



Institutionalization of Digital Assets

Digital Assets Today and What it Will Take to get to the Next Level of Institutional Adoption

Paper Roadmap

1. Executive Summary (Pgs 2-3)
2. What is the current institutional state of digital assets? *(Pgs 3-13)*
 - a. Futures contracts on CME and institutionalization *(Pgs 3-5)*
 - b. Other signs of institutionalization *(Pgs 6)*
 - c. Current investable crypto products *(Pgs 7-9)*
 - d. Lending firms/ Genesis Capital *(Pgs 9-10)*
 - e. Normalizing volatility/ correlations *(Pgs 10-12)*
 - f. Recent guidance from OCC and SEC *(Pg 12-13)*
 - g. Conclusions on current state of institutionalization *(Pgs 13)*
3. What will the next level of institutionalization of digital assets look like? *(Pgs 13-28)*
 - a. ETF's *(Pgs 13-17)*
 - b. Improved regulations *(Pgs 17-20)*
 - c. Custody & prime brokers/ PolySign *(Pgs 20-22)*
 - d. More use-cases for Digital Assets *(Pgs 22-25)*
 - e. Education/market awareness *(Pgs 25-26)*
 - f. Future of digital assets *(Pgs 27-28)*
4. Conclusion *(Pg 29)*

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Christopher Maturri
cm1867@georgetown.edu
(201) 400-0120

Executive Summary

The purpose of this paper is to explore the current levels of institutionalization of digital assets. Over the past few years, there has been significant progress made in institutionalizing these new technologies. The first half of the paper will examine the current status of the digital asset space through the success some of the largest exchanges, banks, and investment firms have had in being some of the first on wall street to embrace digital assets. Next, the paper will look at the growing number of ways people can invest in digital assets today. Further, we will look at new firms offering services that replicate what is seen in traditional areas of finance. The paper will then address how bitcoin's decreasing volatility and low correlations to other asset classes is a sign that the digital asset space is becoming more investable. Finally, we will examine some of the most recent guidance from regulators on digital assets as an indication that they are looking for ways to help address regulatory issues.

While the first half of the paper will show there has been some great progress already made in evolving digital assets, the second half will explore what is needed to get to that next level of institutionalization. From an investing standpoint, we will start off by looking at the status of a digital asset ETF and why their approval is so necessary and will help protect investors. Next, the paper will discuss the need for additional clarity from regulators on digital assets. Building off regulations, we will look at the need for custodians and prime brokers to expand their services into the digital asset space, which will enable institutional investors to access these markets. Perhaps most importantly, the paper will then address the need for digital assets to have actual 'use-cases' to truly encourage institutional adoption. Later, we will look at how there is still a strong need for education and market-awareness, and touch on a few organizations helping address this. Finally, the paper will examine what the future of the digital assets will look like if institutions actually begin investing in them.

Ultimately through this analysis, the goal of this paper is to show that the digital asset space has matured quite a bit over the last few years. However, there is still a lot of work to do before digital assets can truly reach their potential. As we will later discuss, one promising sign is that many of the suggestions to encourage further institutional adoption made in the second half of the paper are already in the works. Because the digital asset space is constantly evolving, if someone were to revisit this paper in a few years it is possible that many of these topics covered throughout this paper will seem antiquated because they are already fully functional.

Introduction/ Background

Are digital assets a great bubble or will their underlying technology, blockchain, transform the world? People have debated this very question since bitcoin and other digital assets took the world by storm in late 2017. However, digital assets were first developed over a decade ago and have been quietly building steam since then. In simple terms, digital assets are anything that can be stored digitally. Bitcoin was the first digital asset, developed in response to the Financial Crisis of '07-'08, and a growing distrust towards banks and other financial institutions that contributed to the crisis. In the original Bitcoin Whitepaper, bitcoin's anonymous founder Satoshi Nakamoto claimed, "what is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party."¹ Little would he know that nearly a decade later this thesis would lay the groundwork for a future of digital assets and blockchain technology that may revolutionize our world.

Although bitcoin is the most popular cryptocurrency today and represents ~75% of the total market cap of digital assets, it is still just one small piece of this ecosystem. To clarify, bitcoin is a cryptocurrency, which is a subsegment of the entire digital asset class. A cryptocurrency is essentially a digital instrument that uses encryption to conduct monetary transactions without the need of a bank or third party. Cryptocurrencies have use-cases ranging from payments, to stores of value, to enabling of smart-contracts. Another example of a digital asset can be a stablecoin, which uses the same blockchain technology as other cryptocurrencies but is backed by a traditional fiat currency or even a tangible asset.

Blockchain, is the underlying technology that makes all these cryptocurrencies and digital assets usable. A blockchain is basically a distributed ledger that can be used to record anything. In other words, a blockchain is the digital book-keeping of any transaction. The 'blocks' that are part of the blockchain are all linked together and create what is known as a 'chain.' This seamlessly allows all cryptocurrency or digital asset transactions to be recorded on one massive ledger, for everyone to see. While cryptocurrencies made blockchain popular, there are countless use-cases for blockchain technology outside of the digital asset world.

What is the current institutional state of digital assets?

When someone thinks of digital assets, their thoughts often rush to individuals using bitcoin to hide their tracks as they purchased illegal drugs from the Silk Road or the Mt. Gox Bitcoin exchange hack in 2014. This caused the industry to draw well-deserved comparisons to the 'wild west' and other fads that would quickly fade away over time. However, like any revolutionary technology or industry, the digital asset space has matured tremendously over the past few years. Although they still have a long way to go, digital assets have already become much more institutionalized than many realize and already being embraced by some of the largest banks, exchanges, and investment firms in the world.

Futures Contracts on CME and Institutionalization

One of the earliest and most prominent wall street firms to take digital assets seriously was CME Group, the world's largest exchange. Originally known as a small commodities exchange in the Midwest for

farmers to hedge their agriculture exposure, CME has turned into the largest venue in the world to transact derivatives on Equities, Interest Rates, Foreign Exchange, and Commodities. CME Group's customer base includes nearly every bank in the world, commercial producers, sophisticated investment firms, high-speed professional market-makers, and even retail traders. Thus, given CME's advanced customer base, many consider their successful launch of cryptocurrency products as a barometer for institutional growth in the digital asset space.

To many people's surprise, CME announced in October 2017 their intentions to launch a Bitcoin Futures contract by the end of the year shortly after their cross-town rival CBOE announced plans of their own, creating an arms race to get the first regulated Bitcoin Futures contract to market. While CME and CBOE went toe-to-toe the first few months of their respective launches, traders seemed to gravitate towards CME's Bitcoin Futures contract and CBOE delisted their contract nearly a year later.² Due to the competitive nature of exchange businesses it is very difficult to launch a brand-new contract and have a critical mass of customers trading to keep the product profitable.

New futures contracts often follow what is called a 'hockey-stick trajectory,' of very slow growth at first followed by a strong uptick in volume as the contract matures and more entrants to the market creates a 'network' effect enabling more participants to trade amongst each other. However, CME's Bitcoin Futures launch appears to have bucked this trend seeing immediate adoption, indicating a strong built-up demand in a regulated venue to trade digital assets. Looking deeper into the Average Daily Volume and Open Interest numbers CME discloses (Figure 1), one can see a strong upward trajectory in adoption from day one.

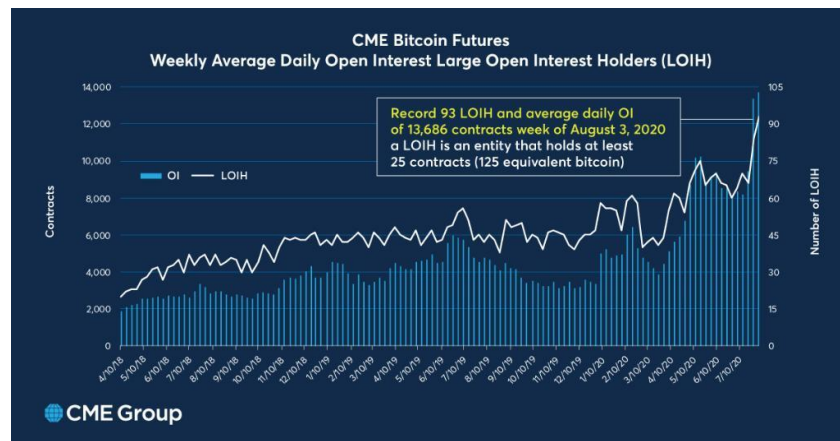


(FIGURE 1- PANTERA CAPITAL/ CME GROUP)

Digging deeper into some of CME's publicly disclosed statistics indicate that Bitcoin Futures is among the fastest growing products on their exchange. In 2019, CME's Bitcoin Futures contract had an Average Daily Volume of 6,365 contracts, which is equivalent to 31,825 bitcoin and represents a notional transactional value of nearly \$250mn per day. As a result, Bitcoin Futures finished as CME's 55th largest futures contract by volume in 2019, which is impressive considering CME lists over 500 futures contracts.³

Perhaps even more telling of this institutionalization is the steady growth in Open Interest of CME's Bitcoin Futures contract. Unlike volume, which simply measures the number of contracts transacted,

Open Interest tells how many open positions there are- or in other words how much risk traders are taking or hedging against. There are two ways to observe the growth in Open Interest at CME, through a total number of contracts (Figure 1) or by looking at the number of LOIH (Large Open Interest Holders). To classify as a LOIH, a market participant must hold over 25 contracts in a specified futures market. For example, to appear as an LOIH in Figure 2 someone must own over 25 contracts of Bitcoin Futures at the time of disclosure. As one can see, not only has CME recently set an Open Interest record of 13,600 contracts, but they have also grown to 93 LOIH which is up from nearly 45 at the start of this year.⁴ Perhaps given all the volatility and selloff in equities in the beginning of 2020, many traditional investors turned to CME's Bitcoin Futures market as a quick way to gain exposure to cryptocurrencies as a hedge to their portfolio.



(FIGURE 2- CME GROUP- EQUITY INDEX)

Not only is CME's Bitcoin Future's growth impressive for a regulated futures market, but they have also become one of the largest venues in the world to transact bitcoin. With an average daily turnover of 31,825 bitcoin at CME in 2019, CME now ranks as the largest venue in the world to transact USD Bitcoin.⁵ Unlike many of these 'spot' cryptocurrency exchanges that are more retail oriented and take only minutes to open up an account to trade, it is much more difficult to open a futures account to trade on CME. All futures trading is regulated by the CFTC and in order to even access CME's markets, a trader or firm must be approved by an FCM (Futures Commission Merchant) who faces the exchange directly and guarantees the trade of their customer. Thus, looking at CME's volume is much more indicative of institutional adoption than just observing the volume of cryptocurrencies in totality at some of these other, non-regulated exchanges.

A further sign of an increased appetite for digital asset products from their clients, CME has expanded their digital asset lineup with the calculation of a new Ethereum Reference Rate (May 2018)⁶ and the launch of a Bitcoin Options contract (January 2020).⁷ These additions are a clear sign that CME has seen success in their Bitcoin Futures rollout and their institutional customer base has demand for additional digital asset products.

