The Future is Now: A marriage of novel technologies and traditional financial infrastructure for the democratization of privately held assets.

By Lydia Ofori, CFA, CAIA

March 2021

Contact Details:

Email: lydia@hunter-labs.io

Ms Lydia Ofori, CFA, CAIA is Founder & CEO of Hunter Labs Technologies where she is responsible for software product design and business strategy. Ms Ofori, also founded Victoria Lion Partners, a boutique manager selection and capacity fulfilment platform for boutique private capital investment teams.

Ms Ofori has 19 years investment industry experience, is a frequent speaker at industry events and was named Finalist for the Investment Week Investment Woman of the Year Award (Small to Medium Business) 2019. She was a Milken Institute Young Leader in 2017, sat on the CFA UK Continuing Education Committee for 5 years and the Education Committee for 100 Women in Finance for 3 years. Ms Ofori is a CFA charterholder and a CAIA charterholder. She has completed Executive Education at Columbia Business School, New York. She holds a Masters (MSc) in Financial Management and an Honors degree in business studies from The Robert Gordon University, Aberdeen Scotland

Acknowledgement:

In writing the foundational paper for Hunter Labs Technologies, the author consulted with professionals and experts in the field of data science, machine learning, cryptography and subsequent blockchain technologies. I am grateful to all of them for sharing their knowledge and expertise.

Anna Zaremba, PhD, Data Scientist at Hunter Labs Technologies
Dr Stylianos Kampakis, Data Scientist Consultant for Hunter Labs Technologies
Dr Theo Mourouzis, Cryptographer, Consultant for Hunter Labs Technologies

Introduction

As of Dec 2020, the total assets overseen by asset owners globally exceeded the $100trillion mark to $140trillion[1]. Out of this, circa $14trillion (10%)[2] were allocated to private markets by ultra-high net worth investors whose allocation to private markets and alternatives have increased by 13% since 2012, and whose total allocation to private markets and alternatives now represent 40% of investable assets. By all accounts, allocations to private market strategies are expected to grow by 8% p.a. to circa $21trillion by 2024, at which point it is expected that private market allocation would fall between 43 – 45% of total assets for ultra-high net worth investors. The current low yield market environment and regulatory changes have been some of the catalytic events that have supported the increase of allocations to private markets. But of course, for the ultra-high net worth investor who would typically have 60% of total investable portfolio invested in liquid asset classes (mutual funds), expectations that private market vehicles would have similar characteristics – daily computation of NAVs, shorter lock up periods, secondary markets, access to high quality investment opportunities etc. – are unmet. The private market structures are after all different from liquid market operations and must be respected as such.

That said, the client demand for privately held assets along with regulatory tail winds has called for the democratization of privately held assets but not without challenges posed to the ultra-high net worth investor which needs addressing. In this preliminary paper, I propose that some of the challenges - secondary sales / liquidity events and high-quality investment opportunities - can be alleviated thanks to technological innovation. To resolve the secondary market challenge, we must consider the value of a smartly designed cryptographic permissioned distributed ledger for

[1] Thinking Ahead Institute 2020
[2] Oliver Wyman Research - Morgan Stanley, Oliver Wyman Bluepaper, After the Storm, Global Wealth Management Report, 2020. Figure as at 2019

the issuance of security token offerings (STO) that directly mimic underlying privately held asset funds such that the transference of the digital asset (in this case the securitized token) to a physical state (in this case, the underlying private asset fund) can occur without friction, in our case PASTOs. To resolve the lack of access to high quality investment opportunities, we must also consider an active manager, fund and deal selection process that will optimize insights from the past and the present to infer prospective manager, fund, and portfolio behavior, thanks to the application of machine learning and natural language processing techniques as applied to alternative and traditional data sets.

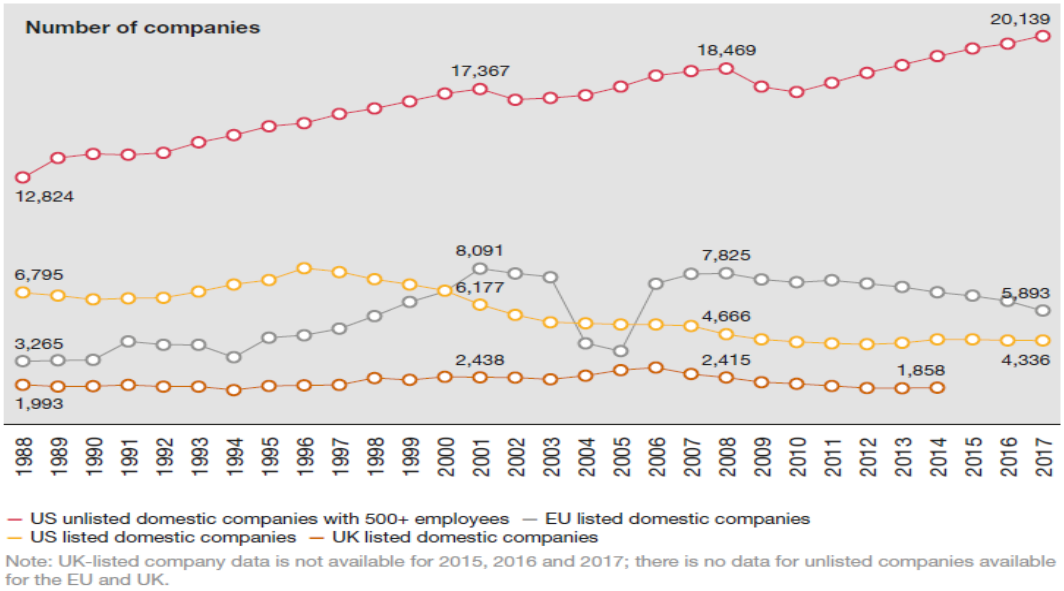
The paper is organized as follows: Section 1 questions if the democratization agenda is feasible, Section 2, draws similarities between corporate finance, stock issuance and private equity. Section 3 propose an innovative smart cryptographic design of distributed ledgers with oracles to support primary private assets securitized offerings (PASTO) issuance and secondary markets. We also discuss how artificial intelligence could be used to identify emerging private markets investment themes with aligned investment teams and funds. Section 4 discusses additional applications of the discussed solutions to other case studies – as would be used by a venture company to raise capital, a crowd funding platform to enable secondary markets, an art gallery to effect art sales, etc. Section 5 directs the reader to consider other factors necessary to allow for primary and secondary PASTO and Section 6 concludes the discussions.

Section 1: Is the agenda to democratize privately held assets achievable?

Asset owner portfolios are traditionally tilted towards publicly listed securities (equities and bonds) and although allocations have been decreasing over the past 20yrs, they still form a higher proportion of investable assets at 74%[3] for institutional asset owners and 60%[4] for mass affluent / ultra-high net worth investor group. Ironically, publicly listed securities, represent a smaller fraction of existing companies. In the US for example, less than 20% of companies with more than 500 employees are publicly listed (Figure 1), 2% of all companies regardless of size. What is more, companies are choosing to delay public listing. If we consider therefore that the larger proportion of economic activity lies outside publicly listed markets, then from an investor's perspective, it makes sense to find ways to access the private markets; a market relatively easier to access if an investor is classified sophisticated / professional or institutional (an umbrella term covering pension funds, endowment and foundations, family office, sovereign wealth fund, mutual funds). For here, the sophisticated / professional or institutional investor have access to a large spectrum of high quality privately held asset investment opportunities to choose from to enhance return per unit of risk taken. Also, here, such investor group would have the wherewithal to select opportunities and structure portfolios such that the probability of permanent loss of capital is reduced.

