World Review of Science, Technology and Sustainable Development

ISSN online: 1741-2234 - ISSN print: 1741-2242
https://www.inderscience.com/wrstsd

Blockchain for the asset management industry

Vijaya Killu Manda, Vijaya Kittu Manda, Vedavathi Katneni

DOI: 10.1504/WRSTSD.2023.10051918

Article History:

Received:	23 March 2021
Accepted:	18 May 2021
Published online:	30 November 2022

Blockchain for the asset management industry

Vijaya Killu Manda*

GIS, GITAM (Deemed to be University),
Visakhapatnam, India
Email: MVKillu@gmail.com
*Corresponding author

Vijaya Kittu Manda

GIM, GITAM (Deemed to be University),
Visakhapatnam, India
Email: vijaykittu@hotmail.com

Vedavathi Katneni

GIS, GITAM (Deemed to be University),
Visakhapatnam, India
Email: vedavathi.katneni@gitam.edu

Abstract: The financial asset management industry is constantly looking for ways to reduce the cost of running funds by simplifying their processes and making it easier to comply with regulatory requirements. Blockchain provides a feasible solution to these requirements. This paper explores the operational and implementation aspects of the business-grade version of the enterprise blockchain technology that benefits all stakeholders in the asset management industry using a theory-driven approach. Implementation technology, procedure, regulation, and social dimensions for practical implementation are discussed. Enterprise Ethereum Alliance's (EEA) Ethereum Architecture Stack describes the architectural framework in the technical implementation. This paper explains how EEA features give the asset management ecosystem a value proposition from a practical implementation perspective. Hence, stakeholders (regulators, asset management companies, registrars) and financial intermediaries get directions on migrating to the blockchain network.

Keywords: asset management; fund management; smart contract; regulatory; technology; Ethereum; enterprise blockchain.

JEL codes: E42, G24, G21, O31.

Reference to this paper should be made as follows: Manda, V.K., Manda, V.K. and Katneni, V. (2023) 'Blockchain for the asset management industry', *World Review of Science, Technology and Sustainable Development*, Vol. 19, Nos. 1/2, pp.170–185.

Biographical notes: Vijaya Killu Manda is a Software Consultant and Architect building frameworks for various industries. He is currently researching the use of decentralised systems in maintaining data efficiently in the asset management industry. His areas of research include decentralised systems, blockchain, hyperledger, amongst others.

Vijaya Kittu Manda is a stock market trainer, author, and financial advisor. He is interested in personal finance, collective investment schemes, and equity shares. His current focus area of research is on asset management industry. He has ten university post-graduate degrees from different streams/disciplines. He is a columnist for several newspapers, editor for a book series, and author of several titles related to investing.

Vedavathi Katneni is currently working as HoD of the Computer Science Department, GITAM, Visakhapatnam. She did her PhD from Andhra University. She is a member of several industry bodies, including CSI, the Indian Science Congress, and ISTE. She received multiple awards. Her areas of interest are data mining, cognitive learning, machine learning, and IoT.

1 Introduction

Business disruption technologies such as blockchain, and its improved avatar, Enterprise Blockchain, have an immense impact in terms of cost-saving, process optimisation, and elimination of intermediaries in the banking and financial services (BFS) industry. (Crosby et al., 2016) Several industries within the BFS domain have started either re-designing their processes or are migrating to blockchain because the technology forces them to either 'disrupt or get disrupted.' the world economic forum (WEF) estimates that about 10% of the World GDP will be stored in blockchain technology-led assets by 2025. The value in blockchain will be $176 billion by 2025 and $3.1 trillion by 2030 (WEF, 2018).

The financial asset management industry is ready to embrace the change and gearing itself towards the necessary transformation. Companies are now eager to experiment with new analytics and alternative data and are increasing spending on digital infrastructure and techie headcount. Hedge funds, for example, are not just building digital strategies but defining their business strategies in the digital world by experimenting with innovation, particularly in the areas of front-office systems and trading tools (Mike, 2017). Among other factors, firms have to innovate and emerge through bold execution, and emerging technologies will separate them from the rest of the pack. (Deloitte, 2018) New-gen asset managers are working on fully integrated digital strategies with digital tools and predictive analytics for managing their retail and institutional client investments better. (Fages, 2018) The $79.2 trillion asset management industry is heading towards digital transformation.

Early blockchain implementations, such as the Bitcoin, laid the groundwork for some innovative ideas. They fostered cryptocurrencies and concepts such as decentralisation and ledger-based accounting system. Whether involving cryptocurrencies or not, blockchain saw some early use-case solutions stemming from the basic distributed ledger, smart contracts, shared records, and smart tracking concepts. Supply chain and cross-border currency exchange domains were early beneficiaries of the use-cases. While this paper does not focus on cryptocurrencies per se, it is worth mentioning here that more assets will move to digital platforms, and blockchain will be at the helm of them. We will hear a newer form of stock exchanges that deal in trading of cryptocurrency. A whole new financial vocabulary, such as wallets, initial coin offering (ICO), bitcoin derivatives, amongst others, will become common parlance going forward. Because of its

low correlation with other asset classes, investments in cryptocurrencies will act as good diversification, thereby giving favorable risk/reward to investors. Cryptocurrencies pass qualification tests and are thus an asset class by themselves. (Ankenbrand and Bieri, 2018) They showed positive response upon being subjected to tests such as stable aggregation, inevitability, internal and external homogeneity, expected utility, selection skills, and cost-effectiveness. Cryptocurrencies can thus pave the way for newer passive investment products (such as index funds and ETFs) in the future. (Dieterich, 2017)

2 Need for study

Investment returns are at the heart of the investors globally, irrespective of which asset class or financial product that the investor puts money into (Jason, Dec 2002). When funds begin to give good returns, more investors express confidence and invest in the there schemes, thereby increasing capital inflow into the schemes. As a consequence, the fund assets under management (AUM) increases, but this puts more pressure on the fund manager to give similar or superior returns, which is not that easy to repeat. Failure to cut expenses would be detrimental to the fund house because it can lose its AUM. (Cui, 2016) On the other hand, regulators force schemes with higher AUMs to reduce the cost of running and managing the fund. Hence, the industry is in dire need of innovative technologies that can promise cutting costs. (Phinney et al., 2013).