Other Signs of Institutionalization

CME Group is far from the only institutional firm to dip their toes into digital assets. After initially questioning the value of cryptocurrencies, top-tier banks such as Goldman Sachs and JP Morgan have begun to build out teams focused on ways to make digital assets more easily acceptable for their clients. Goldman Sachs initially established a trading desk looking to offer Non-Deliverable Forwards, an over-the-counter derivative based swap, to their clients.⁸ On the other hand, not long after JP Morgan CEO Jamie Dimon referred to bitcoin as a ‘fraud,’ JP Morgan established their own stablecoin called JPM Coin.⁹

Additionally, some of the largest hedge funds in the world have begun allocating to digital assets. Earlier in 2020, Renaissance Technologies, who manages \$75bn in total assets, disclosed they had begun trading digital assets.¹⁰ Similarly, the renown hedge fund manager Paul Tudor Jones announced that he put 2% of his assets in bitcoin, arguing that “bitcoin reminds me of gold when I first got into the business in 1976 [and] the most compelling argument for owning bitcoin is the coming digitization of currency everywhere, accelerated by Covid-19.”¹¹ Millennium Management, a \$40bn AUM hedge fund, has been rumored to be very close to opening a digital asset portfolio management team as well.¹²

Perhaps the largest institutional entrant to digital assets is a company with no ties to the financial world, but with a network of over two & a half billion users. Facebook received a lot of publicity for their announcement of Libra, a digital currency that would be backed by a basket of fiat currencies and US treasury securities. While at first met with much skepticism, some have commended Facebook’s efforts and view Libra as a much-anticipated attempt on their part to enter the financial services industry. While there is a lot of uncertainty surrounding Libra’s launch, partly due to regulatory concerns, Facebook’s announcement of Libra is a very strong indication that some of the world’s largest institutions are finding ways to embrace digital assets today because they are scared they will be left behind tomorrow if are unable to adapt.

Another key indicator of institutionalization in digital assets are the growing number of hedge funds focused exclusively on strategies around cryptocurrencies. Earlier this year PWC & Elwood Asset Management published their annual “Crypto Hedge Fund Report.”¹³ Their report found that the total AUM of cryptocurrency hedge funds increased from \$1bn in 2019 to \$2bn in 2020. Additionally, they found that the average AUM of a crypto hedge fund increased from \$21.9mn in 2019 to \$44mn in 2020. Further, the median AUM in new crypto hedge funds has increased to \$2mn, representing a 400% increase from 2019. The growth in total assets in funds with digital asset strategies is a strong indicator that institutional investors are gaining exposure to digital assets through allocations to cryptocurrency hedge funds.

Similarly, Fidelity Digital Assets, a division of Fidelity focused on building out custody and execution services surrounding cryptocurrencies, published a report of their own on the state of institutionalization in cryptocurrencies.¹⁴ Fidelity surveyed 774 institutional investment firms from both the U.S. and Europe, and found that 36% of respondents already had some sort of exposure to digital assets with hedge funds and venture capital firms as their primary source of exposure. Somewhat surprisingly, European institutions had more exposure than U.S. based firms (45% vs 27%). Fidelity also found that 80% of investors they surveyed found “something appealing about the asset class,” perhaps indicating this is just the beginning of a trend.

Current Investable Crypto Products

Grayscale Bitcoin Trust

Aside from directly purchasing or trading cryptocurrencies themselves, there are a growing number of ways to access the digital asset market. One of the most well-known investable digital asset products is the Grayscale Bitcoin Trust (GBTC). A division of Digital Currency Group, Grayscale is the largest digital asset investment firm in the world and began managing the GBTC product in September 2013.

Grayscale reserves access to the GBTC for accredited investors only and ownership of shares in the GBTC are backed by underlying bitcoin, much like shares of the SPY S&P 500 ETF are backed by S&P 500 component stocks. In early 2020 Grayscale registered with the SEC as reporting company and GBTC became the first digital asset investment to receive such a designation.¹⁵ Since there has not yet been a bitcoin ETF approved by the SEC, many investors have turned to the GBTC for an ETF-like product to invest in without having to worry about actual ownership of bitcoin.

Grayscale has seen AUM in their GBTC product surge recently, reaching as high as \$6bn.¹⁶ Due to high demand of their product, GBTC trades at a premium compared to the price of its underlying bitcoin and there is a six-month lock-up period before an investor can sell their shares.¹⁷ However, that has not discouraged investors turning to Grayscale's product as they have seen inflows of over \$1bn to the GBTC in the first half of 2020. Grayscale credits this to its growing customer base of hedge funds, family offices, and endowments. To put the impressive size of GBTC in perspective, its \$6bn market-cap would put it in the top 5% of all ETFs in the world.¹⁸

Active Managers/ Typhon Capital

On the other hand, an institutional investor can turn to many of the newly launched, actively managed crypto funds. As the PWC/ Elwood Asset Management piece referenced earlier pointed out, there is a growing number of crypto only funds. Unlike the GBTC product which simply gives someone long exposure to bitcoin, 48% of actively managed crypto funds employ a quantitative trading strategy.¹⁹

One example of an investment firm that launched an actively managed cryptocurrency fund is Typhon Capital. Typhon Capital is a multi-strat hedge fund formed by James Koutoulas in 2008, and now manages over \$300mn in assets across various commodity, equity, currency, and volatility strategies. In 2017, Typhon launched the Leonida's Cryptocurrency Fund. The Leonida's Fund selectively trades 10 cryptocurrencies and provides a risk-management approach to trading digital assets. Since inception, the fund has an impressive 1.23 Sharpe Ratio and 4.09 Sortino Ratio.²⁰

According to James Koutoulas, most actively managed cryptocurrency funds today employ either a basic cross exchange arbitrage or levered beta strategy. The cross-exchange arbitrage strategy effectively exploits arbitrage opportunities across various cryptocurrency exchanges but is subject to operational risks. Many of these exchanges are at risk to hacks or poor infrastructure that could crash and lead to catastrophic losses for funds trading on them. The other common strategy actively managed crypto funds follow is a levered-beta product, which is essentially highly levered exposure to digital assets. However, many of these levered-beta funds charge extremely high fees (as high as 3% management & 30% performance) and do not really deliver any true 'alpha' other than leveraged, long exposure to digital assets. Additionally, they are not providing any downside protection and can have huge drawdowns.

James explained that Typhon's Leonida's Cryptocurrency Fund differentiates itself from other actively managed cryptocurrency funds by making risk management the center of their strategy. The Leonida's Fund avoids operational risks that arbitrage funds face by trading only on US-domiciled exchanges and using trustworthy firms like Gemini and Fidelity for storage of their digital assets. Additionally, unlike the common levered-beta funds, the Leonida's Fund actively uses derivatives such as futures and options for risk management. The ability to short Bitcoin Futures or purchase a put option on a Bitcoin Options contract enables the Leonida's Fund to provide downside protection for their investors if the price of digital assets ever drops substantially. This can be seen through Leonida's max drawdown of 24% since the fund launched in late 2017, compared to bitcoin's largest drawdown of 75% during that same period.²¹

While the downside protection the Leonida's Fund provides is a key differentiator for them, it prevents some of the big upside rewards in bull markets for digital assets. However, the Leonida's Fund is ok with this, and wants to be viewed as a means for institutional investors to gain access to digital assets in the safest way possible. James argues, "real institutional investing hasn't happened in digital assets and we are building a risk-managed product that investors actually want to see." In addition, the Leonida's Fund keeps fees low by not charging a management fee for their investors. Evidently, the Leonida's fund is the type of strategy that investors will look to when they finally decide to allocate to digital assets and their risk-managed strategy indicates growing institutionalization in the actively managed digital asset investing space.

Venture Capital Firms

Lastly, there are a growing number of Venture Capital-style investment firms that could provide exposure to the digital asset space through investments in new blockchain start-ups. Unlike actively managed crypto hedge funds, crypto VC firms have a much longer-term holding period and draw better comparison to traditional Private Equity or Venture Capital investment firms. According to research see in Figure 3 from Hutt Capital, a blockchain VC fund of funds, as of April 2020 there were over 65 venture funds managing over \$4bn in assets- an increase from 49 funds with an aggregate of \$3.8bn in assets a year prior.²²

Aggregate Fund Capital			
April 2020		April 2019	
# Funds	65	# Funds	49
Total \$	\$4,068	Total \$	\$3,822
Average Size	\$63	Average Size	\$78
Median Size	\$30	Median Size	\$60

All dollar figures in USD millions

(FIGURE 3- HUTT CAPITAL)

Additionally, Hutt Capital estimates that of the \$4bn AUM in blockchain VC funds- nearly \$1-1.5bn is available as dry powder and ready to invest. This represents roughly 0.5% of dry powder for all VC funds, which is a slightly undersized amount since blockchain startups raised 1.1% of all VC capital and accounted for 2.8% of all deals in 2019.²³ Perhaps indicating that VC blockchain funds are putting their capital to work more quickly than traditional VC funds, as they are finding more attractive deals in the blockchain start-up space.

Some of the largest and most successful blockchain VC investment firms include Pantera Capital (\$750mn AUM), Polychain Capital (\$1bn AUM), and A16 Crypto (\$860mn AUM fund part of renown VC firm Andreessen Horowitz). These firms have had great success with their investments and boast some very impressive portfolio companies as can be seen below in Figures 4 & 5.²⁴

Investor	Deal count
Digital Currency Group	127
Blockchain Capital	57
Pantera Capital	56
Digital Horizon Capital	38
Fenbushi Capital	36
Plug and Play Tech Center	32
500 Startups	31
Andreessen Horowitz	30
NEO Global Capital	27
Boost VC	25

(FIGURE 4- PITCH BOOK)

Company	Month	Amount	Deal type	HQ
 coinbase	October 2018	\$300M	Series E	San Francisco
 Bakkt	December 2018	\$183M	Series A	Atlanta
 BLOCKTOWER	January 2018	\$140M	Early Stage VC	Stamford, CT
 BASIS	April 2018	\$133M	Early Stage VC	Hoboken, NJ
 R3	May 2018	\$122M	Series A	New York
 CIRCLE	May 2018	\$110M	Series E	Boston
 coinbase	August 2017	\$108M	Series D	San Francisco
 FINOVA financial	October 2017	\$103M	Early Stage VC	Palm Beach Gardens, FL
 Hedera Hashgraph	August 2018	\$101M	Early Stage VC	Richardson, TX
 FORGEROCK	September 2017	\$88M	Series D	San Francisco

(FIGURE 5- PITCH BOOK)

Lending Firms/ Genesis Capital

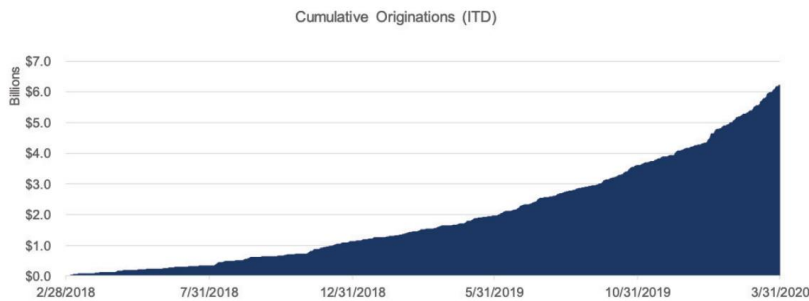
In recent years there has been a surge in the number of digital asset lending firms. Lending in the digital asset space has become quite common, as long-term holders of cryptocurrencies loan them out to capture yield. While others looking to short digital assets may borrow crypto to put on a short position in the open market, much like Securities Lending in the equity space.

One of the largest digital asset-lending firms is Genesis Capital, run by Mike Moro ('00). Genesis Capital was founded in March 2018 and has quickly become the leader in the institutional digital asset lending space. Since inception, Genesis has originated over \$6bn loans- with \$2bn currently outstanding on their platform. Mike estimates that the current lending market in digital assets sits around \$5-6bn, giving Genesis a good chunk of the total market-share.²⁵ While a total market size of \$5-6bn is certainly impressive for a new market, it is still dwarfed compared to the \$2tn+ market for Securities Lending.

Unlike Genesis Capital's competitors in the lending space like BlockFi or Celsius who have targeted both institutional and retail clients, Genesis is exclusively building out their lending platform for just institutional clients. Genesis Capital's current customer base of hedge funds, family offices, market-makers, exchanges, and payment providers uniquely position them to grow the pie of the entire lending business as more institutions embrace digital assets.