Figure 1: Trend of Global Companies (listed vs private)

[3] See Thinking Ahead Institute, Global Asset Allocation 2020 report
[4] Morgan Stanley, Oliver Wyman and BluePaper – Global Wealth Management Report 2020



Source: PwC, 2020

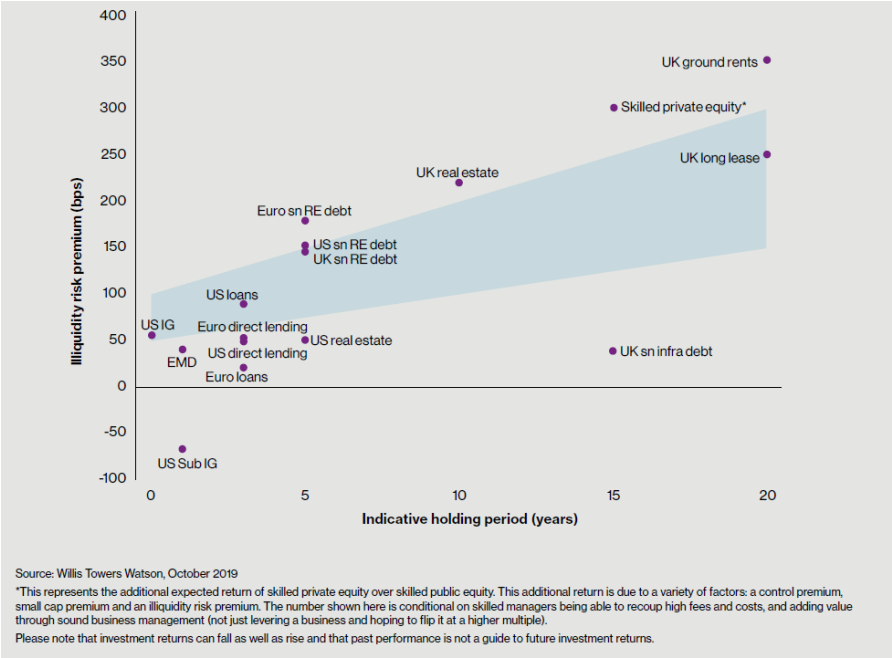
Outside this bracket, for the mass affluent / ultra-high net worth investor group who account for circa 64%[5] of global client accounts, there is an extremely tremendous effort, herculean maybe, related to selecting, structuring and implementing a viable privately held asset investment strategy and attaining access by investment amount. This is a puzzle considering that this investor group represent a $6trillion[6] market opportunity for private asset managers, advisors, and wealth managers. The call to provide solutions to support a democratized privately held assets markets could not have come any sooner.

Accessing both primary and secondary private markets can help improve the efficiency of investment portfolios. Private markets investment opportunities are documented to introduce an illiquidity risk premium[7] to the investor; by virtue of such investments portfolios being closed out for a longer investment period and by virtue of such investments not being exposed to the typical price whipsaw[8] behavior of publicly listed equities, private equity and venture funds benefit from

[5] PwC, The Asset and Wealth Management Revolution, 2020
[6] Preqin, 2020
[7] We note that the illiquidity risk premium varies across privately held assets. For the previously noted illiquidity risk premium for large buyouts in certain regions appear to be wading whilst illiquidity risk premium remains high in other sectors
[8] We ignore the artificial structures created on public markets with private equity and venture funds and focus on true close ended structures.

an illiquidity risk premium which can contribute an additional 0.5% - 2% p. a (Figure 2) to a portfolio.

Figure 2: Forward looking illiquidity risk premium



Source: Willis Towers Watson, October 2019

*This represents the additional expected return of skilled private equity over skilled public equity. This additional return is due to a variety of factors: a control premium, small cap premium and an illiquidity risk premium. The number shown here is conditional on skilled managers being able to recoup high fees and costs, and adding value through sound business management (not just levering a business and hoping to flip it at a higher multiple).

Please note that investment returns can fall as well as rise and that past performance is not a guide to future investment returns.

The shaded area indicates the fair value of illiquidity risk premium at time of research. Asset classes sitting below the shaded area indicated excessive demand and potentially lower expected returns.

In a period of low yields, being able to access this excess return is important; and yet, a large proportion of investors have been excluded from participation. Most have cited the lack of access to investment professionals in selecting quality private asset funds and direct opportunities, investment access limits usually required by such funds, lack of readily available secondary markets to enable liquidation at the right time as they would for publicly listed equities. Some of these challenges have eased over the years following the relaxation of regulation that restricted the marketing of such investment strategies and have subsequently led to the creation of access funds by Advisors / intermediaries (wealth managers, private banks etc.). Nevertheless, there is room for innovation made possible thanks to the smart design of cryptographic distributed ledgers and API technologies for a frictionless transformation of private equity and venture funds into

securitized tokens as the solution directly addressing the accessibility and secondary markets conundrum for ultra-high net worth / retail investors. If we could also consider the benefit that artificial intelligence could bring to the discovery of viable high quality private equity and venture funds, then access to quality deals and portfolios (be it primary or secondary access), could be achieved in a much cost-effective way, further giving way a rather promising democratization agenda.

Section 2: The journey of an equity issuance - from corporate finance to stocks and private equity

A company is an aggregation of its tangible and intangible assets, and the liabilities incurred in the production of goods and services sold to a market for revenue and inevitably cash. In forming a view on current value, we estimate its potential to generate more cash and value, discounted to the present by a viable discount rate. When management decides to raise capital to supplement operations, they consider equity or debt (or combination). In theory, the decision for equity or debt is irrelevant[9]. In practice, the equity or debt choice does matter as frictional elements such as monetary costs and time are considerable factors.

In raising equity for the said company, we can say that the company has effectively ***securitized*** its current and expected cashflows and in so doing, has unitized its value. If such an issuance occurs on a public forum, such equities become listed equities with an affordance of a transparent display of value if the market is informationally efficient. Conversely, if the issuance of said equities occur on a private forum, the said equities become privately held equities with an affordance of a transparent display of value to holders of such equity only. The major difference between the two forms of issuance at the stage is that in the former, value discovery is available to everyone whether the said individual holds the issued equities or not. With the later, a private market, value discovery is limited to participating equity holders and usually verified by an external party.

[9] Modigliani and Miller Theorem

To access the securitized company, an investor has two options. The option to discover the best company through one's own research and buy the stock directly on an exchange if publicly listed or through a fund or the option to discover a private company, approach the said company, negotiate the unit price, and take a position. If at any point in time, the individual decides to part ways with the company, for the publicly listed equities, she sells it back to the ***market*** for ***liquidity*** at any point in time as she wishes. For the privately held equities, the market is not typically readily available in the same way as the public secondary market is, so here she finds a new buyer, typically through an intermediary, negotiate a price that aligns with the value of the company at that time as the base level of negotiations plus other considerations such as the urgency on her part which could well lead to a discounted price or the perceived future value of the company which could also lead to a premium to current value. As a result of the sale not being immediate / instant, privately held equities are in this instance said to be ***illiquid*** securities. Today there are as 4.5x[10] companies who have issued equity via the private markets as there are for public markets.