Two major areas where the industry is seeking technology help are innovation and automation of manual processes. There is an increased use of other disruptive technologies such as artificial intelligence (AI) and Robotics in the middle/back office. When an organisation wants to embrace new technology, there will be an increase in operating expenses for building the necessary technology infrastructure, outsourcing complex processes to outside vendors, or for increasing headcount, particularly for specialists like Solution Architects and IT Managers. There will be costly organisational changes to be made that can stress financials briefly during the period. In comparison, automation projects give almost immediate benefits, while other projects take a little time. Overall, there will be an increase in sustainable earnings from IT investments (Anderson et al., 2003). The new investment in blockchain systems increases the cost of running the funds initially. The savings and benefits will follow later as fund size increases leading to a sustainable higher level of earnings over time.

Like other businesses, the asset management industry has several functions - such as sales and marketing, investment management and trading, operations, IT and Business management, and support services. These functions have broad productivity differences when observed between top quartile, industry average, and the bottom quartile concerning costs. These factors indicate that there is ample scope (and necessity) to cut costs. Optimising the operating model and refocusing the business model are two stages of action suggested by Fages (2018) towards this.

A variety of expenses eat up the returns pie in the asset management industry setup. The breakup of various fees that make up the expenses include investment advisory fees (47.5%), brokerage commissions (12.8%), transfer agent fees (12.7%), marketing and distribution (11.0%), custodians (2.6%), auditing and legal services (2.1%), shareholder communication (1.6%), SEC registration (1.4%), and directors (0.6%). The quantum of the fee depends on the underlying asset class. Alternative assets (including investment in high-value art and rare collectibles) fetch higher management fees. Equity and

convertible investments (such as secondary market company equity shares and private equity) charge moderate fees. Bonds, fixed-income instruments, and commodity investments (real estate funds, commodity funds, debt, and gilt funds) charge a low fee. Passive investment tools such as Index funds and ETFs are ultra-low-cost funds. For actively managed schemes, the base fee will usually be a fixed amount, often stipulated by the regulator. Topping it up will be additional fees that are paid depending on the fund performance. The fee structure of hedge funds is high but straightforward. The standard management fee would be 1 to 2% and calculated on the NAV of the scheme. The performance fee would be 10 to 20% of the positive performance, and this will be high. Increased competition, however, has brought down the total fee to single digits. The '2 and 20 fee structure' is a standard industry figure. A lot of literature study is already available in support of the need to cut fee expenses to generate better alpha to the investors.

Lower expense ratio leads to economies of scale, as observed from profitability analysis of fund management companies. (Haslem, 2017) Increased investor awareness is tempting investors to invest directly with the fund house, thereby bypassing the distributors' route. Meanwhile, regulators are removing or putting a cap on entry load and upfront commissions, thereby reducing the distributor brokerage earnings. Globally, the average operating expenses of hedge funds have come down from 1.95% in 2015 to 1.75% in 2017. (THFJ, 2017).

In some cases, the management fee includes non-fund-based services. Wealth management, for example, will have advisors providing customised and one-to-one personalised investment services for their clients. Hence, the intermediary serves multiple roles, such as being a financial planner, offering private banking services, and even services beyond the financial domain – such as legal, succession planning, and taxation. Banks and financial institutions catering to this domain insist on minimum investment ticket sizes and often charge hefty fees for the personalised services they provide. Sometimes, high network individuals are provided even more personalised services of wealth management and call them 'private client services.'

Increased investor attention is now towards passive funds as active fund managers are feeling extreme pressure to bring in alpha - whether it is in ETFs (Rompotis, 2013) or Pension Funds (Walden, 2015). Performance measurement of hedge funds is not just done against the benchmark index but also on an absolute returns basis. They have to ensure that they do not get negative returns though industry figures show it is common to get so. Hedge funds are struggling to make alpha. Even within the ETF space, zero-expense ratio schemes started to evolve while existing ETFs are demanding low cost. The Salt Low truBeta US Market ETF launched in March 2019 surprised the market with its announcement of actually incentivising (paying) investors for investing in its low-beta ETF. Though they intend to raise the desired $100 million AUM to stay afloat, an ETF incentivising investor is probably the first.

The BFS industry has several operational inefficiencies, such as manual work and redundant paperwork (as in the case of KYC), which blockchain attempts to remove. Further, the securities and asset management industry have too many middlemen who hardly bring any value and hence have to be eliminated (Crichton, 2017). This paper explores blockchain technology attempts to lower costs, improve operational performance, and eliminates intermediaries in the asset management industry.

3 Design considerations

Enterprises have to face several managerial challenges to move their blockchain solutions beyond proof-of-concept. (Lacity, 2018) A systematic survey done on various blockchain networks classified the evaluations into two types - empirical and analytical evaluation. (Fan et al., 2020) Designing a blockchain platform requires careful planning, thinking, and foresight. This paper extends the concepts discussed in (Vijaya Kittu and Prasada Rao, 2018) by applying it to the broader investment asset management industry and by discussing their practical implementation.

3.1 Features of enterprise blockchain

Modern blockchain platforms – the enterprise blockchains – such as Ethereum, for example, extended the core foundations and have taken the concept to an entirely new level. These blockchains possess features of a computer – a distributed computing platform in the form of a virtual machine, runs on operating system software, over a peer-to-peer network, and acts as a trusted platform for publishing distributed applications that use Smart Contracts without any central authority.