As part of their quarterly results, Genesis publishes their borrow/ loan book. As can be seen in Figure 6, Genesis's loans outpace their borrows, perhaps indicating that their institutional clients are borrowing more crypto from them to place short bets.²⁶

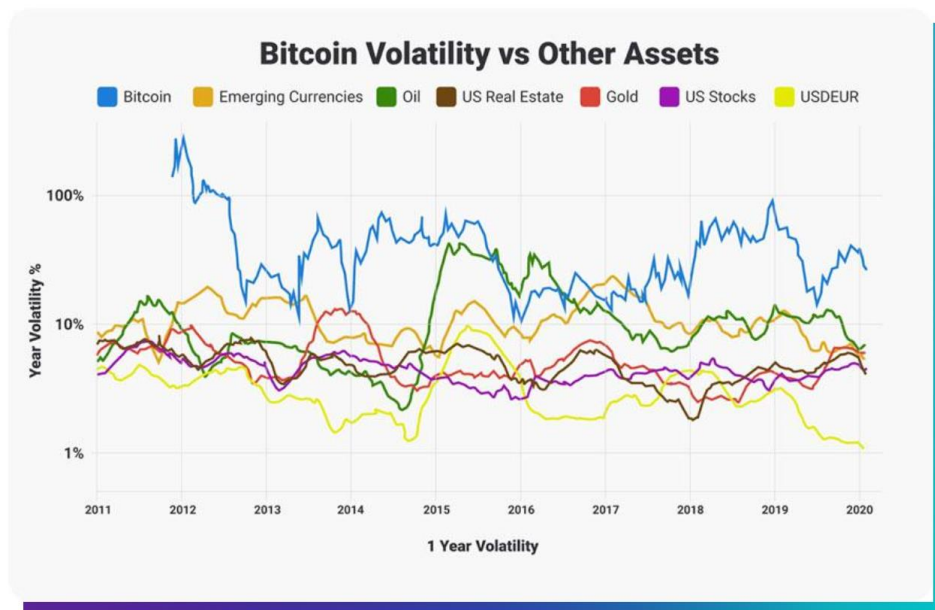
(\$ in mm, except BTC Price)	12/31/2019	3/31/2020	QoQ Growth
Cumulative Originations	\$4,251	\$6,231	46.6%
Cumulative Loans	\$2,710	\$3,937	45.3%
Cumulative Borrows	\$1,542	\$2,294	48.8%
Active Loans	\$545	\$649	19.1%
BTC Price	\$7,145	\$6,469	-9.5%



(FIGURE 6- GENESIS GLOBAL CAPITAL)

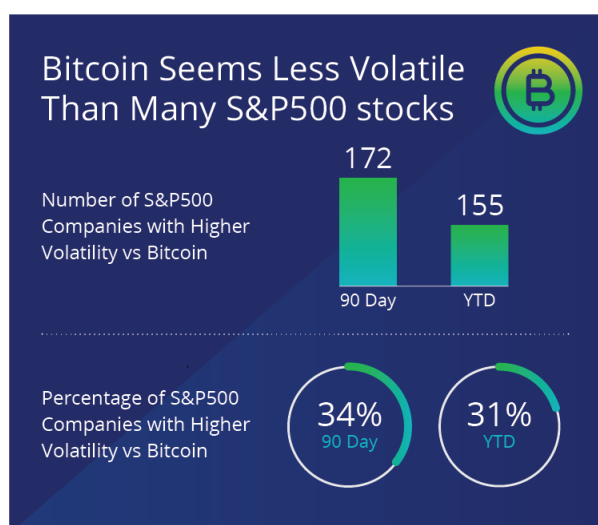
Volatility/ Correlation in Cryptocurrencies

One major complaint people claim prevents digital assets from being widely accepted is their volatility. As seen in Figure 7, bitcoin tends to be much more volatile than other asset classes. However, it appears that the volatility in bitcoin is subsiding and is not that far off from the highs in volatility observed in asset classes like oil or emerging currencies.



(FIGURE 7- NASDAQ)

One interesting piece of analysis by VanEck, an ETF provider with more than \$50bn AUM and one of the firms hoping to launch the first digital asset ETF, concluded that bitcoin is actually less volatile than over 30% of the S&P 500 constituents. Looking at the underlying components in the S&P500 through their 90-day and YTD moving average, VanEck concluded that 34% and 31%, respectively, of those publicly traded companies had a greater volatility than bitcoin (as can be seen in Figure 8).²⁷



(FIGURE 8- VANECK)

These figures indicate the while bitcoin, used here as a proxy for the digital asset space, is certainly more volatile than other asset classes, this volatility is apparently becoming more subdued and is even less

volatile than many equities. As more institutions begin investing and trading bitcoin and other digital assets, this volatility should continue to fall.

Additionally, from an investment standpoint, bitcoin's correlation to other asset classes is perhaps even more important than its volatility. Looking at the highlighted numbers in Figure 9, bitcoin has an extremely low correlation to nearly every investable asset class.

Correlation 2/1/2012 to 6/30/2020	S&P 500	US Bonds	Bitcoin	Gold	US Real Estate	Oil	Emerging Market Currencies
S&P 500	-	-0.06	0.15	0.03	0.60	0.52	0.45
US Bonds	-0.06	-	0.00	0.46	0.42	-0.11	0.35
Bitcoin	0.15	0.00	-	-0.07	-0.04	0.07	-0.02
Gold	0.03	0.46	-0.07	-	0.10	0.10	0.43
US Real Estate	0.60	0.42	-0.04	0.10	-	0.23	0.46
Oil	0.52	-0.11	0.07	0.10	0.23	-	0.32
Emerging Market Currencies	0.45	0.35	-0.02	0.43	0.46	0.32	-

(FIGURE 9- VANECK)²⁸

This low correlation means that bitcoin can provide investors an opportunity to invest in an asset that has little-to-no correlation with the rest of their portfolio. As the adage goes, *'diversification is the only free lunch in finance,'* and while bitcoin certainly has a higher volatility than other assets, its low correlation is perhaps even more important to consider, and a greater sign of the way institutional investors are looking at these markets.

Recent Guidance from OCC, SEC, & DOJ

There has also been some positive news on the regulation front that will help expediate the ability for institutions to hold digital assets. In July, Brian Brooks the head of the Office of Comptroller of the Currency (OCC), claimed:

"From safe-deposit boxes to virtual vaults, we must ensure banks can meet the financial services needs of their customers today... This opinion clarifies that banks can continue satisfying their customers' needs for safeguarding their most valuable assets, which today for tens of millions of Americans includes cryptocurrency."²⁹

This announcement meant banks are now able to custody digital assets for their customers. Up until this time, it was still unclear as to whether banks could store digital assets for their customers. While many banks do not yet have the infrastructure built out, or even enough client interest to do so, this is a great indication that regulators are starting to understand the growing desire to provide more regulatory clarity on digital assets.

Similarly, SEC Chairman Jay Clayton, who has been stringent on approving any ETFs linked to digital assets, seemed to offer a more bullish sentiment towards the notion. At a webinar with the Chamber of Digital Commerce in early October, Chairman Clayton claimed, "We're willing to try that; our door is wide open. If you want to show how to tokenize the ETF product in a way that adds efficiency, we want to meet with you, we want to help facilitate that." Chairman Clayton even went as far as drawing comparisons between the potential he sees in blockchain and digital assets with the increased efficiencies that electronification of trading has brought the industry.³⁰

Additionally, the Department of Justice recently published a report in early October titled, *Cryptocurrency: An Enforcement Framework* detailing the DOJ's plans to enforce regulations surrounding digital assets. Attorney General, William Barr, claims in this report that, "cryptocurrency is a technology that could fundamentally transform how human beings interact, and how we organize society... Ensuring that use of this technology is safe, and does not imperil our public safety or our national security, is vitally important to America and its allies."³¹ Similar to statements made by the SEC and OCC, the DOJ is acknowledging the benefits digital assets can have on society while arguing the need to properly regulate them.

While many in the crypto space believe that regulators have been too slow to support digital assets, much of regulators concerns over the past few years are quite valid. The digital asset space is still very new and can be extremely risky. It is prudent of regulators to cautiously approach this space and these recent statements from the OCC, SEC, and DOJ indicate that they are trying to help facilitate ways for institutions to safely utilize the benefits digital assets can provide.

Conclusions on the Current State of Institutionalization

Whether it is the success CME saw in the rollout of their Bitcoin Futures contract or the addition of prominent firms to the space like Goldman Sachs, JP Morgan, Renaissance Technologies, and Facebook- it is clear that institutions are no longer ignoring digital assets. Additionally, actively managed strategies like the Leonida's Fund and the growth seen in blockchain VC firms along with other investable products like the Grayscale Bitcoin Trust, has shown there is clearly an interest to allocate to digital assets now and the groundwork is being laid for institutional investors. Firms like Genesis Capital are furthering the institutionalization of the digital asset space by developing a lending marketing, much like we see in the Securities Lending space. Finally, subdued volatility in bitcoin and recent comments from the SEC, OCC, and DOJ have shown that these markets are no longer 'the wild west' and there is serious interest to bring about safe ways to access these for institutions.

However, with a total market-cap of only \$360bn, digital assets are still dwarfed compared to the entire investable universe today. There are still a whole host of inefficiencies in the digital asset space that need to be addressed before they are truly institutionalized. Thus, while digital assets have quietly matured over the past few years, they still have a long way to go. The second half of this paper will examine what is needed to get digital assets over the hump to this next stage of institutional acceptance.

What will the next level of institutionalization of digital assets look like?

As discussed earlier, the digital asset space has grown substantially over the past few years and is now embraced some of the largest exchanges, banks, and investment firms. However, there is still a long way to go before digital assets are truly institutionalized. Whether it is the long-awaited approval of the first digital asset ETF, more clarity from the SEC & CFTC, introduction of custodians and prime brokers, further use-cases that will entice institutional adoption, or more education and market awareness

dedicated to the space- there is still much work to be done. This section of the paper will address these very points and ultimately look to forecast what will be needed for digital assets to take this next step towards institutionalization and examine some of the progress already being made in these areas.

Current Status of Digital Asset ETFs

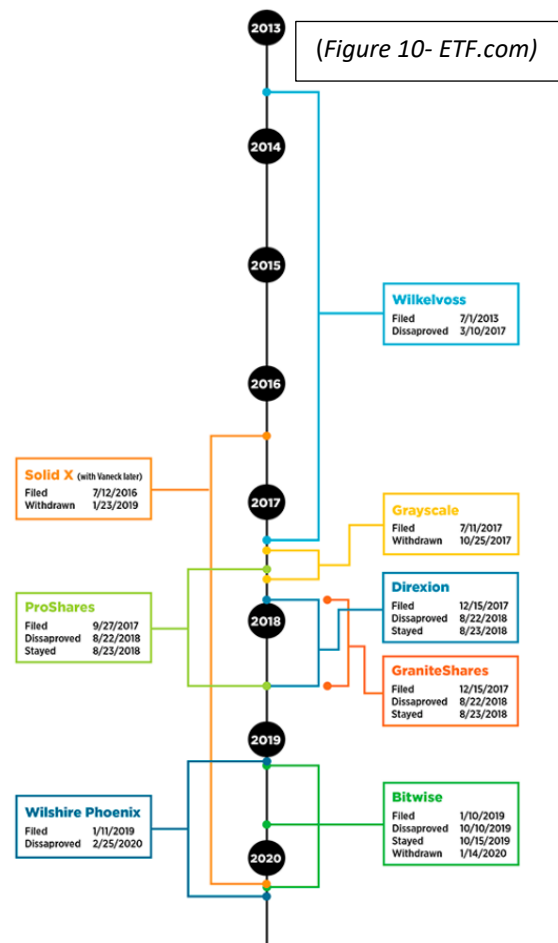
One of the most common 'next-steps' towards institutional adoption of digital assets people point to is the approval of an ETF. To date, the SEC has yet to approve of any ETFs linked to cryptocurrencies despite dozens of applications from firms like VanEck, ProShares, Bitwise Asset Management, and others, as can be seen in the timeline on Figure 10.³²

Before more recently signaling that he was beginning to see the benefits of a digital asset ETF, SEC Chairman Jay Clayton appeared to have been quite dismissive towards them, stating in September 2019:

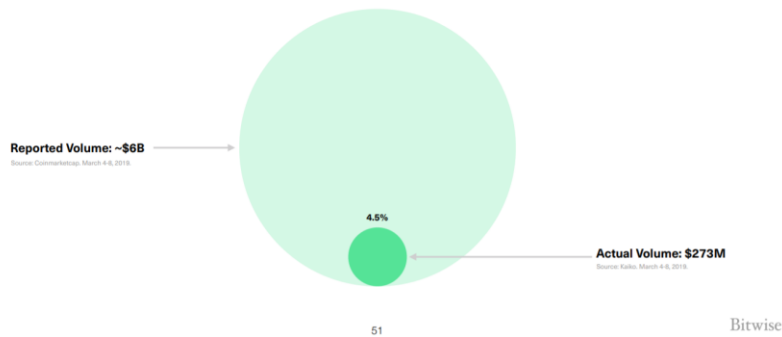
"Given that [digital assets] trade on largely unregulated exchanges how can we be sure that those prices aren't subject to significant manipulation? ... People needed to answer these hard questions for us to be comfortable that this was the appropriate kind of product."³³

The main roadblock the SEC sees that is preventing an ETF approval has been their concerns with the underlying, unregulated spot crypto exchanges. Since most cryptocurrency trading gets done on unregulated exchanges, the SEC believes price manipulation conducted on these offshore exchanges can influence the prices across the entire market. Thus, subjecting even regulated, US-based exchanges to potential price manipulation.