Most investors will seek access to private equity and venture companies through funds. It is not to be assumed that any fund allocation will result in a higher return for the investor. Manager selection in private equity and venture funds is critically important. Cavagnaro, Sensoy, Wang, Weisbach (2018) found that a one standard deviation increase in investor's skill in making investments in private equity and venture funds leads to between one and two percentage points increase in annual returns. The team surveyed private equity and venture fund investments by institutional investors between 1991 and 2011. In addition, they also noted that the results were stronger in the earlier part of the sample period and for venture funds a percentage standard deviation

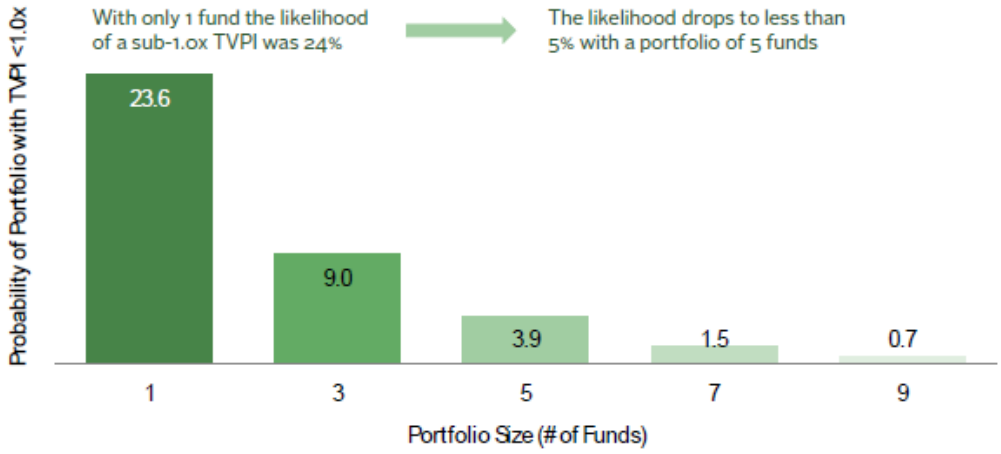
[10] Bain and Co, 2020

increase in selection skill leads to between 2 to 4.5 percentage point increase in returns.[11] Further evidence shows that the difference between the top performing fund /manager and the bottom performing fund / manager is growing. CAIA analysis showed a dispersion of circa 25% between top quartile and bottom quartile private equity and venture capital managers. Similarly, Cambridge Associates based on 2018 data, reported an average of 16.5% dispersion between the median and top quartile for Private Equity and even higher in Venture Capital Funds. The monetary cost involved in assessing a private equity fund / manager's strategy, talents, experience, operational set up is high between $240k – $400k[12]. The resource (mainly time) cost is equally high. An analyst typically aggregates vast amounts of data – on the sector, regional or country traditional fundamental data to estimate strategy attractiveness before pursuing further to the team involved to assess their ability to source and execute deals, mostly leaning on their past to provide some indication to their future performance. In a nutshell, forming a judgment on fund and team's prospective performance in future funds is an extensive task, one that requires investment skill and one where currently, certain tasks are carried out manually.

For the mass affluent group, getting access to one fund (be it a single access fund or through fund of funds) would be inefficient. To make a viable beneficial investment case, it is suggested that one seeks allocation to a minimum of 5 funds to reduce the probability of prospective permanent capital loss (Figure 3). Gredil, Liu and Sensoy, 2020, found significant utility losses from lack of diversification in PE Funds.

[11] Their conclusion suggests that selection of newer smaller funds which would be the characteristics of a majority of private equity funds in the 90's, has the propensity to increase returns.
[12] See Albourne Partners fees

Figure 3: Probability of portfolio with TVPI <1.0x based on portfolio size.



Source: Cambridge Associates LLC.
Notes: Based on simulated portfolios of CA benchmark data for 3,077 funds from 1991 to 2005. Funds are equally weighted in terms of committed capital.

There is also the added benefit of spreading one's investment over a number of years, typically 4years to benefit from vintage diversification. For primary access, the industry has responded through the creation of single access funds and fund of funds, allowing the mass affluent an opportunity to overcome the typical higher nominal investment size challenge. As mentioned above, frictionless securitization of such funds would provide more benefits to the underlying investor. In this sense, a similar principle of how securitization of a company can lead to its democratization can be applied to private equity and asset funds. In the case of a company, its securitization leads to an initial unitization of value, which further leads to the operation of secondary markets and results in the democratization of the said company. For private equity and venture fund democratization can be achieved by securitizing the access fund through the issuance of primary securitized token offerings (STO), which can subsequently trade on a secondary market where there is no friction between the underlying access fund and the digital asset. Lambert, Liebau, Roosenbaum (2020) in their study, defined a security token *as a digital*

representation of an investment product, recorded on a distributed ledger, subject to regulation under security laws. I do find their definition to be sound and directly address the confusion that mostly surrounds digital assets generally. Under this consideration, a pari passu securitized private equity and venture access fund will support the democratization of private equity and venture funds and at the same time fulfil security regulation requirements.

Section 3: Oracles, Cryptography and Artificial intelligence to forge the future.

"Algorithms that enable the creation of distributed ledgers are powerful, disruptive innovations that could transform the delivery of public and private services and enhance productivity through a wide range of applications"…. ***Successful implementation*** *of a* ***distributed ledger*** *will* ***require a combination of governance to protect the participants and stakeholders and regulation to ensure the system is resilient to systemic risk or criminal activity***. ***– Distributed Ledger Technology: beyond block chain, a report by the UK Government Chief Scientific Adviser, 2016***

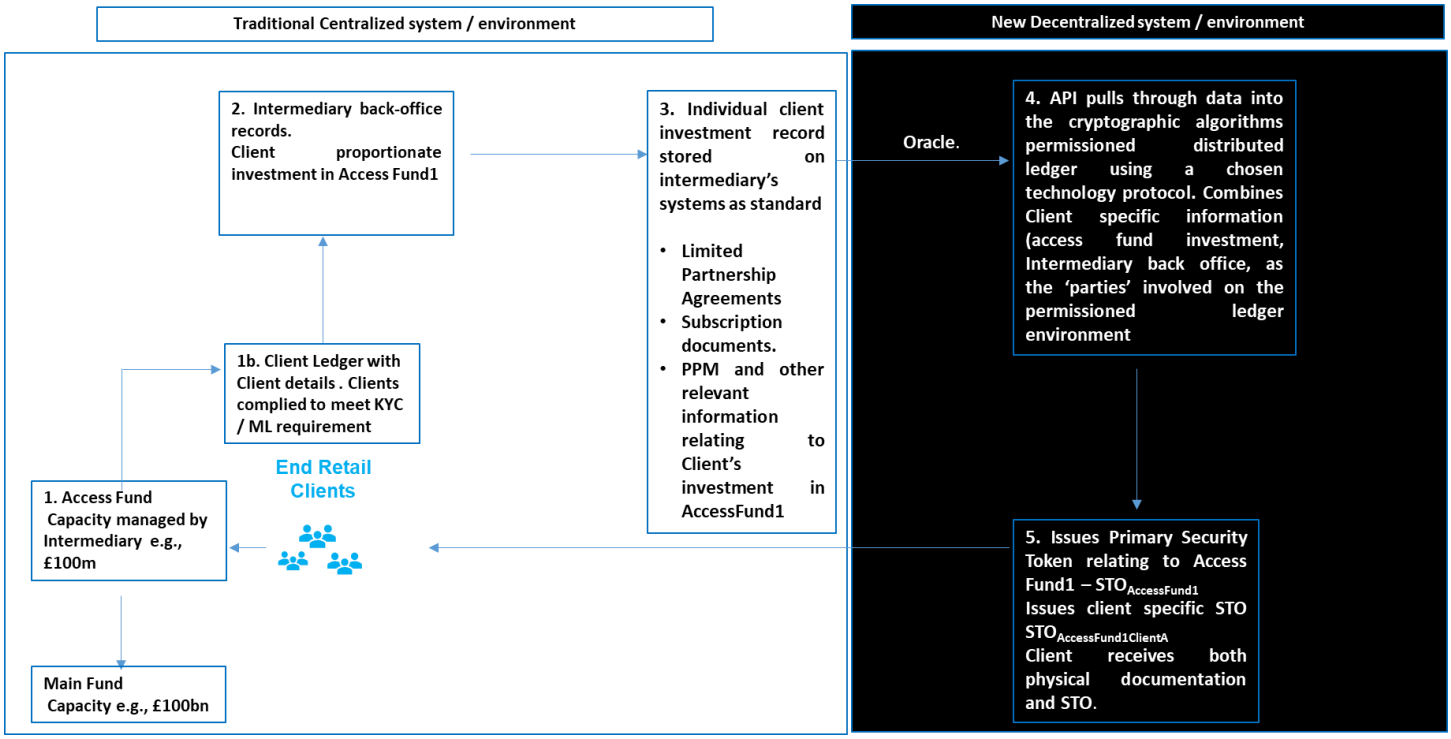
The securitized token offering (STO) market although nascent is a promising one. Like Kuehnl et al[13], I believe the adoption of STOs in private markets should occur alongside traditional systems instead of. The current technology infrastructure for most intermediaries is long embedded in processes that run the industry and has been in existence for a very long time. Distributed Ledger Technology (DLTs) is not so much new for it has been in place for a while, even before it's variant, blockchain became popularized some ten years ago. The primary benefit of DLTs is their ability to reduce cost compared to a centralized system. They are also more resistant to unauthorized record changes and malicious tampering enabling records to become more secure; the implicit consensual agreement required by all parties before a record is accepted also means that all participants receive an immediate update at the same time. Therefore, if used as the base technology supporting a primary STO issuance and a secondary marketplace, such technologies would have exponential benefits to stakeholders and thus worth investigating. Whilst blockchain is an outcome of distributed ledger technology; distributed ledgers are not necessarily blockchains. This differentiation is critical as the use of permissioned network is integral to the

