

# Blockchain: Opportunities and disruptions for real estate



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# 1 Foreword



Blockchain technology allows people to transact without the need for a third-party intermediary.

A simple example of this is Bitcoin, as it allows people to transact with each other without the need for a bank, regardless of who they are or where they are in the world.

This revolutionary technology does this by using smart contracts that are created using computer code and can only be executed once all clauses in the contract have been met. Users digitally sign these contracts which are then uploaded to the blockchain and once executed cannot be undone due to its immutable (unchangeable) nature.

As blockchains are unchangeable, this means that malicious actors cannot tamper with the transaction or contract and mitigates against the fraud that we see in our current systems. As a result, smart contracts reduce a lot of the transaction costs that we have seen in incumbent trust providers (like banks) as they are no longer needed. Additionally, due to their immutable nature, blockchains record a complete history of all transactions on the network.

For public blockchains this is transparent, and anyone can access it; and for private blockchains, only those who are granted access can view it.

What this provides is a great way to audit transactions which can help to solve a lot of the issues we see with corruption, money laundering and tax evasion.

The Real Estate Institute of Australia (REIA) and the Real Estate Institute of New Zealand (REINZ), identified the need to analyse what both the opportunities and disruptors are for blockchain technologies for real estate practitioners, agencies and property transactions.

As the readers will be aware, for the real estate industry, the contracting process is a lot more complex than a simple Bitcoin trade and with multiple actors and processes involved for the average transaction. However, the principles of value exchange remain the same. Due to its complex nature the real estate industry is unlikely to be replaced by automated smart contracts anytime soon and still relies heavily on person-to-person interaction and expert local knowledge.

What we have observed when conducting this research is that the general population is not yet ready for a fully blockchain driven or decentralised market for real estate.

Blockchain applications in real estate are still very nascent and the regulatory landscape is slowly developing to support these start-ups. Regulatory bodies are still trying to grasp the fundamentals of this technology and develop regulations for transactions.

Many start-ups that we observed failed within a few years, yet some have really thrived and gained traction in the industry with Propy being one example. Others such as Hutly are developing strategic partnerships to develop its 'smart' contract management platform.

Despite challenges, the fundamentals of blockchain technology are wide-ranging and provide a lot of opportunities for the real estate industry.

What we have observed is that the real estate industry is comprised of several disparate systems that contain siloed data which is difficult to transfer to others. As a result, transactional friction is created due to the opaqueness between systems.



Blockchain technology presents an opportunity to solve this and whilst the market isn't ready for decentralised real estate markets, there is still a lot of opportunity to improve current systems.

Blockchain's ability to solve information complexities that exist within traditional organisational structures and to increase liquidity and accessibility to real estate markets are important.

Tokenisation of real estate assets and collateralising them to take out loans in cryptocurrency on decentralised finance platforms, will raise many questions on regulatory settings to adequately support the industry and its participants moving forward. This means that there is plenty of scope for blockchain in the real estate industry to grow and mature and what we are currently observing is similar to the early days of the internet.

This research paper *Blockchain: opportunities and disruptions for real estate* (the report) outlines why blockchain awareness is needed, new frontiers for economic organisation, value propositions for the real estate industry and practitioners and future directions.

This report will outline how blockchain technology works and its different components that it uses such as smart contracts and Non-Fungible Tokens (NFTs). Additionally, new organisational forms such as Decentralised Autonomous Organisations (DAOs) will be discussed and the opportunities that they provide for the real estate industry.

In summary, blockchain, particularly tokenisation, offers significant opportunity for real estate in both Australia and New Zealand with blockchain technologies expected to enhance real estate agents, agencies and transactions rather than simply disrupt it.



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## Key points

- Web3 will bring significant changes to the real estate market, facilitating the intergration of a wide array of technology with blockchain as a foundational infrastructure
- The frontiers of this digital infrastructure – DeFi, DAOs, NFTs – are rapidly developing opportunities to tokenise real estate
- Once tokenised – opportunities to use real estate assets in Decentralised Finance (DeFi) applications such as collateral/mortgages, rapidly expand and can increase liquidity
- Many of the real estate projects being developed revolve around tokenisation, yet there remains a high attrition rate in blockchain driven real estate start-ups
- Challenges include market acceptance/legal and tax regulation
- There is still a need for boots on the ground with local knowledge – local valuation mechanisms
- Blockchain can help real estate agents to broaden service offerings, facilitate tokenisation, increase transparency and streamline workflow inefficiencies





# Introduction



## 2 Introduction



Technological innovations are changing the shape and nature of our economy, streamlining process and changing production and consumption behaviours.

In the real estate sector, technology has changed the way business is transacted and resulted in improved efficiencies, with online listings, virtual tours, e-signing and digital property settlements the norm.