Different blockchain platforms and layers will have different levels of security and technology. Further, since transaction speed and security are interrelated, managers need to decide what business processes need to be on-chain and which ones are to be shifted for off-chain processing. The delicate balance between transparency and confidentiality have to be explicitly mentioned and taken care of during platform design. As an evolving technology, there will be a great need for developers to learn and unlearn the subject.

Some of the basic expectations of a blockchain system, with improvements, of course, for the asset management industry are:

1 Account/client management, order routing (via the stock exchange, websites and offline channels, via direct investor route or the distributors)

2 Front-end management (for various stakeholders ranging from the regulator, fund manager to the end-investor) and

3 Connectivity (through API for backward compatibility, proprietary networks like SWIFT, and to other blockchain networks)

Because of the nature of distributed computing, the system will be more secure and will be resilient to cyber-attacks and system breakdowns.

3.2 Blockchain networks

Globally, digitalisation is helping corporates move their business onto platforms. Third-party service developers can use the core features of these platforms to extend them for use by other corporates. Blockchain is one such system designed to be a trustless recordkeeping protocol built over the ground rules of the distributed ledger technology (DLT). However, the finance industry deals only with known and trusted parties for security and privacy reasons. The system controls trust in a blockchain, and all stakeholders in the system should abide by this software-enforced trust. A decentralised public blockchain, no particular entity regulates the system. An enterprise blockchain will have both permissioned and permission-less (public and private) layers. Though the

concept of permission is in contrast to the spirit of the earlier envisaged public blockchain networks, they are the primary and most preferred when it comes to the financial domain. The private network part can deal with the privacy part as well to a certain extent. In the financial industry, the privacy of information is vital. The identity of the transaction, for example, should not be revealed to the public unless asked to be disclosed following the due legal process.

The permissioned blockchain, being private, can be used to put private data like customer information or fund transaction data (purchases, switches, and redemptions) without exposing it to the internet. Quorum is one such permissioned blockchain implementation built from the Ethereum codebase and is being implemented by JP Morgan Chase. A permissioned blockchain can restrict access to the public, and users cannot join the chain unless invited by the administrator. Performance evaluation shows that the maximum achievable load on the system was 900 transactions per second beyond which the system failed to reach consensus. (Arati et al., 2018) In another performance evaluation and taxonomy research, various consensus algorithms, development platforms, and simulators. Bandwidth and execution time degrades with an increase in validation count, and that increasing number of blocks does not improve bandwidth performance but increases execution time. Increasing block size improves performance keeping execution time the same. (Ismail et al., 2019)

A workable solution is to separate public and private states and to transfer private data to network participants in the form of peer-to-peer encrypted messages, as seen in Quorum. Transaction messages in quorum implemented via constellation (Haskell implementation) and Tessera (Java implementation).

Private blockchains can use cryptographic methods like zero-knowledge proof, where one party can prove to another that it holds specific information without revealing any sensitive data. These methods can address the increasing need for transaction processing yet maintain security standards (Espel et al., 2017). As high-speed processing levels are reaching new highs every year, the existing cryptographic methods are getting proved vulnerable because of advancements in quantum computing. However, this problem is outside the purview of blockchain systems and falls more in the domain of cryptography. Of course, both permissioned and permission-less implementations have different barriers and diffusion drives. (Helliar et al., 2020)

Modern businesses are increasingly getting interconnected. It is not uncommon for one organisation to have multiple blockchains for different use-cases. Further, the latest evolution is not just about bringing one organisation onto a working blockchain system. The broader goal is to allow a group of organisations that collaborate over a network of blockchains. Investment services involve rendering services by several intermediaries. Each intermediary adds value to the investment process chain. Exchange or data or assets (securities or funds) is a basic necessity of the investment function. Regulators encourage healthy competition and fair play amongst the intermediaries so that the end investors get benefited. Once the industry embraces the technology, each of these stakeholders will not only have their blockchain but also collaborate on an inter-blockchain network. The blockchain of an asset management company (AMC) might have to inter-connect with blockchains owned and managed by other entities (such as registrar and transfer agents (RTAs)) with whom data interchange has to happen. Hence, it is not uncommon for the need to inter-connect for low-cost payments and sharing transactional data between blockchains (Madisetti and Bahga, 2019). Blockchain can fit into the existing business process management (BPM) lifecycle, execute business processes across organisational

boundaries and thereby allow enterprise collaborations between untrusted parties with system-enforced trust (Mendling, et al., 2018). However, blockchain implementations should consider design challenges and trust issues in inter-organisational business processes (Quekel, 2018).

3.3 Smart contracts and DApps

Smart contracts are pieces of self-executing computer code written by one network participant and deployed onto the blockchain. (Zheng, et al., 2020). However, any other participant or contract on the network can execute it. The contract code can run upon triggering an event or a happening, either fully or partially. Sometimes, these code snippets run on their own on the blockchain. Because the code is itself available on multiple nodes on the blockchain, it is secure, immutable, and stays on the blockchain permanently. Solidity is the most commonly used programming language to write smart contracts on the Ethereum network. The historical background, its interplay with traditional agreements, enforceability, and issues surrounding smart contracts, are thoroughly discussed in the research circles (Stuart and Alex, 2018). Since the system takes care of the execution, there will be fewer errors and hence fewer potential legal disputes.