[13] Bain Consulting, 2020

proposed solutions and if one is to make a differentiation between securitized tokens, utility and payment tokens which are typically designed on public permissionless blockchains.

Using distributed ledgers alone as the base technology for securitized token offerings is however deficient. Given the entrenched nature of current financial systems, one must find a way to bridge the existing technology infrastructure with the decentralized ledger ecosystem in such a way that there is no friction between the physical asset that is securitized and the digitized asset i.e., the STO and in such a way that there can be an immediate transference between the two states. Enter system oracles which form as an interface that defines and facilitates the interaction between multiple software intermediaries and can allow for interoperability between an old system and the proposed new decentralized distributed ledger environment. It is unlikely that investment firms and the industry in totality will and can immediately overhaul existing centralized systems onto new decentralized ledgers. This is a cost prohibitive exercise that would destroy value as opposed to creating one. Oracles as systems flow make the bridge easier and more practical. The benefit thus is that securitizing a private equity and venture fund becomes possible without interfering with the most important advantage of private equity and venture funds i.e., the illiquidity risk premium.

Figure 4 – Issuing a primary securitized token offering based on an Access Fund with a Private Bank / Wealth Manager etc. as an intermediary.



In the illustration above (Figure 4) a marriage of two worlds is proposed – the existing technology infrastructure usually of a centralized nature and the path forward which is a ***permissioned*** decentralized ecosystem with oracles connecting the two ecosystems. The principal goal is to allow the issuance of primary STOs whose value **directly mimics** that of the access fund (usually with a finite number of underlying investors and finite initial capacity); and the investor's unit holding of the access fund is exactly the same as the unit value holding of the STO, such that:

$$\$100m \text{ Access Fund 1; unit value, } \$50k = \$100m \text{ STO}_{\text{AccesFund1}}\text{; unit value, } \$50k$$

In thinking through the optimal solution possible, the introduction of access funds into the equation is critical in the design of PASTOs especially for primary STOs for reasons explained below. Thus, the intermediary, for example the Wealth Manager / Private Bank, would initiate an

access fund that invests in a main larger fund. The oracle connects critical dataflow from the Wealth Manager / Private Bank, as advisor to the fund and fiduciary of the client overall portfolio; administrator of the access fund, custodian of the investor, typically designated for the client by the Wealth Manager / Private Bank, legal firm as counsel to limited partnership agreements to the access fund; all pulled through to a permissioned ledger environment where a cryptographic algorithm combines the required client related information and access fund information through a chosen cryptographic protocol to issue a token STO AccesFund1 whose value is equal to the aggregate unit value of the access fund. Subsequently, the client specific token representing their holdings in the said fund is issued to the client so that the client now holds the physical traditional documentation related to her investment as well as the digital asset STO AccesFund1ClientA. By design and construct STO AccesFund1 and STO AccesFund1ClientAB should comply with the *"classical set of rules provided by the legislative framework, code of law and regulation…. and the set of rules that determine the operations of algorithms encoded by the software."*[14] Making such instrument recognizable by regulators.

The benefit of STO AccesFund1, a primary issuance, to the investor and the intermediary comes into effect in the follow up. In that, it allows for an easy and transparent discovery of the value of the underlying access fund. Traditionally, to track value movement, the investor would have read through numerous quarterly reports relating to the Access Fund, sent in pdf format and in some cases, track portfolio value through spreadsheets. In the proposed solution, STO AccesFund1ClientA is visibly displayed on a portal which refreshes every time AccessFund1 receives a new valuation report from the main fund.

[14] UK Government Office for Science, 2016

In Figures 5a and Figure 5b below, I show that the digital asset now begins to reflect the movement in value of the underlying access fund as the fund receives its quarterly reports. The revealing net asset value movement is immune to demand and supply forces which, if allowed for, would distort the value that could be recognized for a token and the underlying asset. Transformed from a physical asset to a digitized one, an STO of the access funds allows participating and non-participating **clients** of the intermediary to discover the value of the access fund and for non-participating clients to position themselves for a secondary opportunity when participating client is ready to sell.

Figure 5a – administration of the securitized token offering based on an Access Fund.