One of the main arguments the SEC has used is that much of the 'reported' cryptocurrency volumes across exchanges are fake. Bitwise Asset Management published a report in March 2019 illustrating this very phenomenon and found that over 90% of the reported cryptocurrency volumes are fake, as can be seen in Figure 11.³⁴



Total Volume Is Considerably Less Than Reported



(FIGURE 11- BITWISE ASSET MANAGEMENT)

However, Bitwise believes that while much of the volumes are fake, bitcoin's 'real' market is still liquid enough for the SEC to approve an ETF. The SEC has approved ETFs that see much less underlying daily turnover than the 'real' volumes of bitcoin. At the time of the Winklevoss Bitcoin Trust application, their exchange had \$4.2mn ADV- exceeding those seen across other ETFs in Figure 12. Nevertheless, the SEC claimed that:

"The issue here is not that the Gemini Exchange has low trading volume in an absolute sense but, rather, that the Trust would value its holdings using the Gemini Auction price, even though there is no basis in the record to find that the Gemini Auction represents a significant portion of the worldwide bitcoin trading."³⁵

In other words, there is no indication that the ETF's theoretical closing price derived from Gemini's Auction has enough volume to act as an appropriate proxy for the entire bitcoin market. Thus, perhaps if an ETF filing changed their benchmark to a venue that represents more of the total traded market, then the SEC would feel more comfortable approving it.

ETF Ticker	Name	Underlying Type	Average Underlying \$ADV (\$MM)
NGE	Global X MSCI Nigeria ETF	INTL	0.2
ICOL	iShares MSCI Colombia Capped ETF	INTL	2.3
PAK	Global X MSCI Pakistan ETF	INTL	2.4
VNM	VanEck Vectors Vietnam ETF	INTL	2.8
XMPT	VanEck Vectors CEF Municipal Income ETF	CEF	3.0
PCEF	PowerShares CEF Income Composite Portfolio	CEF	3.1
QAT	iShares MSCI Qatar Capped ETF	INTL	3.3
EPHE	iShares MSCI Philippines ETF	INTL	3.4
GREK	Global X MSCI Greece ETF	INTL	3.6
PZI	PowerShares Zacks Micro Cap Portfolio	SM CAP	3.7
GXG	Global X MSCI Colombia ETF	INTL	3.7
YYY	Yield Shares High Income ETF	CEF	3.9
ENZL	iShares MSCI New Zealand Capped ETF	INTL	4.1

(FIGURE 12- BITWISE ASSET MANAGEMENT)

There have been two main types of digital asset ETF filings, physical-based filings and futures-based filings. As per their namesake, physical-based filings would hold 'physical' cryptocurrencies for their underlying exposure in the ETF. Whereas a futures-based filing would hold futures contracts traded on an exchange for their exposure. A physical-based filing would replicate what is traditionally seen in the equity space, where an ETF holds the underlying shares of stocks or other instruments that make up the

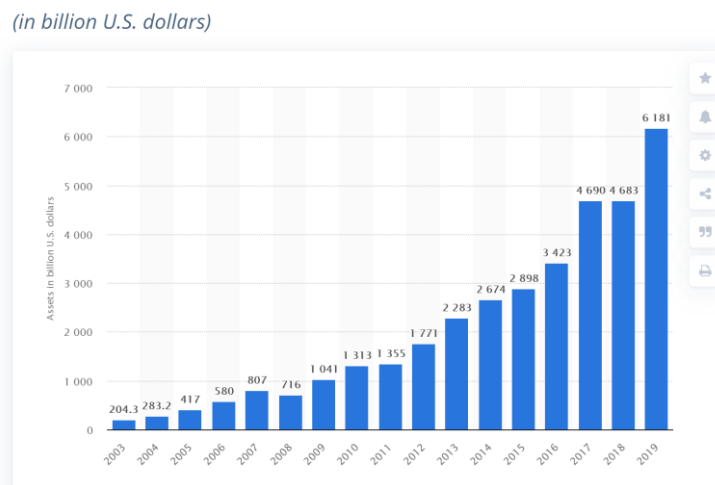
basket in the ETF. On the other hand, a futures-based filing would be similar to most commodity-based ETFs that get their exposure through holding futures contracts based off the underlying asset.

While it is not clear what type of filing the SEC would prefer, some speculate that a futures-based filing would be easier to approve. A futures-based filing would meet the liquidity thresholds and potentially alleviate any concerns the SEC has on unregulated exchanges, since the futures market is regulated by the CFTC. As demonstrated earlier in the paper, with CME Group's \$250mn daily volume and open interest of \$750mn+, there is clearly sufficient liquidity in the futures market to support a bitcoin ETF.

Additionally, some have argued that since bitcoin holds no true value it could go to 0 and result in catastrophic losses for investors who might hold the ETF. This exact phenomenon played out in April 2020 when the front-month WTI Crude Oil contract briefly went negative.³⁶ However, USCF (the manager of the \$3.5bn ETF that tracks the WTI contract) had already rolled out of the April WTI contract that went negative and avoided shares of their ETF going negative.³⁷ A bitcoin futures based ETF could follow similar protocols, rolling their positions well before expiry so that they can avoid any large price jumps associated with the calendar roll of futures contracts.

Benefits of a Digital Asset ETF

A bitcoin or digital asset-based ETF could provide numerous benefits to the investment and retail community. ETF's have revolutionized finance by giving investors a low-cost way to access stocks, bonds, currencies, and commodities in a 'basket' that trades on a public exchange. At the end of 2019, over \$6tn in assets were pegged to the global ETF market.³⁸



(FIGURE 13 – STATISTA)

A bitcoin or digital asset-pegged ETF would give institutional and retail investors a simple way to access this market. Outside of the Grayscale Bitcoin Trust, which is reserved for only accredited investors and trades OTC, there is no easy way for someone to invest in digital assets without owning the 'physical' coin or investing in a fund that will do this for you.

There is certainly strong demand from individual investors to own bitcoin. One such example is Michael Barston ('81), who was recently looking for a way to access bitcoin through his Vanguard account. Mike believes bitcoin trades like a commodity that is inversely correlated to the US Dollar and sees the benefit of diversifying his current portfolio, that consists of just stocks and bonds, with a small allocation to digital assets.³⁹ However, his brokerage account, Vanguard, does not currently support any way for him to access this market. An ETF that trades on a regulated exchange would likely be supported by Vanguard, and other brokers, and finally provide him a way access to digital assets.

Mike is not alone; Coinbase, one of the largest cryptocurrency exchanges in the world- with a stronghold on the retail market, announced that they have over 35 million customers in 2020.⁴⁰ Through Coinbase, many retail customers are able to purchase fractions of digital assets. Purchasing digital assets through Coinbase requires individual investors to 'own' these coins, subjecting them to hacking risks and worry about ways to custody their bitcoin holdings. For the majority of these 35 million customers on Coinbase, owning an ETF would be a much safer and simpler method for them to invest in digital assets.

Improved Regulations

Another key hurdle preventing digital assets from being adopted is the need for more clarification on regulations. Even though the SEC has authority over any ETFs or securities touching digital assets and the CFTC oversees anything dealing with futures tied to digital assets, there are still a lot of questions as to what falls under each regulating body's jurisdiction and what is outside of their control completely. As mentioned earlier, while there has recently been some positive guidance from the SEC, OCC, and DOJ, there are still several things that need to be addressed before institutions feel more comfortable with digital assets.

The SEC's oversight on digital assets dates back to May 2014, following the hack of the largest digital asset exchange at the time, Mt. Gox. After the hack, the SEC published a lengthy warning on the risks associated with investing in 'Bitcoin and Other Virtual-Currency Related Investments' arguing that:

*"The rise of Bitcoin and other virtual and digital currencies creates new concerns for investors. A new product, technology, or innovation – such as Bitcoin – has the potential to give rise both to frauds and high-risk investment opportunities. Potential investors can be easily enticed with the promise of high returns in a new investment space and also may be less skeptical when assessing something novel, new and cutting-edge."*⁴¹

While this may seem like a rather grim outlook on bitcoin and its fellow digital currencies, this was an important first step in acknowledging the need for enforcement. Additionally, at the time digital assets were still very nascent and much of what the SEC claimed was not untrue given some of the illicit use-cases bitcoin was being used for.

A few years later, in July 2017, the SEC made a groundbreaking ruling on Initial Coin Offerings (ICOs) in the Dao Token report. In their investigation, the SEC concluded that:

*"tokens offered and sold by a "virtual" organization known as "The DAO" were securities and therefore subject to the federal securities laws. The Report confirms that issuers of distributed ledger or blockchain technology-based securities must register offers and sales of such securities unless a valid exemption applies. Those participating in unregistered offerings also may be liable for violations of the securities laws. Additionally, securities exchanges providing for trading in these securities must register unless they are exempt."*⁴²

This meant that many ICOs exhibit the same characteristics of basic securities and must be treated as such under regulation.

Similarly, the CFTC has had their eyes on digital assets for the past few years, and one might even argue they have appeared a bit more accepting towards them than the SEC. In September 2015, the CFTC officially declared bitcoin as a commodity. A few years later In October 2019, CFTC Chairman Heath Tarbert followed with a similar ruling on Ethereum, the second largest digital asset in the world:

“We’ve been very clear on bitcoin: bitcoin is a commodity under the Commodity Exchange Act. We haven’t said anything about ether – until now. It is my view as Chairman of the CFTC that ether is a commodity, and therefore it will be regulated under the CEA. And my guess is that you will see, in the near future, ether-related futures contracts and other derivatives potentially traded ... It’s my conclusion as Chairman of the CFTC that ether is a commodity and therefore would fall under our jurisdiction.”⁴³

Many in the crypto community celebrated this news as meaning that digital assets will be considered commodities and fall under regulation of the more crypto-friendly CFTC, while any securities-based products associated with them, like a digital asset ETF, will fall under the SEC.

On state and local level, more regulating agencies need to take the lead of *New York State Department of Financial Services* (NYSDFS), who has set up a designation called a “BitLicense.” A BitLicense is a permit that allows a firm to participate in any digital currency related businesses in the state of New York. According to the NYSDFS, without a BitLicense, a firm is not allowed to take part in⁴⁴:

- receiving Virtual Currency for transmission or transmitting Virtual Currency;
- storing, holding, or maintaining custody or control of Virtual Currency on behalf of others;
- buying and selling Virtual Currency as a customer business;
- performing exchange services as a customer business; or
- controlling, administering, or issuing a Virtual Currency.