Smart contracts run perfectly where the processes are rule-driven. Application areas like computing NAV, determining scheme returns, benchmarking with indices, and preparing compliance reports are some application areas where they can be used. Since all the scheme related information – such as performance data, metrics, and financial ratios – are available online fairly and transparently, they can be updated in real-time. The AMC need not spend additional money on marketing to promote their schemes as their performance numbers speak out loud. The blockchain system can itself act as a proof of their performance! For the returns-chasing-investor, scheme performance comparison becomes easy and becomes available on-the-fly. The offline and online system facilities of the network can help in taking complex computation offline and post only the result (such as NAV value) onto the blockchain network.

There is much debate on the legal nature and enforceability of smart contracts for use in real-life business applications. Declarative smart contracts have been found to provide technical and legal advantages. (Governatori, et al., 2018)

Third-party decentralised apps (called DApps) hide the technical complexities of the blockchain and provide decentralised services and allow business intelligence to be pushed to the users. For example, they can bring about attractive dashboards to monitor and compare investment performance. DApps are the applications that run on the distributed peer-to-peer computing network such as the Ethereum. Since they run on the blockchain itself and because there is no commercial company owning or running the network itself, the system takes the onus of providing decentralisation and trustlessness facilities. Acting as a sublayer, DApps behave like blockchain explorers – tools to monitor the blockchain.

Stacked or layered system implementation in the form of pluggable modules can be built so that they can be interconnected. For example, modules designed by a stock market data feed service vendor can be plugged onto the blockchain so that all AMCs or Registrars who wish to use data services from them can pull the data.

Blockchain has a definite influence on the upcoming Web 3.0, which wishes to separate interface, code, and data and blockchain (The Economist, 2018). Projects such as Blockstack, Solid, and interplanetary filing system (IPFS) are a case in point.

3.4 Eliminating middlemen

The DLT provides a single 'golden record' of the transaction and can be safely distributed across to market participants. With blockchain itself acting as an immutable distributed ledger, the role of recordkeeping RTAs will increasingly be questioned. Fund distributors and agents who are feeling pressure because of investor switching to direct plans are further getting affected with artificial intelligence-backed Robo-advisory services. While blockchain can accommodate distributors in its framework, their value addition to the system will be less, and hence they are prone to disruption.

The audit process will become quicker and cheaper because the information is already available on the blockchain. While a section says auditors will themselves be eliminated from the system because blockchain does auditing, a blockchain system cannot talk about the nature of the transaction (unauthorised, fraudulent, or illegal). Though the transaction occurs between parties, there could be side agreements performed outside the blockchain, which only an auditor can assess (Reza and Darius, 2019).

Blockchain discourages intermediaries by performing a distribution verification process in order to get a consensus. The two most commonly used mechanisms are proof of work (PoW) and proof of stake (PoS). (Torre and Seang, 2018). While PoW is famous in existing implementations, PoS is gaining increasing importance. Other authentication/verification mechanisms such as proof of authority (PoA), proof of importance (PoI), and Proof of History (PoH) are fast evolving. (PWC, 2018)

3.5 Settlement

With enhanced transparency (proofs and timestamping), trading, reporting, and settlement become immediate. Stock exchanges (such as NASDAQ, NYSE) are already evaluating the use of blockchain in various forms (such as order routing, reducing settlement time, or a consortium network for thinly traded securities). The US and Canadian stock exchanges have already moved from the T+3 settlement time to T+2. (CDS, 2015) Will full-scale blockchain implementation, real-time settlements of asset transfer (such as shares, bonds, and mutual fund units), can happen. Many stakeholders in the system will have to make necessary changes to derive the benefit from the real-time settlement. The use of blockchain in clearing and settlement (such as with US Treasury), and for portfolio management services are widely explored. The economics of using DLT is well discussed in research circles. (Benos et al., 2017) Overall, the post-trade settlement and balance checks processes will become smoother, faster, and more efficient.

3.6 Regulation and governance

Regulatory compliance is a serious thing and is proactively taken care of by the asset management companies. It is so severe that companies having asset management arms would do anything to avoid a potential conflict of interest and keep their wealth management arms a distant away, as seen in the case of Merrill Lynch in 2005 and

Citigroup in 2006. This is because the consequences in the form of penalties and fines are very high and might even cost their licenses too.

Regulators see blockchain to be an 'emerging business practice requiring vigilant monitoring' and are not fully endorsing it though they acknowledge it could positively impact the financial system (Financial Stability Oversight Council, 2016). The (ESMA, 2017) however, feels the use of DLT can enhance reporting and supervision functions. If a regulatory nod is obtained, blockchain can help smoothen information flow in the entire asset management system. Regulators themselves can connect to the blockchain and collect whatever information they need, whenever they want and without asking or waiting for the stakeholders to provide it. All that is needed is the grant of access to connect and access data on the blockchain. Though the original DLT was not designed for tasks like risk management, modern developments do facilitate these.

Because the system does the execution of various business processes as per pre-defined business logic, there will hardly be any scope for non-compliance and its enforcement. Regulatory Technology or RegTech has the potential of identifying and addressing risk in real-time and facilitating efficient regulatory compliance (Arner et al., 2016).

Lessons from the recent spate of attacks made blockchain give high priority to governance. Governance of the system can be on-chain or off-chain. Governance rules are written in the programs of the on-chain system, and hence governance cannot be avoided or bypassed. The off-chain rules are endogenous and exogenous and usually come from decision-making processes (Reijers et al., 2018).

3.7 Enterprise Ethereum Alliance

Standards and Standardisation are essential for smooth communication between the 'users' and 'techies' and can be critical enablers of innovation, particularly in information technology (Jakobs, 2006). These are more important in the case of evolving technologies such as blockchain and more so in providing business and financial solutions. Standards are necessary when a system is built using building blocks sourced from different vendors. Further, standards are set forth by way of compliance indirectly by regulators and, in some cases, necessitated because of inter-compatibility.