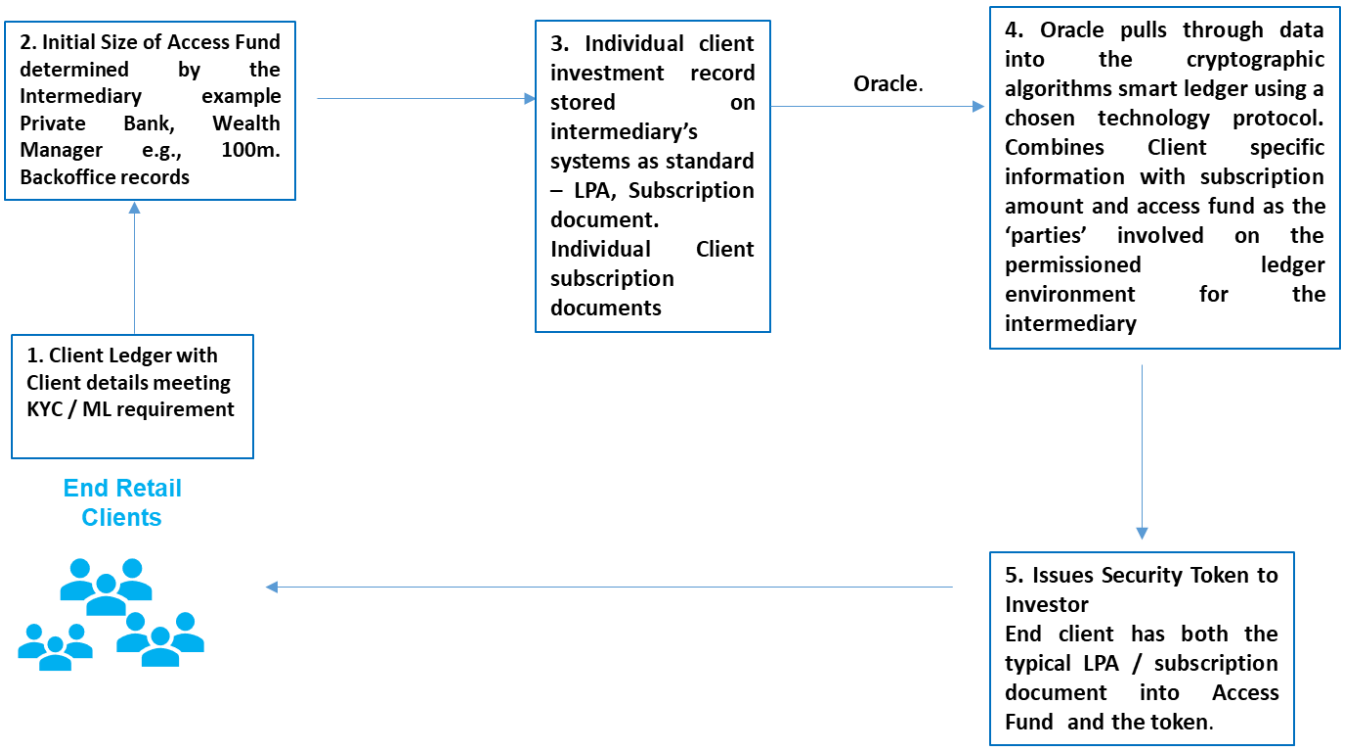
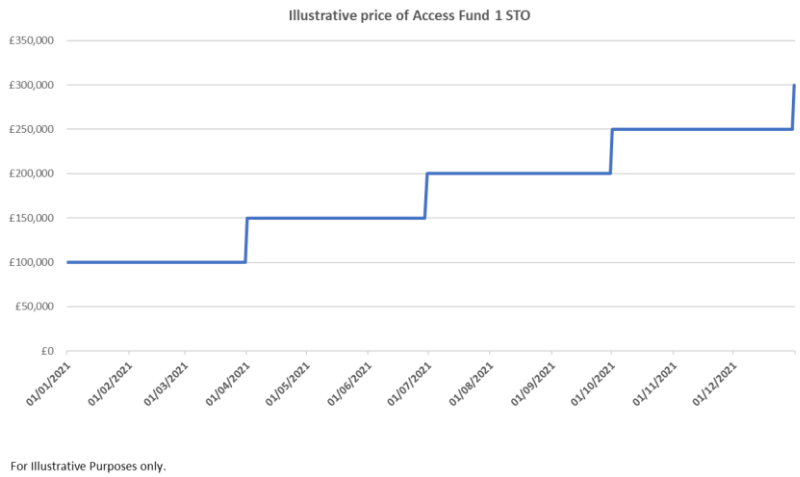


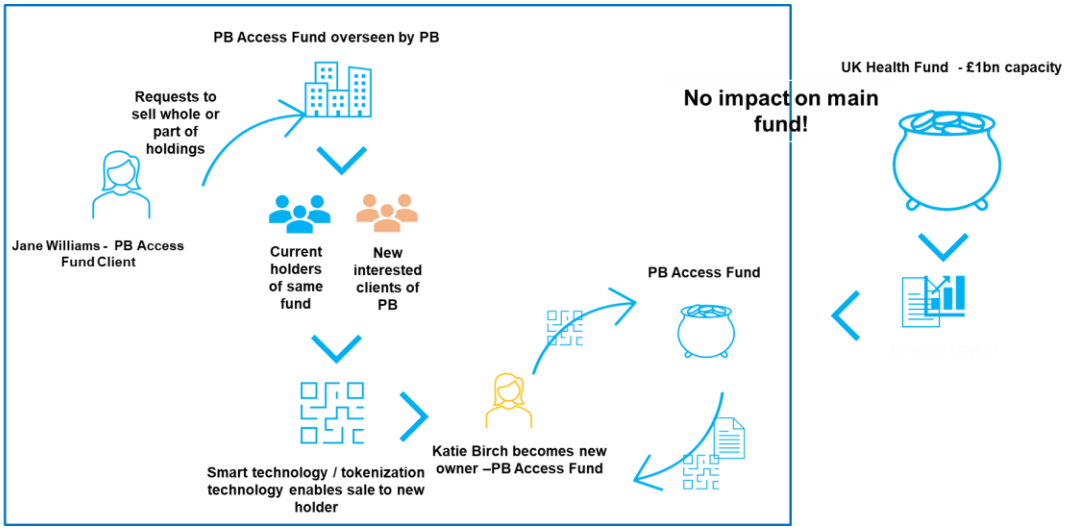
Figure 5b – Illustrative price movement of the frictionless securitized token in primary state



On the secondary market, be it a private secondary market specific to the intermediary or a global secondary market, the secondary sale of the investor's position in the access fund is now achievable efficiently, thanks to the proposed solution. In line with investment practice, I propose a minimum 3 year holding period of the token / access fund. The suggested holding period aligns with the minimum holding period required for other buy-and-hold investment opportunities that typically require time for an investment thesis to fully develop, for example a small cap fund, an emerging market fund. Indeed, the 3year holding period is generally the minimum recommended holding period for a sensible investment plan to start bearing fruit. For empirical support, for privately held assets, the 3-year holding period aligns with the investment period (i.e., the minimum time the private equity investment team takes to deploy committed capital). Kaserer and Diller, (2004) found that private equity funds draw down circa 83% of capital within 3 years (23% on vintage year date and 60% within 3 years of first capital draw down). As such the suggested 1 year. turnaround for a secondary sale that some retail private market fund marketplace suggest is misleading and will only lead to capital loss for the investor.

By construct of the internal secondary marketplace, the current holder can now easily sell their holdings as illustrated in Figure 6 below.

Figure 6 – suggested secondary market operated by the intermediary e.g., Private Bank.



As shown above, the current holder of $STO_{AccesFund1ClientA}$ at the time appropriate time, in need of liquidity places her request via the intermediary's internal secondary marketplace. Assuming there is no negotiation between the new buyer Client B, and Client A, the exchange takes place between Client B and Client A. The token refreshes to acknowledge the exchange into $STO_{AccesFund1ClientAB}$ maintaining previous transactional information and records (to comply with security laws of record maintenance), removes Client A as having ownership in the access fund from the time of secondary sale, and replaces Client B as the new owner. By design, it is also possible for Client A to sell part of her holding to Client B as opposed to whole. If this happens, then $STO_{AccesFund1ClientA}$ would become $STO_{AccesFund1ClientA1B}$ for example. The proposed design allows for the frictionless transference between the digital and physical ecosystem. Therefore,

Client B, will also immediately receive the physical documentation (LPA, Fund documents, etc) concerning the access fund.