Many in the crypto community have complained about the BitLicense making it difficult to conduct business associated with digital assets in New York. However, it is a great first step by the state regulating agency overseeing New York City, the financial capital of the world, to make sure they are monitoring digital assets as they do other parts of the financial system.

Additionally, the CFTC has promised to “develop a holistic framework to promote responsible innovation in digital assets,” even referring to digital currencies as “21st Century Commodities” by including Figure 14 in their 2020-2024 Strategic Plans.⁴⁵

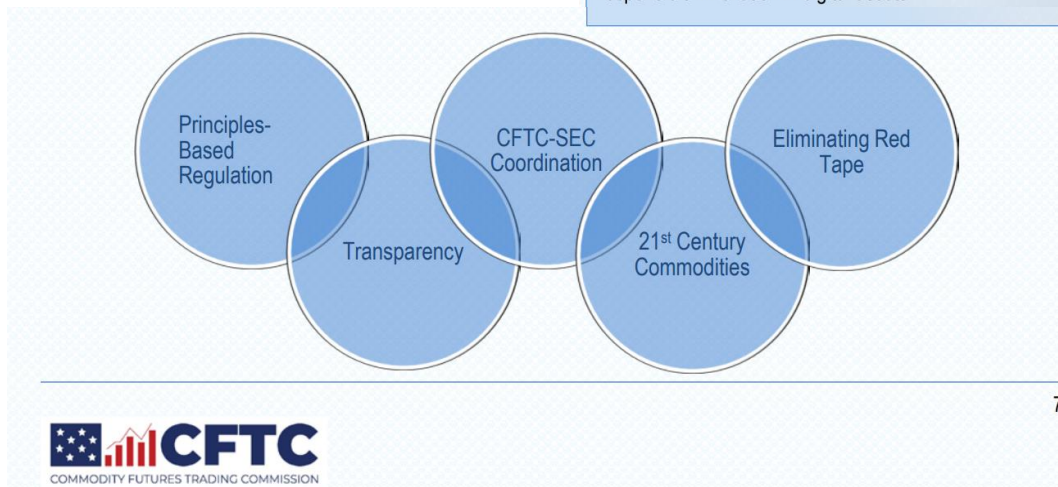
Strategic Goal 3

Encourage innovation and enhance the regulatory experience for market participants at home and abroad.

Strategic Goal 3: Strategic Objectives

3.4 Address the risks and opportunities arising from "21st century commodities."

We will develop a holistic framework to promote responsible innovation in digital assets.

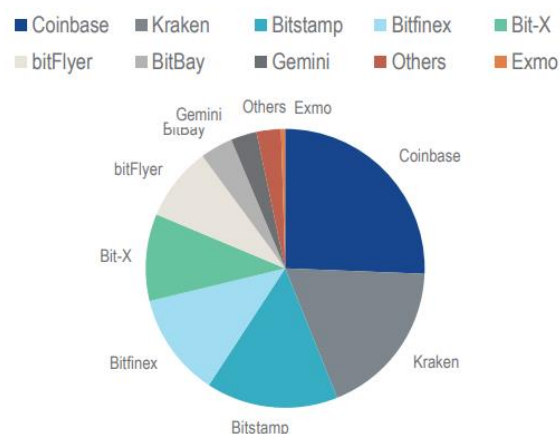


(Figure 14- CFTC)

When considering potential ways to regulate digital assets in the future, it is important to look at how other markets are currently regulated. The Securities Acts of 1933 & 1934 require all securities sold to the public be registered with the SEC and regulates all stock exchanges and trading.⁴⁶ There are currently 13 registered US Stock Exchanges that fall under this jurisdiction and are closely monitored by the SEC. Internationally, stock exchanges are also tightly regulated by the country they are domiciled in—for example, the London Stock Exchange is monitored by the UK's Financial Conduct Authority and Euronext is regulated by France's *Autorité des marchés financiers*.⁴⁷ While each country's set of rules may differ slightly, nearly all public securities that trade on these exchanges are monitored by regulating bodies that uphold the integrity of these markets.

Conversely, there are nearly 200 cryptocurrency exchanges across the world that mostly go unregulated. Unlike a stock exchange which must receive approval before listing new securities, cryptocurrency exchanges often list thousands of highly illiquid cryptocurrencies. As can be seen in Figure 15, there are dozens of different spot exchanges claiming significant portions of market share.⁴⁸

Exchange	6 Months	
	Volume (BTC)	Market Share
Coinbase	3.70M	25.62%
Kraken	2.64M	18.30%
Bitstamp	2.21M	15.30%
Bitfinex	1.74M	12.02%
Bit-X	1.46M	10.09%
bitFlyer	1.24M	8.59%
BitBay	545K	3.78%
Gemini	433K	3.00%
Others	410K	2.84%
Exmo	68K	0.47%



(FIGURE 15- VANECK)

Originally, much of the appeal to cryptocurrencies was their decentralized nature and the fact that they were outside of control of the banks or regulators. This allowed digital assets, like bitcoin, to truly act like a safe-haven asset and offered protection against inflation or changing monetary policies from central banks. However, this “laissez-faire” attitude must change if digital assets are to be truly adopted by institutions. Proper regulation must exist and there can no longer be unanswered questions as to what and who truly regulates digital assets or institutional investors will continue to wait on the sidelines.

Custody & Prime Brokerage of Digital Assets

Background on Custody and Prime Brokerage

Another key piece to the institutionalization of digital assets is the ability to custody them. In traditional markets, custodian banks act as a third-party agent that holds assets and securities on behalf of their customers. Two of the largest custodian banks in the world, BNY Mellon and State Street, have nearly \$70tn in assets under custody combined.⁴⁹ Custodian banks safeguard these assets and even offer services such as transaction settlements, interest payments, and tax support. One of the major barriers preventing true institutional adoption of digital assets is that large custodian firms have not begun offering custody services for institutional investors.

There are several potential reasons why traditional custodians have not yet begun offering custody solutions for digital assets. The first, and perhaps most obvious reason, is a lack of comfort with digital assets. Hundred-year-old firms like BNY and State Street may not feel it is worth the risk to custody digital assets for their clients in such an evolving, volatile space. Secondly, up until recently there was a lack of regulatory clarity on holding and storing digital assets. While the OCC recently appeared to give custodians and banks clearance to begin storing digital assets for their customers, a large custodian may not have the risk tolerance to be one of the first to enter this space. Finally, there may be a lack of ambition and drive at larger firms to enter this new market. One could imagine that the type of engineer or developer that wants to create custody solutions for digital assets would prefer to work at a start-up environment rather than in a larger, bureaucratic organization.

While custodianship of any financial instrument is vastly complicated, storing digital assets presents an even greater challenge. Since cryptocurrencies have a history of being hacked and stolen, owners of digital assets tend to keep their holdings in a 'cold wallet,' or in storage that is not connected to the internet- much like a thumb-drive device. The preference of large holders of digital assets to self-custody, with their own cold storage devices, plays up to the decentralized intention of cryptocurrencies, but also acts as a major hurdle preventing institutions from entering the space since it is not what they are accustomed to for other markets.

Additionally, many believe that the prime brokerage model that exists in traditional markets must be replicated for digital assets. Most institutional investors are used to the full-encompassing services in the traditional prime brokerage model offered by banks, such as trade settlement/ clearing, connectivity to exchanges, securities lending, access to leverage, and institutional research reports. Prime brokers play a vital role in the institutional trading and investing space. For example, without a prime broker, many hedge funds would be unable to short stocks or trade derivative contracts. Hedge funds rely on their prime broker for connectivity to exchanges and settling their trades. Since many of the traditional prime brokers that hedge funds and investment firms use do not yet offer these services in the digital asset space, they feel uncomfortable participating in these markets.

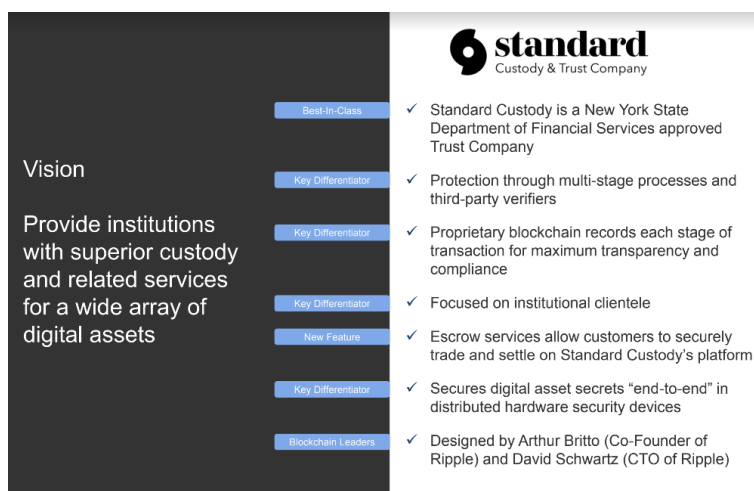
Since very few custodians and prime brokers exist in the digital assets space, cryptocurrency exchanges are beginning to offer some of these services. Gemini and Coinbase, two of the leading cryptocurrency exchanges, recently dipped their toes into the custody and prime brokerage spaces. Lending firms like Genesis, mentioned earlier, are also looking to expand into the custody space through a recent acquisition they made of a London-based custodian named Volt. Investment banks like Goldman Sachs and JP Morgan have even begun to offer some basic prime brokerage services, like the settlement and clearing of digital asset futures contracts. However, it is clear that the custody and prime brokerage space is one of the biggest areas of growth needed for digital assets to become further institutionalized.

PolySign

One interesting case study of an innovative firm attempting to break into the digital asset custody and prime brokerage space is PolySign. PolySign was founded in 2018 by Arthur Britto, the former co-founder of Ripple, and several of his colleagues who helped develop XRP's blockchain. PolySign is now led by Jack McDonald (SFS'88 & L'93), who previously served as CEO of Conifer Financial Services- a global custodial and fund administration firm that had over \$125bn of Assets Under Administration. One of PolySign's main selling points to customers is their private blockchain, which ensures each client's transactions are highly secure, recorded and can be transferred with ease. This private blockchain was developed with the needs of institutional customers in mind and will be highly scalable.

PolySign's subsidiary organization Standard Custody & Trust Co. was recently granted a 'Trust Company Charter' by the NY Department of Financial Services. This key designation allows Standard Custody to act as a Qualified Custodian. As per the SEC's Investment Advisers Act of 1940, any institutional investment firm with over \$150mn AUM must custody with a Qualified Custodian.⁵⁰ Additionally, being a Qualified Custodian allows Standard Custody to be appointed a sub-custodian by larger banks or custodians that are not yet equipped to offer digital asset custody solutions to their clients. For example, a bank can sub-contract out Standard Custody's custody services for clients of their own that are looking for a Qualified Custodian to custody their digital assets. JP Morgan was recently mentioned

as one of the banks actively pursuing these types of sub-custody agreements with crypto-native firms.⁵¹ Figure 16 displays many of Standard Custody's key differentiators in the custody market.



(FIGURE 16- POLYSIGN)⁵²

PolySign is also looking to expand their custody offering into the prime brokerage space by additional services such as lending and collateral management. PolySign's prime brokerage services would utilize the same proprietary blockchain used by their custody businesses, potentially acting as a key link between the two. Finally, PolySign is leveraging their blockchain technology with the development of PolyNet, a software platform that will enable trading and instant atomic settlement of transactions involving illiquid securities and/or digital assets.

The entrance of firms like PolySign, offering services in Custody and Prime-Brokerage, provide one of the necessary 'on-ramps' for institutional firms looking to get involved in digital assets that did not exist before.