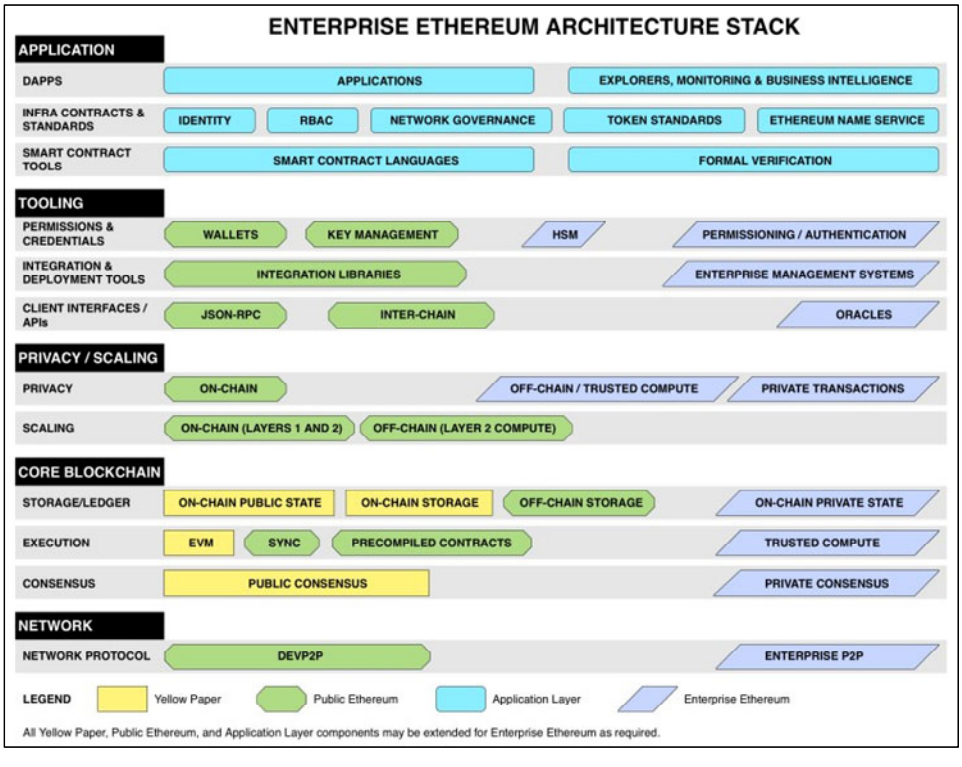
The n-layer based architectural framework for the blockchain was made is worth mentioning. (Glaser, 2017) At the lowest base level of the architecture is the physical Hardware / Network layer. The decentralised fabric layer is built on top of it and fulfills the essential services of tokenisation of ecosystem value, immutable distributed database, decentralised and permissioned. On top of this is the decentralised application layer that takes care of the tokenisation of ecosystem value, autonomous services, and user-controlled services. The presentation layer runs on top of this.

An even better and more standardised attempt is made by the Enterprise Ethereum Alliance (EEA), who took up the responsibility of setting standards and specifications (EEA, 2018). EEA's attempt focuses on secure interoperability, gives vendor choice, and reduce implementation costs. The EEA was formed with 30 founding members and currently has 319 members (March 2019), including some Fortune 500 companies. Following the EEA specifications are essential for blockchain developers because such implementations will be easily scalable, and different client applications will be able to communicate with each other smoothly.

The first version of the client specification was released in Spring 2018 while the second version came out in October 2018. Version 2 proposed a five-layer architecture stack comprising Network, Core Blockchain, Privacy / scaling, tooling, and application layers. The application layer will have Dapps, infra contracts and standards, and smart contract tools. All the other four layers will have a separation between public and enterprise Ethereum. The current Version 3, released on 13 May 2019, made permissions system more simplified, is more flexible, and carried updates for improved performance and reducing interoperability issues. Alongside it, the EEA Off-chain trusted compute specification Version 1.0 is released. Yellow Papers are available for the Core Blockchain layer for the areas of EVM, public consensus, on-chain public state, and on-chain storage. These standards can help technology companies in provide blockchain solutions for their asset management clients.

Clique proof of authority consensus algorithm was introduced as the first standard baseline. The next version is planned to use the byzantine fault tolerant algorithm as the second baseline. Improvements in the Ethereum ecosystem are included.

Figure 1 The layered enterprise Ethereum architecture stack allows smooth and quicker development of solutions by plugging applications from different vendors (see online version for colours)



Source: Enterprise Ethereum Alliance (entethalliance.org)

By following the architectural standards, IT service vendors can write interoperable code and build applications rapidly. Many such small functionalities from different vendors can be brought to a single place and interlinked to get a complete solution. For example, a

data feed vendor can bring in a tool that fetches the closing market prices of various securities. At the same time, another vendor would provide a tool that takes the data feed and use it for computation and dissemination of the NAV. This way, the asset management industry can quickly build blockchain-based solutions with vendor inter-connections.

3.8 Backward compatibility

Though online fund transfers have become common now, there are still many transactions happening offline using conventional bank channels such as by cheque transfers. Bank demand drafts are still used as fund transfer tools in remote areas. AMCs maintain several separate designated accounts for collection, investment, expenses, and redemptions. The collecting banks often give the AMCs and RTA updates on the cheque clearing and fund levels. Further, banking systems provide multiple channels for fund transfer. While the future would be towards the use of cryptocurrencies, wallet payments, and instant fund processing (for purchase and redemption transactions), for now, compatibility and backward integration support for various traditional channels should still be continued.

Timestamping has two dimensions when the asset management industry implements blockchain – one from a real-life practical perspective and another from a technology perspective. Regulations insist that every transaction be timestamped. From a technology perspective, blockchain provides an enhanced version of this called data anchoring, blockchain time stamping (Crespo and García, 2016).