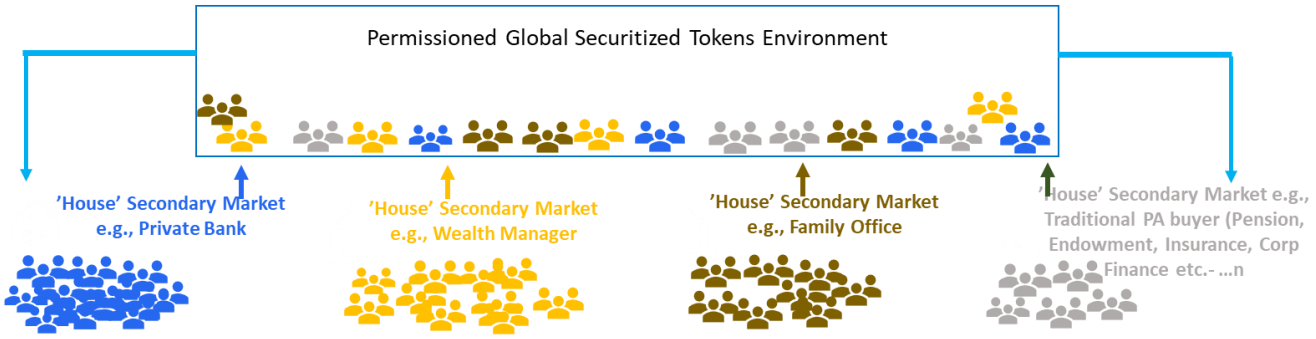
Practically however, a secondary sale of any item usually requires some form of negotiation. For if the seller, Client A, is giving up the prospects of future growth of the underlying portfolio companies, she would expect some form of compensation in the present time. Compared to publicly listed equivalents where expectation of future value of an asset is immediately incorporated into the public price, here the improved expectations cannot be directly reflected in increasing asset prices *…hence additional money attracted due to this improved economic prospect must entirely be absorbed by an adjustment of* ***deal*** *pricing* - Kaserer and Diller (2004). Therefore, irrespective of the value of $STO_{AccesFund1ClientA}$ which is a frictionless representation of the unit value of $STO_{AccesFund1}$, the STO of the access fund, to attain the deal price for the client's specific STO, we need a near scientific way to gauge the future economic prospect of the underlying fund. For this, I propose that artificial intelligence would be of great help if designed to acknowledge factors that have the propensity to influence performance of privately held assets and acknowledge the demand forces concerning the investor specific token. As result, the **economic outcome** for Client A would be specific to her individual circumstance guided by the knowledge of a fair value estimation; and finally if taxable, their individual tax situation.

Profit/loss from sale of access fund/ $STO_{AccesFund1ClientA}$	=	Unit Price of access fund / $STO_{AccesFund1ClientA}$ + Premium / Discount received – platform fees to enable secondary sale – tax liability.

The discovery of improved economic prospects can be achieved thanks to artificial intelligence which is further expanded on in the coming sessions.

If an internal secondary market local to the said intermediary could be made possible using the proposed design, then in a similar fashion, a global exchange with permissioned participation can be possible and could allow the underlying client of the intermediary access to a wider market of buyers and a wider opportunity set outside of the intermediary's own offering. The 'global' secondary exchange is a broader permissioned distributed ledger ecosystem where each intermediary exchange is a node that is connected to the global master node localized by the operative country's legislative framework, code of law and regulation of the underlying asset; such that the participation in a secondary sale on this medium is based on the rules governing the access fund as dictating by the supporting private placement memorandum (PPM), LPA etc., of the underlying asset i.e., the access fund.

Figure 7 – Global Secondary Market accessed by invitation.



For illustration only

The role of Artificial Intelligence in value discovery.

The above discussion has thus far assumed that the underlying fund in which the access fund will take a position on behalf of the mass affluent client base was duly selected with care and that there is an expectation that the future outcome of this investment will lead to a return higher than

the average of similar funds and of course above public markets equivalents. A securitized private equity / venture access fund that is based on a main fund with dimmed prospects will only lead to a permanent loss of capital for the investor. The process of fund discovery, assessment and selection is currently an arduous task for most fund selectors let alone if done by the individual investor.

Empirical research has highlighted areas of focus when selecting private equity and venture funds, particularly in explaining the drivers of private equity performance. In investigating if market sentiment and business cycles have any impact on private equity performance, Phalippou and Zollo (2005) in their study concluded that PE returns are pro cyclical which is to say that macroeconomic events at the time of investments, during the investment and at time of exit are important factors to consider and that there appears to be a strong relationship between GDP growth rates and PE returns and an inverse relationship between the level of interest rates and performance implying that bond yields matter at time of investment, that the level of stock market returns prevailing and during the investment period also matter. Likewise, Aigner et al,(2008) study showed that the level of interest rates has a negative impact on PE performance, whilst GDP growth has a positive influence on fund performance and vintage year GDP and MSCI growth negatively influence fund performance especially for US markets. Kaserer and Diller,(2004) study on European private equity funds showed that market sentiment has a significant impact on a private equity fund. Funds raised in vintage years with above average stock market returns tend to have lower returns. In other words, high stock market return in vintage year leads to a lower final return of the private equity fund - the more money is poured into an industry in a given vintage year, the lower the return of funds closed in that particular vintage year. Also, they found that the better the prospects of a particular industry, as measured

by the number of newly founded companies in that industry, the higher the returns of a private equity fund investing in this industry. Robinson and Sensoy, (2011), study equally showed that funds raised in hot markets underperformed in absolute terms. Equally Bernstein et al, (2010), study showed that industries in which PE funds have invested in the past 5yrs grow more rapidly than other sectors and these industries appear to be less exposed to aggregate shocks. Whilst PE investments caused industry performance, past industry performance had no impact on PE investments.

By inference therefore, interest rates, GDP growth expectations, stock markets, industry/sector performance are important factors for one to consider at the fund's vintage year and investment period and at exit. Fund managers have adopted a number of fund end of life strategies to mitigate losses in winding down a fund (for example extending the fund life if market environments for exits is not conducive). For the investor looking to exit the access fund mid fund life, as part of the deal pricing activity would need to consider these factors in determining economic prospects of the secondary sale.

Another explanatory factor in private equity and venture fund performance is to be found in the individual / people behind the fund itself. Ewens and Rhodes-Kropf (2015) in examining whether VCs have repeatable investment skills at the partner level found evidence supporting venture partner skill and partner level skill, concluding partner human capital is more important than a firm's organization capital. Aigner et al, (2008) also found that the experience of GP does matter, but then their study also showed that experienced GPs tend to have more losses as they are more prone to undertake riskier investments. Gompers et al, (2008) in examining how changes in public markets signals affected venture investing, found that experienced funds react better

during hot markets and inexperienced firms perform worse. In addition, they concluded that industry specific experience leads to better performance compared to the overall experience. Marquez, Nanda and Yavuz, (2014), concluded the success of PE funds depends on high quality entrepreneurial firms and that entrepreneurs will only hire talented managers who can add value. Braun, Dorau, Jenkinson and Urban, (2019) in their study which investigated individual manager persistence and the importance of the individual vs. the organization supplements Ewens and Rhodes-Kropf (2015) observations on a venture capital data set. The study concluded that the individual is a relevant determinant in explaining cross sectional differences in buyout returns; and what is more, that the manager appears to be about four times as important as the organization. Thus, the concluding inference to be attained here is that who one chooses to back is equally important, if not more important.

Private equity and venture fund past performance are important signals of the future. Kaplan and Schoar, (2005) amongst others, have shown that performance persistence prevailed in private equity funds. However, that assertion should not be dogma. For although when it comes to private equity and venture funds, the past does shed some on the future, such persistence is known to be fading especially within some segments and more prevalent in others. Braun, Jenkinson, and Stoff, (2017) study showed a considerable decline in performance persistence for buyouts, whilst Harris et al, (2014), confirmed performance persistence remained in venture capital. Chung (2012) exploring performance persistence in private equity found that the longer the time gap between two funds managed by the same GP, the weaker the persistence in performance hence there is usually no persistence for second and third funds from same GP. He also concluded that market conditions could affect performance persistence and the flow of capital to better performing funds could erode future performance.

It is important that models are revised to take into account new findings as information feeds through from broader sets of data. Taken from an interview given in 2019 to the CFA Institute, Frank, J. Fabozzi, CFA [15] explains, "*My criticism of academic economics is that the models built by economists basically treat market agents as robots. They make decisions according to defined rules, and the constructed models are labeled "rational models."... The problem with relying on rational models and treating them as the foundation of finance is that new findings that are inconsistent with the bedrock theories are dismissed.....A true empirical science would revise its models so that they fit empirical data. Financial economics, however, takes the opposite approach and considers deviations from an idealized economic rationality to be anomalies of the true empirical price processes."* Enter the relevance of alternative data sets in discovering new information that would help analysts in making better informed decisions vs taking results as dogma. *"At present, there is no excuse for not using alternative datasets, which inform us in great detail about the daily activities of hundreds of millions of individuals"*. – Fabozzi, 2019. The future of finance will dictate the inclusion of alternate data sets in financial and economic analysis. Improvements in current networks for example, will further escalate how quickly and transparently information can get around. It thus means that we can glean more insights in real time to support judgements formed on the best / or worst private equity / venture capital funds. Alternative data sources can shed more light on the manager, funds, strategy, portfolio holdings and if properly integrated into the traditional data sources, can help with better decision making in a cost-efficient manner.