More Use-Cases Needed for Digital Assets

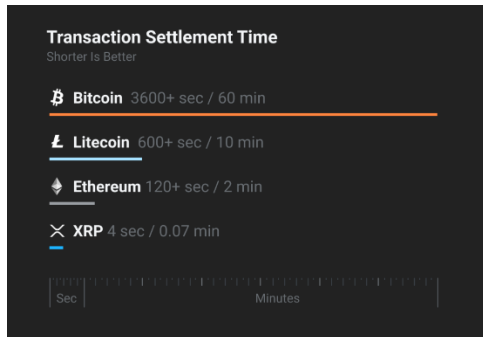
Perhaps the biggest roadblock for institutional adoption is the lack of true 'use-cases' for digital assets. Bitcoin was originally intended to be used for peer-to-peer, anonymous payments. However, as the price of bitcoin became too volatile, online payment services could no longer keep up. For example, Steam, a well-known online video game marketplace announced in 2017 that they would no longer accept bitcoin due to its "high [processing] fees and volatility."⁵³ While there have been some great innovations in newly launched digital assets, we are still a ways off from seeing them fully serve a functional purpose in our financial or payments services. Ultimately, until more use-cases are readily available it is unlikely we will see scalable adoption.

Ripple

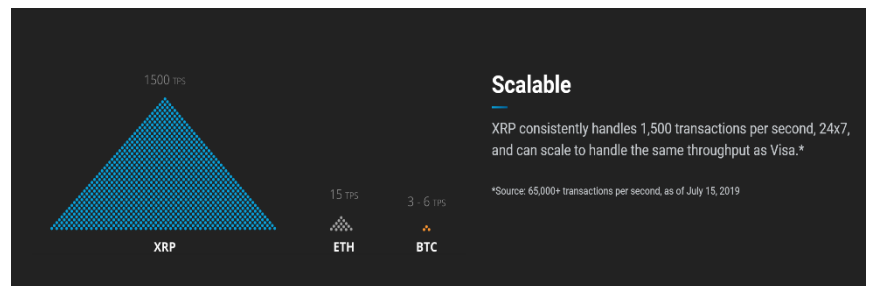
Ripple's cryptocurrency, XRP, is an example of a new digital asset that has a functionable use-case and can provide institutions a reason to adopt them. Ripple, founded in 2012, is hoping to transform the antiquated payment system banks have been using for nearly the last 50 years. SWIFT (Society for Worldwide Interbank Financial Telecommunications) is the current 'gold standard' for global payment processing. Developed in the 1970s, SWIFT is the technology behind monetary transfers between

banks. There are over 11,000 SWIFT member institutions that process over 30 million transactions per day through this network.⁵⁴

Ripple believes they will revolutionize this outdated payment process with their cryptocurrency called XRP. XRP, the 4th largest digital asset in the world with a market cap of over \$10bn, was developed by Ripple to facilitate peer-to-peer payments without the need of an intermediary.⁵⁵ Unlike SWIFT, which can take anywhere from two-five days to fully process a transfer, XRP can settle transactions in 3-5 seconds. XRP can process transactions faster, more securely, and cheaper due to its decentralized blockchain technology as can be seen in Figures 17 & 18 below.⁵⁶



(FIGURE 17- RIPPLE)



(FIGURE 18- RIPPLE)

Ripple already has a network of over 100 banks utilizing their payment network, as they look to transition them away from SWIFT. While XRP is a great example of a cryptocurrency with true use-cases looking to revolutionize an older system, there needs to be more like this to encourage further institutional adoption.

Tokenization of Assets

Tokenization is a way to digitize physical assets or other traditional financial instruments and is quickly becoming a way for more institutions to use digital assets. Tokenization has become quite popular in the real-estate sector and is beginning to catch on with securities/ ETFs and potentially even commodities. The benefits of tokenization are potentially huge and can allow individuals to access assets that they would not normally be able to. In a paper on digital assets, Deloitte- one of the largest consulting firms in the world- claims, “we foresee that tokenization could make the financial industry more accessible, cheaper, faster and easier.”⁵⁷

At a recent virtual conference with Washington D.C.’s Digital Chamber of Commerce, SEC Chairman Jay Clayton commented on the benefits of tokenization in the financial marketplace. Chairman Clayton said that the SEC was happy to work with ETF providers who are looking to tokenize funds and find ways to safely facilitate this. Chairman Clayton further claimed, “It may very well be the case that stock certificates will all be tokenized going forward.” There is certainly demand for this as WisdomTree Asset Management, a \$60bn AUM Asset Manager, is rumored to be working on introducing one of the first tokenized ETFs.⁵⁸

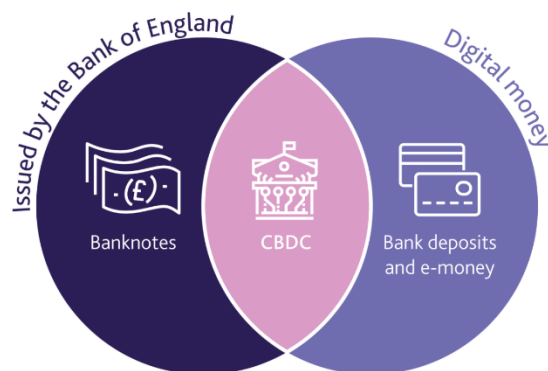
Central Banks

Another big step in digital asset adoption will be central banks introducing a virtual currency of their own. Some of the most technologically advanced countries in the world have even begun testing digital assets pegged to their currency, effectively creating their own stablecoin. In August 2020, the Wall Street Journal reported that China has begun testing a digital currency pegged to the Yuan, in a pilot program led by the People's Bank of China.⁵⁹ The currency, referred to as “DC/EP,” short for ‘digital currency/ electronic payment,’ has been rolled out in some of China’s most populous cities such as Beijing, Hong Kong, and Tianjin for trials. While not much is known about the digital currency, the PBOC claims it has some similar features to bitcoin and Facebook’s Libra project with its main purpose being able to quickly process transactions.

The Bank of England has also been reportedly prioritizing the development of a digital currency of their own. The BOE has dedicated an entire section to what they call a “Central Bank Digital Currency” (CBDC) on their website and how it would potentially work.⁶⁰

An electronic form of central bank money

A Central Bank Digital Currency (CBDC) would be an electronic form of central bank money that could be used by households and businesses to make payments. The Bank has not yet made a decision on whether to introduce CBDC, and intends to engage widely with stakeholders on the benefits, risks and practicalities of doing so.



(FIGURE 19 - BANK OF ENGLAND)

Most recently, the Federal Reserve announced they were working on developing a digital currency as well. Fed Governor, Lael Brainard claimed in a speech to the Federal Reserve Bank of San Francisco in August:

“We are taking the time and effort to understand the significant implications of digital currencies and central-bank-digital-currencies around the globe... Given the dollar’s important role as a global reserve currency, it is essential the Fed remain on the frontier of research and policy development of digital currencies.”⁶¹

Look no further than the recent stimulus packages Americans received to understand the potential benefits of a digital currency the Fed can distribute. After millions of Americans lost their jobs due to

the pandemic, Congress passed the CARES Act in March to send a \$1,200 stimulus check to nearly 100 million Americans. From the time Congress approved this act, it took months for most Americans to receive checks or direct deposits. As recently as September, nine million Americans still had not received their stimulus checks.⁶² If a digital dollar existed, Americans could have been sent their payments almost instantly, giving them much needed aid during the pandemic.

Ultimately, until there are legitimate use-cases for digital assets there will not be serious adoption by institutions. The launch of new cryptocurrencies with actual use-cases like XRP, the tokenization of ETFs, and even the development of stablecoins by central banks are exactly what is needed to expedite this process. While progress is certainly being made, it appears we are still years away from having usable digital assets readily available for the public to use, and until this happens institutions will continue to be skeptical on the benefits of investing in them.

More Education/ Market Awareness

While interest in digital assets is near an all-time high, much work still needs to be done to educate the public on how they work and what their benefits are. Unfortunately, still today, people associate bitcoin for being used to purchase illicit goods and ways to circumvent banks. Recently, several high-profile twitter accounts of politicians and business leaders like Barack Obama, Joe Biden, and Elon Musk were hacked to solicit bitcoin donations.⁶³ Despite all the progress that has been made in digital assets, bitcoin's association with online scams like this will continue to be a hinderance to get institutions to take digital assets seriously.

Association for Digital Asset Markets

The Association for Digital Asset Markets (ADAM) was founded in 2018 as an industry trade association to promote fair and orderly digital asset markets. ADAM is an industry group like the FIA or IIA, representing the futures and indexing industries. Industry trade associations serve an important role in representing benefit of a collected group. These trade associations can exhibit a lot influence and are especially important for relatively new industries, particularly something like the digital asset market. ADAM's members include some of the largest digital asset trading firms and service providers, with their mission statement listed below in Figure 20.



(FIGURE 20- ADAM)⁶⁴

With there is still much uncertainty around the trading of digital assets, it is great to see the largest market participants collectively work together, and trade associations like ADAM are vital for encouraging the further institutionalization of these markets.

Chamber of Digital Commerce

More work needs to be done to educate not only the public, but also politicians on the benefits of digital assets and blockchain technology. Groups like the Chamber of Digital Commerce are trying to fill this education gap. The Chamber of Digital Commerce, founded by Perianne Boring in 2014, has become the world's leading digital asset and blockchain trade association. Unlike ADAM, which represents just the digital asset trading community, members of the Chamber of Digital Commerce range from premier financial and technology companies like Goldman Sachs, JP Morgan, Fidelity, Microsoft, and IBM to high-profile crypto-native firms like Cumberland, Ripple, and BlockFi. The Chamber of Digital Commerce is broken into sub-committees across initiatives surrounding tokenization of assets, developing best-practices in accounting/ reporting for digital assets, and even educating political officials.

While operating as a PAC (Political Action Committee) and non-profit, the Chamber of Digital Commerce plays a vital role educating regulators and legislators about digital assets. Perianne explained that, "the Chamber's main mission is to bring greater awareness to the blockchain space and to work with all bodies of government."⁶⁵ Perianne claims that she hopes the Chamber will soon recommend its first piece of non-partisan legislation that will not just benefit their members, but the entire digital asset and blockchain community. The work Perianne and her team is doing helps provides firms in the digital asset space a voice when it comes to bringing about some of the necessary regulations mentioned earlier.

Education in Universities

Given the growing interest in digital assets and blockchain from students, colleges and universities are beginning to allocate more resources to developing curriculums around on these evolving new technologies. There are over 70 student-run blockchain organizations on college/ university campuses.⁶⁶ Further, in the "2019 Leaders in Crypto Education," Coinbase found that 56% of the world's top 50 universities now offer at last one course on blockchain, an increase from 42% in 2018.⁶⁷

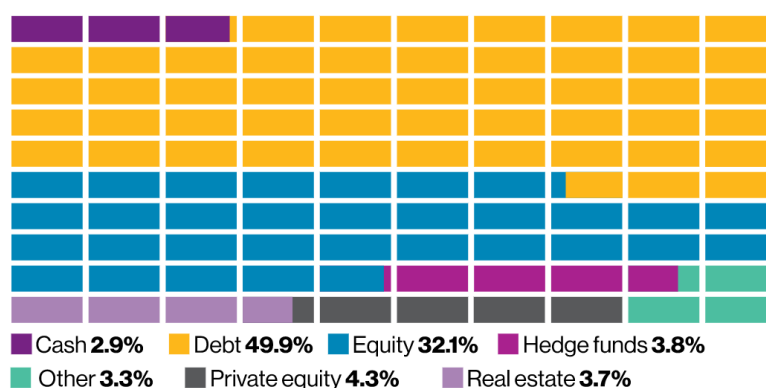
One such program encouraging education on digital assets and blockchain is Ripple's University Blockchain Research Initiative (UBRI). The UBRI provides funding for universities throughout the world to support academic research initiatives on blockchain and digital assets (*disclaimer- Georgetown is a member of the UBRI*). Aside from financial resources, participating universities receive access to Ripple's technology and members of their organization. Ripple has generously committed \$50mn to the UBRI, clearly indicating the value they see in providing education for students, which will perhaps lead them to pursue fields in this industry as opposed to traditional sectors like banking or law.⁶⁸

For digital assets to be truly taken seriously, much work still needs to be done surrounding education and policy in the space. Trade groups like the Chamber of Digital Commerce and ADAM are helping advocacy in this space. Further, it appears there is a strong growing interest among our younger population to learn more about digital assets and blockchain. More universities offering clubs or courses on blockchain and organizations like Ripple's UBRI will help in this as well.