3.9 KYC and documentation

Digitalisation or not, the documentation process in the financial industry is still bulky and is essential in order to meet regulatory compliance. BFS regulators across the world are united in their fight against money laundering (ML) and terrorism financing. This resulted in the insistence of newer forms of client verification, such as using in-person verification (IPV) to avoid identity theft along with the increase in documentation requirements as part of compliance requirements. Financial institutions are directed to ensure the usage of secure methods of client data storage and management. These standards are often part of anti money laundering (AML) norms and know-your-customer (KYC) requirements. Failing to comply with financial institutions will mean that they have to pay hefty fines. Financial history already has stories of how financial institutions (such as HSBC and ING Bank) paid hefty fines in the past for not maintaining proper KYC documentation because of which two big cartels flourished. Further, repeated attempts to build a global registry or a centralised registry, a KYC platform, or a reputation book system is often failing to yield results.

The bulkiness of financial documentation is often confusing investors who might think of delaying their investment plan or even avoid it altogether, hampering investor experience. The KYC process is not a one-time activity, and regular, time-to-time compliance is mandatory – more so for big investments are involved. So, the investor conduct might insist on enhanced documentation requirements. Further, financial documentation does not mean just KYC documents alone. It is often supplemented with additional ancillary documents (such as partnership deeds) for a higher level of investors (such as an Association, Trust, LLP, Company). Treaties by the US with various

countries have necessitated investors in other countries to provide a declaration in the form of a FATCA update. All these documents pile up at the registrar and transfer agent (RTA) or the KYC registration authority (KRA). Several use-cases are already available on how KYC and documentation process can be optimised using the distributed ledger technology (Moyano and Ross, 2017). When one financial institution accepts and verifies a digitally signed KYC form, all other institutions on the network will accept it. Allowing the investor to do KYC with any party gives convenience, thereby reducing the cost and onboarding time of the investor. Traceability of the transactions will be increased. Blockchain helps regarding data storage, accountability, and provenance tracking in the context of the general data protection regulation (GDPR) (Neisse et al., 2017).

4 Findings

This study explored the application of blockchain technology by the asset management industry, keeping in mind the industry requirements, availability, and applicability of the technology. The earlier envisaged public blockchain might not fit the trust conscious asset management industry. Hence, the features of Enterprise Blockchain are explored and found to fit the industry requirements and expectations. The future is all about not just one single blockchain network working in isolation but an interconnected blockchain network spanning across various stakeholders. Smart contracts and DApps are close to the user and provide the intuitive and easy to understand user interface. While blockchain aims at eliminating non-value-adding intermediaries, stakeholders such as distributors, RTA, and auditors are still retained in the present design. However, they are having a severe threat of being eliminated. Blockchain reduces settlement time and improves transaction processing time.

Further, regulations, governance, and compliance become easier. The structure proposed by the EEA can help in inter-operability and quick building of pluggable applications by different vendors. Backward compatibility with legacy systems needs to be part of the design considerations to allow a smoother transition. Existing use-cases have already addressed the KYC and documentation storage and management.

5 Scope for further study

1 As discussed in (WEF, 2018), blockchain as technology needs to overcome six high-level risks and challenges – Adoption challenge, technology barrier, security risks, legal and regulatory challenges, interoperability risks, and energy consumption challenges.

2 Regulatory changes are not fast enough to catch up with the technology changes. The legal implications and compliance with the law regarding cryptocurrencies, smart contracts, data storage, and transactional usage need further exploration. (Fulmer, 2019)

3 Transaction speeds are the most significant deterrents stopping live implementations using blockchain right now. Visa, for example, process 45,000 transactions while Ethereum could only process a mere 25 at current technology levels (January 2016). Transaction speed improvement is the need of the hour. Ethereum Plasma is trying to

solve this problem by moving the transaction processing part to 'off-chain' away from the Ethereum main chain.

4 Various legislations govern asset management institutions. Mutual funds, for example, are governed by the Investment Company Act of 1940 and investment advisers registered under the Investment Advisers Act of 1940 (Gibson and Kirk, 2016). Using blockchain in the present circumstances might lead to legal consequences, and hence there is a need for updating the legislation to allow blockchain-based 'shared distributed ledger.' The fallouts because of these need to be studied.

5 Tax laws are applicable based on the location where the transaction happens. In a blockchain network, transactions happen on the network. Who will tax the transaction, and which tax laws will be applicable?

6 Conclusions

Blockchain networks connect and perform data exchange in a trustless and decentralised environment essential for the asset management industry. Enterprise Blockchain provides cost benefits, improves processes, saves time, and eliminates non-value adding middlemen in the asset management industry, thereby benefiting all stakeholders. Standards set forth by the EEA can help technology providers in building individual and independent blockchain solutions that can be easily plugged in for use by the asset management industry. Smart contracts take care of code execution as per business logic. Time-saving and transparency will be visible right from order routing to the last-mile settlement stage. Regulatory compliance and auditing processes will get easier and quicker.

Credit author statement

All the researchers have worked on this paper over the last three years at different times and in different ways, and the paper evolved dynamically over time. We are happy that overall, each author has contributed to the study.

Compliance with ethical standards

There were no humans or animals involved in this research, and the authors have complied with ethical standards of research.

Funding

The authors performed the research in their individual/personal capacity and have not received any explicit funding for the propose of this research from any institution or a funding agency.

Acknowledgements

The authors wish to thank Dr. Aruna Polisetty of GIM, GITAM Deemed to be University, Visakhapatnam, India, for her inputs.

References

Anderson, M., Banker, R. and Hu, N. (2003) 'The impact of information technology: spending on future performance', *Twenty-Fourth International Conference on Information Systems*, pp.563–575.