Alternative data are typically undiscovered unorganized data with different statistical and storage characteristics from the traditional data used in the industry such as, financial statements,

[15] Fabozzi was interviewed for the CFA Enterprising investor blog published on June 3rd, 2019. See link here https://blogs.cfainstitute.org/investor/2019/06/03/fabozzi-finance-must-modernize-or-face-irrelevancy/#__prclt=2PJ8YRjK

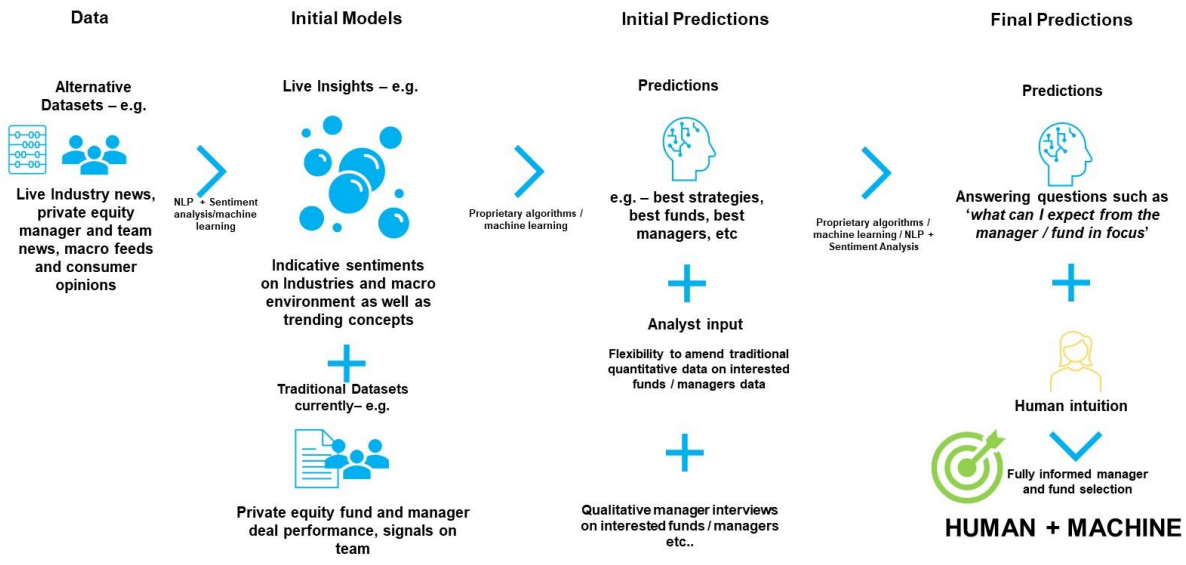
performance information, filings etc. Alternative data sources could be texts posted to Twitter, LinkedIn, Facebook, unorganized data from company website, and other social media platforms etc. Such data sources can add additional signals that we need to know about investment teams, confirm strategy viability, reveal real time insights on industries, markets, underlying holding companies, etc. The use of artificial intelligence constructed using machine learning and natural language processing techniques can help in signaling investment opportunities quickly and effectively and help the analyst to make better investment decisions less influenced by behavioral biases (herd mentality, familiarity bias, overconfidence bias). As Fabozzi explained, "*Machine learning,, comprises a family of computational techniques that facilitate the automated learning of patterns and the formation of predictions from data.... it combines statistics and computing to discover or impose order in complex data to enhance informed decision making. It is thus an* ***inherently practical endeavor****, just like finance, and so is especially suited to investment applications".*

Traditional data sets although organized can be very differently structures, which means that data linkage models must precede the identification of patterns and signals. For one, the analyst is faced with aggregating data from a variety of sources – the manager's own data room, data platforms (Preqin, Pitchbook, Burgis etc.,) all of which would have their own style of presenting information which does not give immediate insights at first glance. For example, although one would find fund information easily from such data sources, one requires in depth review of such funds to test if there has been any investment strategy and style drift that would distort expected behavior and so forth and so on. Here too, machine learning techniques would be useful.

Optimizing signals from alternative data sources and traditional data sets require algorithms that will combine the signals in order to predict the expected future behavior a manager and the fund

of interest. Such a model could be based on the flow proposed below in Figure 8. Here, the analyst is armed with information on the whole data sets that would point her to prospective investment opportunities. The discovery of viable funds and teams become a real time event where alternative data sets can highlight underlying trends in industries and markets as the first point of call to determine strategy viability. Coupled with a universe of managers and funds, we can now see transparently prospective opportunities for selection. However, manager selection cannot be a homogenous event (a thousand analysts cannot all pick the same fund) and as such, it is also important to incorporate the analysts' own views on some of the traditional data sets as well as other alternative information that the analyst gleans from her interviews and qualitative analysis gathered directly from managers of interest.

Figure 8: augmenting traditional sets with alternative data to inform predictive manager / fund behavior.



In the discovery of value for deal pricing on the secondary market, artificial intelligence can also play a valuable role for sellers and buyers to attain a pricing range for the investor interest being sold on a marketplace.

Section 4: Further Applications of the proposed technology designs to consider.

Existing centralized systems and the decentralized environments innovatively allowed for through the discussions above can enable a frictionless existence and transference of events to occur between digital assets and physical assets. This will be a breakthrough for the mass affluent investor who may have a different holding period that needs to be taken into consideration when optimizing her total portfolio. The applications of the new systems proposed do not end with private equity and venture funds. Indeed, it could be applied to a venture company fundraise, a crowdfunding marketplace and even other assets such as Art.

For the venture company looking to raise capital, the mechanics in the new systems is almost the same. There should be a group involved in the transaction that can confirm consensus in the permissioned ledger ecosystem to be able to issue the company raised as a PASTO. In that regard, the price and value movement between the underlying company and $STO_{<company>1}$ is the same and transference between the physical asset and the digital asset is allowable and frictionless. The frequency of the future pricing of $STO_{<company>1}$ is reflective of the reporting frequency. By construct, $STO_{<company>1}$ can now trade on the global exchange made possible by invitation.

In a similar fashion, we can apply the same design to a crowdfunding platform where the platform is now a marketplace that advertises and sells units in an equity raise of a company. The primary PASTO for the company now readies the company and allows investors to sell their interests when they are ready to do so.

When the suggested design is adapted to Art, participants of the ecosystem need to be defined by the authorized art gallery / dealer and in this case also assume the role of asse custodian. The additional benefits of tokenizing an asset such as Art is not only introduced by the divisibility of ownership of the item as a company is in issuing equities, but also the transference of ownership via a secondary market allows smaller investment sized holders to participate in art transactions.

Section 5: Factors that need to be considered for private equity and venture funds backed PASTOs.

There are other key factors that need to be considered as regards to the securitization of private equity /venture funds access funds.

