reasons, models like Deep Q could potentially be used in complement with qualitative analysis of the project to guide a long-term profitable trading strategy. Academic experiments⁴⁰ provide support for this hypothesis.

7.4 MODELS AND DATA IN ALGO-TRADING

Many algo-trading strategies rely on open-source machine learning libraries, such as Google's TensorFlow. Cutting-edge AI models used in a variety of industry applications are often open-source. A discerning investor may ask how certain algo-traders create an edge, when the models themselves are often open-source. The answer lies in the data used to train the model, as well as the talent in tweaking the model to a certain asset and market.

Profit and loss differences between investors using similar algorithms may come from the volume of data, the variety of data sources, the veracity of the data, and the velocity of the data. Further, algo-traders may properly or improperly tune the model's hyperparameters.

7.5 A NOTE ON MACHINE LEARNING IN ALGO-TRADING

While we present non-parametric models that, in conjunction with intuition and rigorous qualitative analysis, may yield high alpha, machine learning is by no means relevant to every aspect of algo-trading.

In essence, machine learning in the context of algo-trading applies dynamic statistical optimization to identify variables for a trading strategy. Done wrong, the models will overfit to the data, creating a useless strategy. Further, many models applied correctly will still yield useless strategies, as they don't capture any fundamental fact of the market.

Done properly, however, machine learning may yield positive alpha. More specifically:

1. The strategy should be based on *a priori* principles that capture underlying assumptions about the market.
2. The strategy should work across crypto assets and across time periods.
3. The strategy should employ few parameters and few variables, few steps in the optimization, and so on.
4. The strategy should identify major regime shifts in market dynamics and be adjusted accordingly.

8. CRYPTO ASSET MARKET DEVELOPMENTS

8.1 CURRENT MARKET

Perhaps the riskiest elements of crypto asset investing are not the meta-risks such as technical vulnerabilities in wallets and exchanges, but the risks related to the extremely high volatility of the assets themselves.

As seen on CoinMarketCap, crypto regularly experiences extreme volatility, with a market cap of just over \$800 billion at the start of 2022, tripling to over \$2.4 trillion by April 2024.

While it may seem that crypto now has a large market cap, especially considering the meteoric rise of these asset classes, crypto asset market capitalization remains modest relative to other markets, as described in a European Central Bank report⁴¹. At the time of writing, the combined value of all cryptocurrencies is lower than that of largecaps like Microsoft and Apple, and only a fraction of gold's market capitalization.

8.2 THE FUTURE OF BLOCKCHAIN FOR INVESTORS – BEYOND BITCOIN

A CB Insights report⁴² analyzes 55 industries that blockchain could transform. Given the rapid growth of the industry and expansion of use-cases to many verticals, we see the industry heading in a positive direction. It is important not to be too caught up in price movements

in the short term, as these are often not reflective of underlying developments in the industry but are instead speculative movements.

Perhaps the most important upcoming trend in the blockchain industry is Security Tokens, as they present an effort to bring regulation and legitimacy to an industry fraught with scam.

As the industry matures, so do the potential use-cases. This expansion and increased depth in use-cases is a positive sign for investors, as it reflects growing traction of the technology.

It is important for investors to look deeper into the potential implications of blockchain technology and recognize that Bitcoin is the first use-case of many, therefore with many early-stage problems of its own, that other Blockchains such as Ethereum attempt to solve.

In fact, it is very likely that Bitcoin is unable to fulfill one of its original intentions, as a “store of value” such as gold. A paper⁴³ by The National Bureau of Economic Research suggests that “Bitcoin would be majority attacked if it became sufficiently economically important.” In other words, “there are intrinsic economic limits to how economically important [Bitcoin] can become in the first place.”

9. CONCLUSION

Many traditional institutional investors are interested in exposure to crypto assets due to their lack of correlation with other asset classes, enabling them to improve the performance of their portfolio from a risk/return perspective. Other investors invest on a principles-basis, for instance that Bitcoin has a chance at dethroning Gold, or that some Blockchain applications will take over their centralized counterparts.

Investors have many rightful concerns, regarding liquidity, the state of regulations, the staying power of crypto assets, custody, security, and other matters, causing institutional investors to focus on major coins like Bitcoin.

There are plentiful methods to investing in crypto assets, such as through CEFs, OTC desks, dark pools, exchanges, and finally approved ETFs.

Lastly, we present a holistic qualitative approach to judging and vetting quality crypto asset investments, which may be used in combination with quantitative methods, such as non-parametric modeling. Investors would be wise to look beyond Bitcoin, employing these frameworks to source new alternative investments for their portfolios.

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AUTHOR BIOGRAPHY



Frederik Bussler is an associate partner at Supercap and the founder of Bussler & Co, he previously founded the world's largest think tank for the security token industry with around 50 partners, as well as chairman at the World Data Science Forum, CEO at bitgrit, and advisor to blockchain startups including SHORTEX Cryptoexchange and klimazone Labs. As a public speaker, he has presented for audiences including IBM, Nikkei, Slush Tokyo, and the Chinese government, and is featured in outlets including Forbes and Yahoo. He has reached audiences of over 200 million on social media channels, and his interviews with Japanese outlets such as NewsTV have been viewed over 1 million times.

In partnership

Supercap.

Bussler & Co.

CONTACTS



Alexis Sheikh
Partner

✉ alex@supercap.group

☎ +46 (0) 73 909 20 21



Frederik Bussler
Associate Partner

✉ frederik@supercap.group



Supercap Group

✉ info@supercap.group

📍 www.supercap.group

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