Ankenbrand, T. and Bieri, D. (2018) 'Assessment of cryptocurrencies as an asset class by their characteristics', *Investment Management and Financial Innovations*, Vol. 15, No. 3, pp.169–181, DOI:10.21511/imfi.15(3).2018.14.

Arati, B., Subhod, I., Pandurang, K. and Siddhartha, C. (2018) *Performance Evaluation of the Quorum Blockchain Platform*, July 19 [online] https://arxiv.org/abs/1809.03421 (accessed 10 August 2021).

Arner, D.W., Barberis, J.N. and Buckley, R.P. (2016) 'The emergence of Regtech 2.0: from know your customer to know your data', *Journal of Financial Transformation*, 1 January, p.44, p.79, UNSW Law Research Paper No. 17-63 [online] https://ssrn.com/abstract=3044280 or http://dx.doi.org/10.2139/ssrn.3044280.

Fages, R., Beardsley, B., Brömstrup, I., Donnadieu, H., Macé, B., Pardasani, N., Schmitz, L-K., Sheridan, B., Taglioni, G. and Xu, Q. (2018) *Global Asset Management 2018: The Digital Metamorphosis*, p.31, BCG [online] https://image-src.bcg.com/Images/BCG-The-Digital-Metamorphosis-July-2018-R_tcm30-197509.pdf.

Benos, E., Garratt, R. and Gurrola-Perez, P. (2017) *The Economics Of Distributed Ledger Technology For Securities Settlement*, Bank of England.

CDS. (2015) 'CDS MOVE TO T+2', [online] https://www.cds.ca/resource/en/174 (accessed 15 June 2021).

Crespo, A.S.D.P. and García, L.I.C. (2016) *Blockchain Timestamping Architecture Version 6 (BTAv6)*, https://doi.org/10.13140/RG.2.2.17223.80805.

Crichton, M. (2017) *Middlemen Not Needed for Blockchain in Asset Servicing—Panel*, Global Investor Group [online] http://fowgi.test.gowi.rs/articles/3688816/middlemen-not-needed-for-blockchain-in-asset-servicing-panel.

Crosby, M., Nachiappan, Pattanayak, P., Verma, S. and Kalyanaraman, V. (2016) 'BlockChain technology: beyond bitcoin', *Applied Innovation Review*, June 2, No. 2, pp.6–19 [online] https://j2-capital.com/wp-content/uploads/2017/11/AIR-2016-Blockchain.pdf (accessed 10 January 2021).

Cui, C. (2016) 'As emerging-market funds drop, so do fees; cuts follow declines in other mutual funds driven by the rise of ETFs and a push by investors to lower costs', *Wall Street Journal* (Online).

Deloitte. (2018) *2019 Investment Management Outlook: A Mix of Opportunity and Challenge,* [online] https://www2.deloitte.com/content/dam/Deloitte/us/Documents/financial-services/us-fsi-dcfs-investment-management-2019-outlook-rev.pdf (accessed 20 January 2021).

Dieterich, C. (2017) 'Cryptocurrency ETF rush is on – competition to launch first fund is intense as start of futures could ease trading concern', *Wall Street Journal*, 14 December [online] https://www.proquest.com/newspapers/cryptocurrency-etf-rush-is-on-competition-.launch/docview/1976349385/se-2

EEA (2018) 'EEA technical documents', *Enterprise Ethereum Alliance* [online] https://entethalliance.org/technical-documents/ (accessed 10 March 2021).

ESMA (2017) *The Distributed Ledger Technology Applied to Securities Market*, No. ESMA50-1121423017–285, European Securities and Markets Authority [online] https://www.esma.europa.eu/sites/default/files/library/dlt_report_-_esma50-1121423017-285.pdf.

Espel, T., Katz, L. and Robin, G. (2017) *Proposal for Protocol on a Quorum Blockchain with Zero Knowledge*, IACR Cryptology ePrint Archive, 1093.

Fan, C., Ghaemi, S., Khazaei, H. and Musilek, P. (2020) 'Performance evaluation of blockchain systems: a systematic survey', *X*, DOI:10.1109/ACCESS.2020.3006078.

Financial Stability Oversight Council (2016) *FSOC 2016 Annual Report.*

Fulmer, N. (2019) 'Exploring the legal issues of blockchain applications', *Akron Law Review*, Vol. 52, No. 1 [online] https://ideaexchange.uakron.edu/akronlawreview/vol52/iss1/5 (accessed 28 February 2021).

Gibson, C. and Kirk, T. (2016) 'Blockchain 101 for asset managers', *The Investment Lawyer*, Vol. 23, No. 10, pp.7–14.

Glaser, F. (2017) 'Pervasive decentralisation of digital infrastructures: a framework for blockchain enabled system and use case analysis', *50th Hawaii International Conference on System Sciences*, pp.1543–1552.

Governatori, G., Idelberger, F., Milosevic, Z., Riveret, R., Sartor, G. and Xu, X. (2018) 'On legal contracts, imperative and declarative smart contracts, and blockchain systems', *Artif Intell Law*, March 5, DOI:10.1007/s10506-018-9223-3.

Haslem, J.A. (2017) 'Mutual fund economies of scale: nature and sources', *The Journal of Wealth Management*, Vol. 20, No. 1, pp.97–124, https://doi.org/10.3905/jwm.2017.20.1.097.

Helliar, C., Crawford, L., Rocca, L., Teodori, C. and Veneziani, M. (2020) 'Permissionless and permissioned blockchain diffusion', *International Journal of Information Management,* Vol. 54, DOI:10.1016/j.ijinfomgt.2020.102136.

Ismail, L., Hameed, H., AlShamsi, M., AlHammadi, M. and AlDhanhani, N. (2019) 'Towardsa blockchain deployment at UAE University: performance evaluation and blockchain taxonomy', *ACM*, DOI:10.1145/3320154.3320156.