What will a truly embraced digital asset- asset class look like?

Fast forward 5, 10, or even 20 years from now, what will digital assets look like when they are truly 'embraced?' Perhaps every government has introduced their own central bank-backed digital currency and physical currencies are less relevant. Maybe the introduction of blockchain backed assets eliminates the need for outdated payment transfer systems like Swift and large monetary transactions can take place in seconds rather than days. Or, possibly, assets are 'tokenized' meaning investors can now easily purchase a token on a physical commodity or ETF.

Perhaps even more interesting, is to consider what will happen if digital currencies become embraced as an investable asset class. For example, a typical pension fund diversifies their assets in a variety of equity, debt, real estate, hedge fund, private equity, and cash related investments. Willis Towers Watson conducted some interesting analysis looking at 472 of the Fortune 1000 companies that disclosed their pension plan investments through the end of 2018. As can be seen in Figure 21, most assets are held in equity and debt related investments.⁶⁹

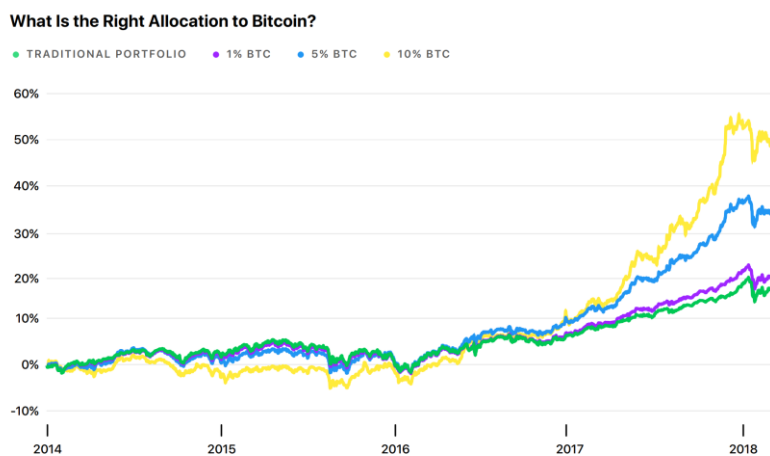


(FIGURE 21- WILLIS TOWERS WATSON)

According to PWC, the global Assets Under Management across all endowments, pension funds, and sovereign wealth funds is set to rise to \$145tn by 2025.⁷⁰ Let's assume that this \$145tn is spread out across a similar diversification of debt, equities, and alternatives to what Willis Towers Watson found among the Fortune 1000 companies. If just 1% of this \$145tn was allocated away from one of these investments to digital assets, then that would represent an astounding \$1.45tn allocation to the space, far exceeding the current market cap for digital assets. While this allocation seems high, it is not completely outlandish to think institutional investors should include a 1% allocation to digital assets.

Based off the performance of bitcoin and other digital assets, there is a sound investment case to include it in a balanced portfolio. Bitwise Asset Management analyzed what the impact of a 1%, 5%, or 10% allocation to bitcoin would have been to a traditional 60% equity/ 40% bond portfolio would have been. From January 1st 2014- March 31st 2018, the traditional 60/40 portfolio (investing in the Vanguard Total World Stock ETF VT and Vanguard Total Bond Market ETF BND, respectively) returned 26.5%. Whereas a 1%, 5%, or 10% allocation to bitcoin would have far outperformed this, without greatly

affecting the volatility of the portfolio and even increasing the Sharpe Ratio, as can be seen in Figures 22 & 23.⁷¹



(FIGURE 22 - BITWISE ASSET MANAGEMENT)

Summary Statistics: How Much Bitcoin Is Enough?

	TOTAL RETURN	VOLATILITY (MONTHLY)	SHARPE RATIO	UP CAPTURE	DOWN CAPTURE	MAX DRAWDOWN
Traditional Portfolio	26.53%	6.5%	0.80	0.61	0.71	-11.37%
1% Bitcoin	31.09%	6.70%	1.02	0.69	0.69	-10.95%
5% Bitcoin	50.89%	8.30%	1.55	0.99	0.68	-9.36%
10% Bitcoin	78.38%	11.6%	1.75	1.37	0.66	-12.11%

(FIGURE 23- BITWISE ASSET MANAGEMENT)

Evidently, a small allocation to bitcoin or other digital currencies can prove to be a great risk-reward investment that can greatly impact the overall performance of a traditional asset allocation. Therefore, it is possible that as digital assets become more institutionalized, through some of the topics addressed above, investors will look to include them in their portfolios.

Conclusion

As one can see, digital assets are no longer a ‘fad’ and may very well be the future of finance and payments. While at first being shunned by some of Wall Street’s largest institutions, digital assets are now embraced by the likes of CME Group, JP Morgan, and Fidelity. A growing number of investment firms are gaining exposure to digital assets through active trading and venture capital style investments. Lending firms are now offering ways to loan digital assets and are seeing staggering growth in their originations. As digital assets volatility continues to normalize and they maintain minimal correlation to other asset classes, investors will continue to be intrigued. Finally, recent guidance from the SEC, OCC, and DOJ has indicated a more bullish stance towards regulatory acceptance of digital assets.

However, there is still a long way to go before digital assets reach a point where they can be truly adopted by institutions. Whether it is the approval of the first digital asset ETF or more clarity from the SEC and CFTC, there is still a lot of uncertainty. Further, while there have been some impressive start-up offerings in the custody and prime brokerage space, it will still take some time before institutions feel comfortable jumping onboard. Additionally, there is still quite a bit of education and market awareness needed. Finally, and perhaps most importantly, until there are legitimate use-cases for digital assets we are unlikely to see true institutional adoption.

While it is unclear what exactly the future holds for the digital asset space, one thing that does appear certain is that we are still in their early days and they are not going away anytime soon. If the question is ‘when’ not ‘if’ digital assets will be fully embraced, then it is amazing to think how far the industry may go. Perhaps every endowment fund and sovereign wealth fund will include some small allocation to cryptocurrencies and the total digital asset market-cap will end up exceeding asset classes that were once thought of as stores of value like gold or silver. Or maybe the true value of digital assets will become payments and they will be treated as a currency going forward, rather than store of value. Regardless of what happens, the institutionalization of the digital asset space has already begun and there is no going back now.

Endnotes

- ¹ Nakamoto, Satoshi. "Bitcoin: A Peer-to-Peer Electronic Cash System." *Bitcoin*, <https://bitcoin.org/bitcoin.pdf>. Accessed 23 August 2020.
- ² Rooney, Kate. "Cboe to stop listing bitcoin futures as interest in crypto trading cools." *CNBC*, 18 March 2019, <https://www.cnbc.com/2019/03/18/cboe-to-stop-listing-bitcoin-futures-as-interest-in-crypto-trading-cools.html>. Accessed 23 August 2020.
- ³ "Daily Exchange Volume and Open Interest." *CME Group*, 8/23/20, <https://www.cmegroup.com/market-data/volume-open-interest/exchange-volume.html>. Accessed 23 August 2020.
- ⁴ "Bitcoin futures and options on futures." *CME Group*, 8/23/20, <https://www.cmegroup.com/market-data/volume-open-interest/exchange-volume.html>. Accessed 23 August 2020.
- ⁵ "Bitcoin trading volume." *Bitcoinity*, 9/25/20, <http://data.bitcoinity.org/markets/volume/2y?c=e&t=b>. Accessed 25 September 2020.
- ⁶ CME Group. "CME Group and Crypto Facilities Launch Ether Reference Rate and Ether Real Time Index." *CME Group*, 14 May 2018, https://www.cmegroup.com/media-room/pressreleases/2018/5/14/cme_group_and_crypto_facilities_launch_ether_reference_rate_and_ether_real_time_index.html. Accessed 25 August 2020.
- ⁷ Ibid.
- ⁸ Rooney, Kate. "Goldman Sachs CFO says bank is working on bitcoin derivatives for clients." *CNBC*, 6 September 2018, <https://www.cnbc.com/2018/09/06/goldman-sachs-cfo-calls-reports-of-shutting-down-crypto-desk-fake-news.html>. Accessed 25 August 2020.
- ⁹ Bambrough, Billy. "JP Morgan – Bitcoin's 'Biggest Enemy' – Suddenly Appears To Be Going All In On Crypto." *Forbes*, 30 May 2020, <https://www.forbes.com/sites/billybambrough/2020/05/30/jp-morgan-bitcoins-biggest-enemy-suddenly-appears-to-be-going-all-in-on-crypto/?sh=2c51ef8423a6>. Accessed 25 August 2020.
- ¹⁰ Chaparro, Frank. "\$75 billion hedge fund Renaissance Technologies is eyeing the bitcoin futures market." *The Block*, 18 April 2020, <https://www.theblockcrypto.com/post/62322/75-billion-hedge-fund-renaissance-technologies-is-eyeing-the-bitcoin-futures-market>. Accessed 1 September 2020.
- ¹¹ Schatzker, Erik. "Paul Tudor Jones Buys Bitcoin as a Hedge Against Inflation" *Bloomberg*, 7 May 2020, <https://www.bloomberg.com/news/articles/2020-05-07/paul-tudor-jones-buys-bitcoin-says-he-s-reminded-of-gold-in-70s>. Accessed 1 September 2020.
- ¹² Chaparro, Frank. "\$46 billion hedge fund Millennium Management was on the verge of diving into crypto." *The Block*, 16 October 2020, <https://www.theblockcrypto.com/daily/80791/46-billion-hedge-fund-millennium-management-was-on-the-verge-of-diving-into-crypto>. Accessed 1 September 2020.
- ¹³ PWC. "Crypto Hedge Fund Report." PWC, *Elwood*, May 2020, <https://www.pwc.com/gx/en/financial-services/pdf/pwc-elwood-annual-crypto-hedge-fund-report-may-2020.pdf>. Accessed 5 September 2020.
- ¹⁴ Baker, Paddy. "Number of Institutions Buying Crypto Futures Doubled in 2020: Fidelity Report." *Coin Desk*, 9 June 2020, <https://www.coindesk.com/institutions-crypto-futures-doubled-fidelity-report>. Accessed 5 September 2020.
- ¹⁵ Reiff, Nathan. "What is the Grayscale Bitcoin Trust?" *Investopedia*, 21 January 2020, <https://www.investopedia.com/news/why-buy-expensive-bitcoin-etf-instead-actual-bitcoin/>. Accessed 2 September 2020.
- ¹⁶ Grayscale. Grayscale Bitcoin Trust, <https://grayscale.co/bitcoin-trust/>. Accessed 2 September 2020.
- ¹⁷ Grayscale Investments. "\$1.4 Billion in First Half of 2020." *Medium*, 15 July 2020, <https://medium.com/grayscale-investments/1h2020-grayscale-record-3c95652bc219>. Accessed 2 September 2020.
- ¹⁸ "U.S. ETF Overview." <https://www.etf.com/channels/us-etfs>. Accessed 2 September 2020.
- ¹⁹ PWC. "Crypto Hedge Fund Report." PWC, *Elwood*, May 2020, <https://www.pwc.com/gx/en/financial-services/pdf/pwc-elwood-annual-crypto-hedge-fund-report-may-2020.pdf>. Accessed 2 September 2020.
- ²⁰ Typhon. "Leonidas Cryptocurrency Fund." *Typhon Cap*, November 2020, <https://typhoncap.com/Performance/Leonidas%20Cryptocurrency%20Fund.pdf>. Accessed 24 September 2020.

²¹ Koutoulas, James. Personal Interview. 24 September 2020.

²² Hutt Capital. "Hutt Capital's Blockchain VC Fund Landscape (2020 Edition)." *Medium*, 13 April 2020, <https://medium.com/@HuttCapital/hutt-capitals-blockchain-vc-fund-landscape-2020-edition-29abdbddfd7>. Accessed 18 September 2020.