Firstly, to allow the access fund investors the freedom of a secondary market, the limited partnership agreement set in place between the access fund and the main fund should be such that the access fund can allow its limited partners to sell their holdings. There is nothing that should stop us from doing so. Secondly, the issuance of the primary securitized token backed by the access fund must be on a subscribed basis vs committed capital basis to reduce the capital call administration and also to ensure that tokens are backed pari passu the access fund. Finally, it makes no sense for the price of the securitized token to move out of scope from the value of the underlying asset. The idea of a primary and secondary securitized asset token is to allow for the democratization of privately held assets, by reducing the barrier of access and enabling an effective and efficient secondary market operation using novel technologies where value consensus can be achieved concurrently with known players and digitized activity can be directly and transparently transferred into the physical environment without friction. The point is not to turn a private equity and venture fund into a daily tradable asset, the illiquidity premium that privately held assets provide for the investor has value and should not be eroded away. PASTOs allow for that price discovery and a readily available secondary market for the investor. The artificial intelligence technology allows for value discovery as regards to the fund manager and fund selection and as regards to determining deal pricing on the secondary market. These novel technologies and systems can therefore become the bedrock supporting the democratization of privately held assets.

Section 6: The Future is Now

"There's a certain set of probabilities associated with certain outcomes … if you calculate [it] out correctly over a series of decisions, you will come out significantly ahead… Elon Musk.

The Future is Now assuming the branching probabilities can be ascertained in the present moment. Some of the technologies mentioned are novel on their own but have enormous growth potential. The alternative data market is a growth market, expected to grow by an annual compound rate of 40.1% from 2020 to 2027 (from $1.06bn in 2019)[16]. 5G networks are being deployed almost everywhere and will allow data to be accessed and assimilated at a much faster rate. Coupled with this is the fact that companies are remaining private for longer, personal wealth is growing as is the need to access private equity and venture funds and as is the supply of private equity and venture funds. Preqin research anticipates a +100% growth in private equity and venture funds over the next 5 years from $4.4trillion to more than $9 trillion by 2025. Finding a way to expand access from a structural perspective has value to both investors and also to the industry.

I have provided a novel system to support the democratization of private equity and venture funds in a way that there is a frictionless existence and transference of asset and value between the digital environment and the physical environment. Even more, so the proposed novel value discovery system makes fund selection and portfolio company economic prospects accessible. Both systems are necessary for investors, advisors, intermediaries, private equity and venture fund managers today and in the future.

[16] Grand View Research

Sources:

1 The Next Decade of Alternative Investments: From Adolescence to Responsible Citizenship, CAIA, Dec 2020

2 The Case for Illiquid Investments – Willis Towers Watson, 2019

3 The Invisible Hands, Steven Drobny, 2014

4 Asset and Wealth Management Revolution: The power to shape the future, PwC, 2020

5 Investopedia: History of stock markets https://www.investopedia.com/articles/07/stock-exchange-history.asp

6 The Age of Asset Management, Andrew G Haldane, 2014 https://www.bankofengland.co.uk/-/media/boe/files/speech/2014/the-age-of-asset-management.pdf

7 Asset Management – Wikipedia https://en.wikipedia.org/wiki/Asset_management

8 Investment Management – Wikipedia https://en.wikipedia.org/wiki/Investment_management

9 Size, Expertise and What really matters with fund selection, Lydia Ofori, CFA, CAIA, https://www.allaboutalpha.com/blog/2020/09/15/size-expertise-and-what-really-matters-in-fund-selection/

10 Private Equity Performance: What do we know? Robert S Harris, Tim Jenkinson, Steven N. Kaplan, The Journal of Finance, Vol 69, Issue 5, October 2014

11 Ewens, Michael and Matthew Rhodes-Kropf, 2015, Is a VC Partnership Greater Than the Sum of Its Partners?, The Journal of Finance 70, 1081-1113

12 Reiner Braun, Nils Dorau, Tim Jenkinson, Daniel Urban, “Whom to follow: Individual Manager Performance and Persistence in Private Equity Investments” Oct 2019

13 Daniel R Cavagnaro, Berk A Sensoy, Yingdi Wang, Michael S Weisbach, “Measuring Institutional Investors’ Skill at Making Private Equity Investments” Dice Center WP 2016 -14 Fisher College of Business WP 2016 03 14, April 17 2018

14 Robert S Harris, Tim Jenkinson, Steven N Kaplan and Ruediger Stucke, “Has Persistence Persisted in Private Equity? Evidence from Buyout and Venture Capital Funds”. April 2013

15 Global Pension Assets Study 2020, Thinking Ahead Institute, Willis Towers Watson

16 Daniel R Cavagnaro, Berk A. Sensoy, Yingdi Wang, Michael S Weisbach, Measuring Institutional Investors’s Skill at Making Private Equity Investments

17 Cambridge Associates, 2019 – Private Investing for Private Investors: Life Can Be Better After 40% https://www.cambridgeassociates.com/insight/private-investing-for-private-investors-life-can-be-better-after-40/

18 Cambridge Associates, 2016 – The 15 Percent Frontier https://www.cambridgeassociates.com/insight/the-15-percent-frontier/

19 Thomas Lambert, Daniel Liebau, Peter Roosenboom - Security Token Offerings, Oct 15 2020

20 For Digital Assets, Private Markets offer the Greatest Opportunities, Mike Koehnl, Thomas Olsen, John Fildes, Karl Gridl, Dec 16 , 2020 https://www.bain.com/insights/for-digital-assets-private-markets-offer-the-greatest-opportunities/

21 Distributed Ledger Technology: beyond block chain, a report by the UK Government Chief Scientific Adviser, 2016

22 How persistent is private equity performance? Evidence from deal-level data Reiner Braun a, Tim Jenkinson b, Ingo Stoff, Dec 2015

23 Aigner, P.S, Albrecht, G. Beyschlag, T.I.M. Friederich, M. Kalepky and R. Zagt. "What Drives PE? Analysis of Success Factors for Private Equity Funds", The Journal of Private Equity, Vol. 11, No 4, 2008

24 Bernstein, S., J. Lerner, M. Sorensen, and P. Stromberg, "Private Equity and Industry Performance", Harvard Business School AFA 2011 Denver Meetings Paper: March 2010

25 Chung, J. "Performance Persistence in Private Equity Funds" The Chinese University of Hong Kong February 2012

26 Diller, C., and C. Kaserer, " What Drives Cash Flow Based European Private Equity Returns? Fund Inflows, Skilled GPs and/or Risk? Working paper, No 2004 -02 Centre for Entrepreneurial and Finance Studies (CEFS) and Department for Financial Management and Capital Markets Technische Universitat Muchen C, 2004

27 Gompers, P.A. Kovner, J. Lerner, and D. Scharfstein "Venture Capital Investment Cycles: The Impact of Public Markets", Journal of Financial Economics, Vol 87, No 1 (2008), pp 1 -23

28 Marquez, R., V. Nanda, and D. Yavuz "Private Equity Fund Returns and Performance Persistence" Review of Finance, 2014, pp 1 - 41

29 Phalippou, L., and M. Zollo. " What Drives Private Equity Fund Performance?", Nov 2005

30 Robinson, D.T and B.A. Sensoy, "Do Private Equity Fund Managers Earn their Fees? Compensation, Ownership, and Cashflow Performance" Jul 15 2011

31 Gohil, R. K., and Vyas, V., " Private Equity Performance: A Literature Review. The Journal of Private Equity Vol. 19, No 3 (Summer 2016)., pp. 76 – 88

32 Grandview Research “Alternative Data Market Size, Share & Trends Analysis Report By Data Type (Card Transactions, Mobile Application Usage, Social & Sentiment Data), By Industry, By Region, And Segment Forecasts, 2020 – 2027” https://www.grandviewresearch.com/industry-analysis/alternative-data-market

33 CFA Institute – GIPS Standards for Firms, 2020

34 Morgan Stanley, Oliver Wyman and BluePaper “After The Storm, Wealth Management Report”, 2020

35 Gredil, O., Liu, Y., Sensoy, B., Diversifying Private Equity, May 2020