Jakobs, K. (Ed.). (2006) *Advanced Topics in Information Technology Standards and Standardization Research*, Vol. 1, Idea Group Publishing, Hershey, PA.

Jason, K. (Dec 2002) 'Returns-chasing behavior, mutual funds, and beta's death', *Journal of Financial and Quantitative Analysis*, Vol. 37, No. 4, pp.559–594.

Lacity, M. (2018) 'Addressing key challenges to making enterprise blockchain applications a reality', *MIS Quarterly Executive*, Vol. 17, No. 3, pp.201–222 [online] https://www.c4scs.org/s/LacityMISQEBlockchains2018.pdf (accessed 10 July 2021).

Madisetti, V. and Bahga, A. (2019) 'Method and system for tuning blockchain scalability, decentralization, and security for fast and low-cost payment and transaction processing', *United States Patent Application Publication* [online] https://patentimages.storage.googleapis.com/7e/81/76/15208deb997209/US20190018888A1.pdf (accessed 15 August 2021).

Mendling, J., Weber, I., Aalst, W.V.D., Brocke, J.V., Cabanillas, C., Daniel, F., Debois, S., Ciccio, C.D., Dumas, M., Dustdar, S., Gal, A., García-Bañuelos, L., Governatori, G., Hull, R., Rosa, M.L., Leopold, H., Leymann, F., Recker, J., Reichert, M., … Zhu, L. (2018) 'Blockchains for business process management — challenges and opportunities', *ACM Transactions on Management Information Systems*, Vol. 9, No. 1, pp.1–16, https://doi.org/10.1145/3183367.

Mike, L. (2017) 'How global hedge fund managers can embrace innovation', *EY* [online] https://www.ey.com/en_gl/wealth-asset-management/how-will-you-use-innovation-to-illuminate-competitive-advantages (accessed 12 June 2021).

Moyano, J. and Ross, O. (2017) 'KYC optimization using distributed ledger technology', *Bus Inf Syst Eng.*, DOI:10.1007/s12599-017-0504-2.

Neisse, R., Steri, G. and Nai-Fovino, I. (2017) 'A blockchain-based approach for data accountability and provenance tracking', *Proceedings of the 12th International Conference on Availability, Reliability and Security*, pp.1–10, https://doi.org/10.1145/3098954.3098958.

Phinney, J., Donnelly, G. and Evans, G. (2013) 'A greater focus on fund & management company expenses in alternative asset management', *Convergence LLC* (accessed 10 August 2021).

PWC (2018) 'Building block(chain)s for a better planet', *Fourth Industrial Revolution for the Earth Series* [online] https://www.pwc.com/gx/en/sustainability/assets/blockchain-for-a-better-planet.pdf (accessed 25 January 2021).

Quekel, M. (2018) 'Smart contracts on the blockchain: optimizing inter-organizational business processes', University of Amsterdam Faculty of Science.

Reijers, W., Wuisman, I., Mannan, M. and De Filippi, P. (2018) 'Now the code runs itself : on-chain and off-chain governance of blockchain technology', *TOPOI : International Review of Philosophy*, Vol. 37, No. 17, pp.1–23.

Reza, M. and Darius, H. (2019) 'Blockchain: the future of the auditing and assurance profession', *The Journal of the American Society of Military Comptrollers*, Vol. 64, No. 1, pp.23–27.

Rompotis, G.G. (2013) 'Actively vs. passively managed exchange traded funds', *Aestimatio, The IEB International Journal of Finance*, Vol. 6, pp.116–135.

Stuart, D. and Alex, B. (2018) 'An introduction to smart contracts and their potential and inherent limitations', *Harvard Law School Forum on Corporate Governance and Financial Regulation* [online] https://www.skadden.com/-/media/files/publications/2018/05/anintroductiontosmartcontractsandtheirpotentialand.pdf (accessed 16 February 2021).

The Economist (2018) 'Raiders of the killer dapp: blockchain technology may offer a way to re-decentralise the internet', *The Economist*, 28 June [online] https://www.economist.com/special-report/2018/06/28/blockchain-technology-may-offer-a-way-to-re-decentralise-the-internet (accessed 10 August 2021).

THFJ (2017) '2017 global hedge fund and investor survey', *The Hedge Fund Journal*. pp.1–12 [online] https://thehedgefundjournal.com/wp-content/uploads/attachments/THFJ%20EY%20article.pdf (accessed 10 August 2021).

Torre, D. and Seang, S. (2018) 'Proof of work and proof of stake consensus protocols: a blockchain application for local complementary currencies', February [online] https://pdfs.semanticscholar.org/3aff/1b46e408cf8d34f67d5b49509d6183dfd9ce.pdf (accessed 23 April 2021).

Vijaya Kittu, M. and Prasada Rao, S. (2018) 'Blockchain technology for the mutual fund industry', *National Seminar on Paradigm Shifts in Commerce and Management 2018 in Congruence with Block Chain Accounting*, pp.12–17, Thiruvarur: Central University of Tamil Nadu.

Walden, M. (2015) 'Active versus passive investment management of state pension plans: implications for personal finance', *Journal of Financial Counseling and Planning*, Vol. 26, No. 2, pp.160–171.

WEF. (2018) 'Building block(chain)s for a better planet', *World Economic Forum* [online] http://www3.weforum.org/docs/WEF_Building-Blockchains.pdf (accessed 20 June 2021).

Zheng, Z., Xiea, S., Dai, H-N., Chen, W., Chena, X., Weng, J. and Imrand, M. (2020) 'An overview on smart contracts: Challenges, advances and platforms', *Future Generation Computer Systems*, April, Vol. 105, pp.475–491, DOI:10.1016/j.future.2019.12.019.