²³ Ibid.

²⁴ Agar, Ian. "The top 10 VC investors in blockchain." *Pitchbook*, 27 February 2019, <https://pitchbook.com/news/articles/the-top-10-vc-investors-in-blockchain>. Accessed 18 September 2020.

²⁵ Moro, Michael. Personal Interview. Accessed 18 September 2020.

²⁶ Ballensweig, Matt. "Digital Asset Lending Snapshot." Roshun Patel, Leon Marshall, *Genesis Trading*, May 2020, https://genesistrading.com/wp-content/uploads/2020/05/GenesisCapital_Q12020_Snapshot.pdf. Accessed 18 September 2020.

²⁷ Gurbacs, Gabor. "Bitcoin: Less Volatile Than Many S&P 500 Stocks?" *Van Eck*, 20 November 2020, <https://www.vaneck.com/blogs/investment-outlook/bitcoin-less-volatile-than-many-sp-500-stocks/?country=US&audience=retail>. Accessed 18 September 2020.

²⁸ Ibid

²⁹ Sun, Mengqi. "Banks May Provide Safekeeping of Cryptocurrency, OCC Says." *The Wall Street Journal*, 24 July 2020, <https://www.wsj.com/articles/banks-may-provide-safekeeping-of-cryptocurrency-occ-says-11595632512#:~:text=The%20OCC%20also%20restated%20its,anti%2Dmoney%2Dlaundrying%20requirements>. Accessed 2 October 2020.

³⁰ Decrypt Staff. "SEC Chairman Open to Crypto-based Exchange-Traded Fund." *Decrypt*, 3 October, 2020, <https://decrypt.co/43803/sec-chairman-open-to-crypto-based-exchange-traded-fund>. Accessed 15 October 2020.

³¹ Pirus, Benjamin. "US Attorney general releases guidelines for enforcing crypto laws." *Coin Telegraph*, 8 October 2020, <https://cointelegraph.com/news/us-attorney-general-releases-guidelines-for-enforcing-crypto-laws>. Accessed 15 October 2020.

³² Voros, Drew. "Where Art Thou Bitcoin ETC?" *ETF.com*, 02 November 2020, https://www.etf.com/sections/blog/where-art-thou-bitcoin-etf?utm_source=newsletter&utm_medium=email&utm_campaign=dailynewsletter. Accessed 15 October 2020.

³³ Foxley, William. "SEC Chair Clayton: Would-Be Bitcoin ETFs Have 'Work Left to Be Done'." *CoinDesk*, 9 September 2019, <https://www.coindesk.com/sec-chair-clayton-would-be-bitcoin-etfs-have-work-left-to-be-done>. Accessed 15 October 2020.

³⁴ Hougan, Matthew. Bitwise Asset Management: Analysis of Real Bitcoin Trade Volume. Bitwise Investments, 11 February 2019.

³⁵ Ibid.

³⁶ Sullivan, Brian. "Why oil prices went negative and why they can go negative again." *CNBC*, 26 April 2020, <https://www.cnbc.com/2020/04/26/why-oil-prices-went-negative-and-why-they-can-go-negative-again.html>. Accessed 17 October 2020.

³⁷ USCF. "United States Oil Fund." USCF, <https://www.uscfinvestments.com/uso>. Accessed 17 October 2020.

³⁸ Rudden, Jennifer. "Worldwide ETF assets under management 2003-2019." *Statista*, 24, February, 2020, <https://www.statista.com/statistics/224579/worldwide-etf-assets-under-management-since-1997/>. Accessed 17 October 2020

³⁹ Barston, Michael. Personal Interview. 19 November 2020.

⁴⁰ Foster, Brian. "What's Driving Growth?" *Coinbase*, July 2020, <https://static-assets.coinbase.com/custody/Coinbase-Institutional-Crypto-H1-2020-Review.pdf>. Accessed 20 October 2020.

⁴¹ Securities and Exchange Commission. "Investor Alert: Bitcoin and Other Virtual Currency-Related Investments." *SEC*, 7 May 2014, https://www.sec.gov/oiea/investor-alerts-bulletins/investoralertsia_bitcoin.html. Accessed 17 October 2020.

⁴² Securities and Exchange Commission. "SEC Issues Investigative Report Concluding DAO Tokens, a Digital Asset, Were Securities." *SEC*, 25 July 2017, <https://www.sec.gov/news/press-release/2017-131>. Accessed 20 October 2020

⁴³ CFTC. "Chairman Tarbert Comments on Cryptocurrency Regulation at Yahoo! Finance All Markets Summit." *CFTC*, 10 October 2019, <https://www.cftc.gov/PressRoom/PressReleases/8051-19>. Accessed 18 October 2020

⁴⁴ Department of Financial Services. "BitLicense FAQs" *DFS*, https://www.dfs.ny.gov/apps_and_licensing/virtual_currency_businesses/bitlicense_faqs. Accessed 20 October 2020.

⁴⁵ Commodity Futures Trading Commission. "CFTC Announces Finalization of 2020-2024 Strategic Plan." *Commodity Futures Trading Commission*, 08 July 2020, <https://www.cftc.gov/PressRoom/PressReleases/8196-20>. Accessed 20 October 2020.

⁴⁶ Georgetown Law. "Securities Law." *Georgetown Law*, <https://www.law.georgetown.edu/your-life-career/career-exploration-professional-development/for-jd-students/explore-legal-careers/practice-areas/securities-law/#:~:text=Both%20state%20and%20federal%20laws,is%20made%20available%20to%20investors>. Accessed 20 October 2020.

⁴⁷ Practical Law. "Stock exchanges and regulatory authorities by jurisdiction." *Practical Law*, 1 October 2020, [https://uk.practicallaw.thomsonreuters.com/8-518-3383?transitionType=Default&contextData=\(sc.Default\)&firstPage=true](https://uk.practicallaw.thomsonreuters.com/8-518-3383?transitionType=Default&contextData=(sc.Default)&firstPage=true). Accessed 18 October 2020.

⁴⁸ "Bitcoin trading volume." *Bitcoinity*, 9/25/20, <http://data.bitcoinity.org/markets/volume/2y?c=e&t=b>. Accessed 18 October 2020.

⁴⁹ Trefis Team. "State Street Or BNY Mellon: Which Custody Banking Giant Uses Its Asset Base More Efficiently?" *Forbes*, 5 November 2019, <https://www.forbes.com/sites/greatspeculations/2019/11/05/state-street-or-bny-mellon-which-custody-banking-giant-uses-its-asset-base-more-efficiently/#421265767953>. Accessed 22 October 2020.

⁵⁰ "Laws and Rules." *SEC*, 10/22/20, <https://www.sec.gov/investment/laws-and-rules>. Accessed 20 October 2020.

⁵¹ Chaparro, Frank. "JPMorgan is actively exploring digital asset custody, and is looking for help from crypto native firms." *The Block*, 27 October 2020, <https://www.theblockcrypto.com/daily/82334/jpmorgan-digital-asset-custody-subcustody>. Accessed 4 November 2020.

⁵² McDonald, Jack. Personal Interview. 2 October 2020.

⁵³ Liao, Shannon. "Steam no longer accepting bitcoin due to 'high fees and volatility'." *The Verge*, 6 December 2017, <https://www.theverge.com/2017/12/6/16743220/valve-steam-bitcoin-game-store-payment-method-crypto-volatility>. Accessed 4 November 2020.

⁵⁴ Swift. "Swift In Figures." *Swift*, December 2019, https://www.swift.com/sites/default/files/documents/sif_201912.pdf. Accessed 5 November 2020.

⁵⁵ "Today's Cryptocurrency Prices by Market Cap." *CoinMarketCap*, 11/05/20. <https://coinmarketcap.com/> Accessed 4 November 2020.

⁵⁶ "XRP: The Best Digital Asset for Global Payments." *Ripple*, <https://ripple.com/xrp/11/05/20>. Accessed 5 November 2020.

⁵⁷ Laurent, Patrick "The tokenization of assets is disrupting the financial industry. Are you read?" Thibault Chollet, Michael Burke, Tobias Seerrs, *Deloitte*, October 2018, <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/about-deloitte/Inside/lu-inside19-full.pdf>. Accessed 5 November 2020.

⁵⁸ Keoun, Bradley. "WisdomTree Mulls New Stablecoin as US Money Manager Drives Toward Crypto." *CoinDesk*, 13 January 2020, <https://www.coindesk.com/wisdomtree-mulls-new-stablecoin-as-us-money-manager-drives-toward-crypto>. Accessed 5 November 2020.

⁵⁹ Xiao, Eva. "China to Expand Testing of a Digital Currency." *Wall Street Journal*, 14 August 2020, https://www.wsj.com/articles/china-to-expand-testing-of-a-digital-currency-11597385324?mod=hp_lista_pos2. Accessed 5 November 2020.

⁶⁰ Bank of England. "Central Bank Digital Currency: opportunities, challenges and design." *Bank of England*, 12 March 2020, <https://www.bankofengland.co.uk/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design-discussion-paper>. Accessed 5 November 2020.

⁶¹ Robb, Greg. "Fed says it is developing an experimental digital currency." *Market Watch*, 15 August 2020, <https://www.marketwatch.com/story/fed-says-it-is-developing-an-experimental-digital-currency-11597352302.11/05/20>. Accessed 5 November 2020.

- ⁶² Haslett, Cheyenne. "Nearly 9 million Americans haven't received their stimulus checks, CDC guidance to schools is 'inconsistent': Report." *ABC News*, 21 September 2020, <https://abcnews.go.com/Politics/million-americans-received-stimulus-checks-cdc-guidance-schools/story?id=73150539>. Accessed 5 November 2020.
- ⁶³ Leswing, Kif. "Hackers targeted Twitter employees to hijack accounts of Elon Musk, Joe Biden and others in digital currency scam." *CNBC*, 15 July 2020, <https://www.cnn.com/2020/07/15/hackers-appear-to-target-twitter-accounts-of-elon-musk-bill-gates-others-in-digital-currency-scam.html>. Accessed 28 October 2020.
- ⁶⁴ "Adam: Building Trust in the Financial Markets of the Future." *Adam*, <http://www.theadam.io/>, Accessed 28 October 2020.
- ⁶⁵ Boring, Perianne. Personal Interview. 8 October 2020
- ⁶⁶ Danziger, Galen. "In 2019, Students Demanded Blockchain Education. In 2020, It's Coming." *Coindesk*, 15 December 2019, <https://www.coindesk.com/in-2019-students-demanded-blockchain-education-in-2020-its-coming>. Accessed 28 October 2020.
- ⁶⁷ Coinbase. "The 2019 Leaders in Crypto Education." *Coinbase*, 28 August 2019, <https://blog.coinbase.com/highereducation-c4fb40ecbc0e>. Accessed 28 October 2020.
- ⁶⁸ Ripple. "FAQ: University Blockchain Research Initiative." *Ripple*, <https://ubri.ripple.com/fag/>. Accessed 28 October 2020.
- ⁶⁹ Aguirre, Mercedes. "2018 asset allocations in Fortune 1000 pension plans." Brendan McFarland, *Willis Towers Watson*, 19 March 2020, <https://www.willistowerswatson.com/en-US/Insights/2020/03/2018-asset-allocations-in-fortune-1000-pension-plans>. Accessed 15 October 2020.
- ⁷⁰ Asuzu, Delia. "Global Assets under Management set to rise to \$145.4 trillion by 2025." *PWC*, 11 August 2017, <https://www.pwc.com/ng/en/press-room/global-assets-under-management-set-to-rise.html>. Accessed 15 October 2020.
- ⁷¹ Hougan, Matt. "The Case for Crypto In An Institutional Portfolio." *Bitwise*, May 2018, <https://static.bitwiseinvestments.com/Research/Bitwise-The-Case-For-Crypto-In-An-Institutional-Portfolio.pdf>. Accessed 15 October 2020.