The COVID-19 pandemic has accelerated the rate of digital transformation and the real estate sector is experiencing a surge in Proptech (property technology) applications which are revamping interactions in the property market be they construction, property management, home services, buying selling or renting.

Big data, virtual and augmented reality, Internet of Things, AI and Machine Learning, drones and 5G, are some of the technologies set to transform the real estate sector and indeed are currently doing so.

Blockchain technology is another which is the focus of this report.

Blockchain technology has a range of potential applications in the real estate sector yet much hype has resulted in blockchain pilots which by the end of 2019 had not resulted too much in practice. This brings to mind Amaras law:

“We tend to overestimate the effect of technology in the short run, and underestimate the effect in the long run.”

— Roy Amara

When in the nascent phases a new technology emerges with bold statements of its capability and applications, but the underlying capability is not yet there, or the mainstream is not ready for its adoption.

Sooner or later the long run will arrive, and rapid change will occur, with those ready to innovative and adopt best positioned to weather the creative destruction process that follows.



In this report we consider the recent developments in the crypto economy and how they are building the conditions to support adoption of blockchain technology in the real estate sector. We examine the current blockchain landscape in real estate and consider the challenges and opportunities blockchain presents for the real estate sectors in Australia and New Zealand.

We convey the findings on how recent developments in the crypto economy may directly impact the real estate industry. The report considers how blockchain may mitigate some of the broader challenges facing the real estate industry, such as carbon reduction, safer building codes and regulation, technological advances such as automated valuation models, machine learning, new modes of marketing and rental management and new financing and data sharing models.

We consider how blockchain utility can integrate with the digital technologies of automation, facilitating the transition from an industrial economy to a digital economy and impacting on the workings of the real estate markets.

We examine how the digital economy stack may present new opportunities for trusted institutions such as the Real Estate Institute.

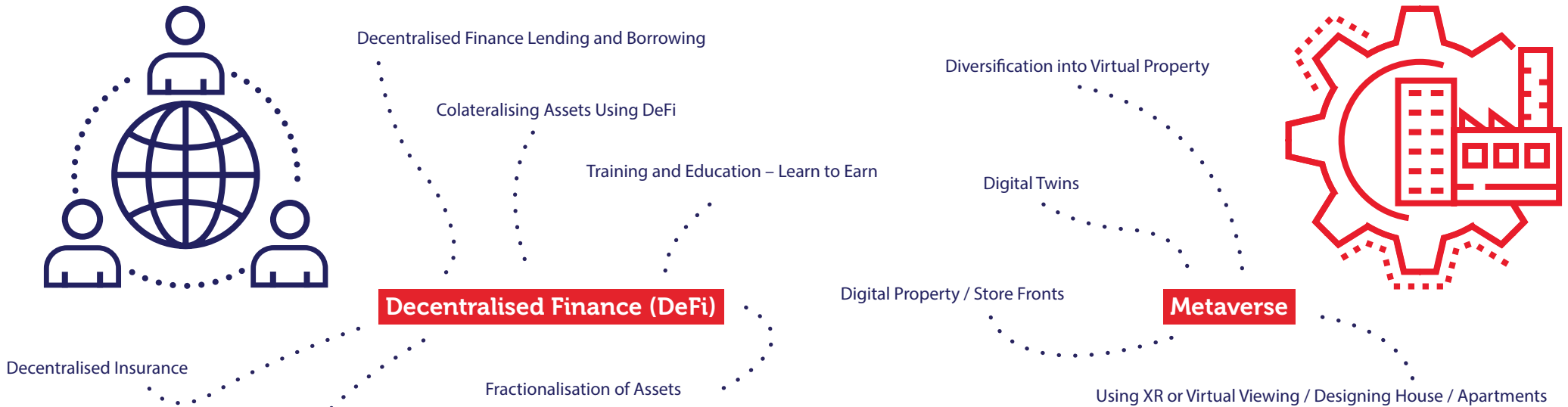
Three conceptual levels are considered:

- 
1. the “macro” or broader macroeconomy impacts of digital transformation and the emergent crypto economy
  2. the “broader property sector” impacts
  3. the “micro” wherein the specific blockchain applications for real estate practitioners are considered
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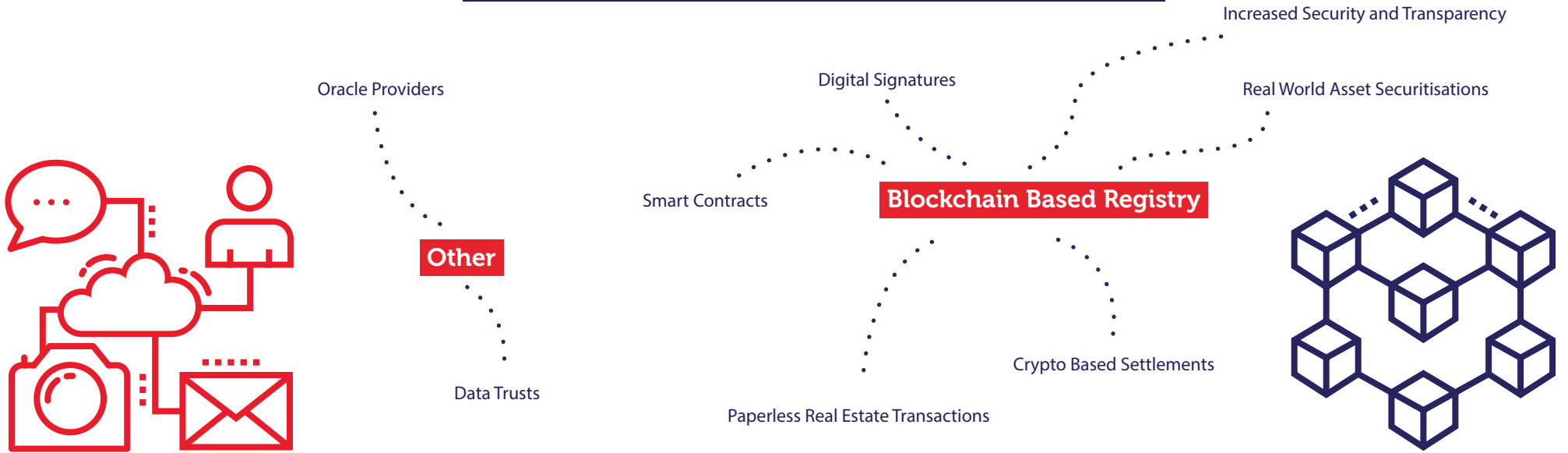
The image on Page 10 presents examples of the multitude of fronts through which blockchain technology can impact on the property sector and real estate more specifically. These include Decentralised Finance (DeFi), blockchain based land registry, the form and transfer of property rights in the real and virtual worlds and new data markets to name a few – which will be explored in this report.







# Real estate, proptech and blockchain: Key intersections identified

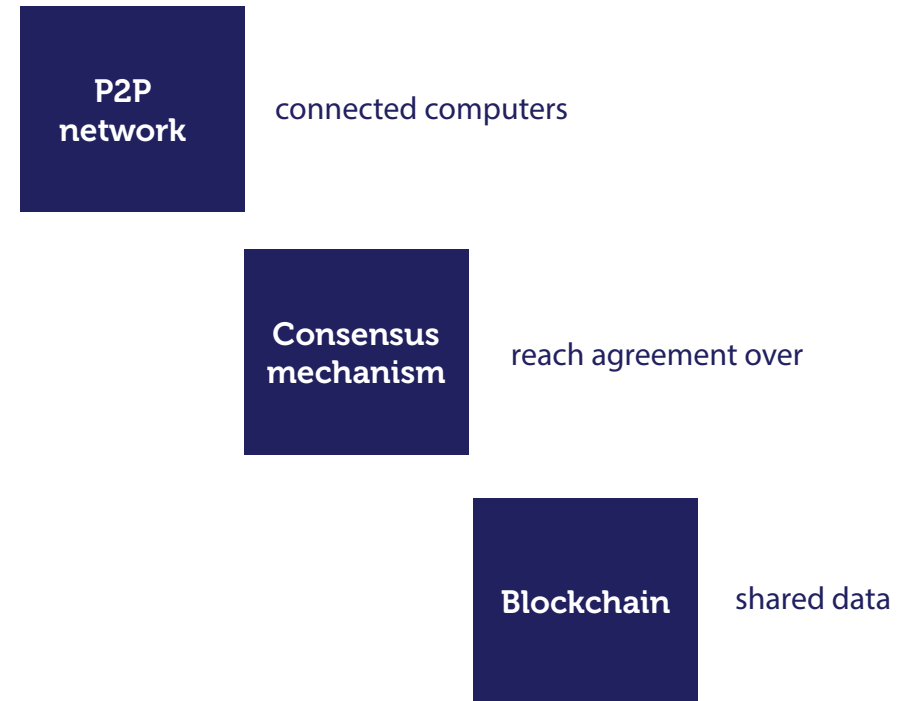


## 2.1 Blockchain – what and why?

Blockchain technology presents as both a trade infrastructure and an institutional infrastructure. As a trade infrastructure it facilitates the transfer of information to accompany “things” as they move along real estate related supply chains from producer to final consumer.

Blockchain is a technology that innovates on governance.<sup>1</sup> Innovation in institutional technologies implies new models of economic interaction which compete with current market practices to drive down costs. In the real estate context, blockchain technology is creating new ways of verifying and transferring property rights and creating platforms for the emergence of new real estate related asset types and related secondary markets.

Developments in blockchain based technology means evolving mechanisms through which information, value and property rights are exchanged digitally. The terminology associated with the emerging cryptoeconomy can be complex and in the next section we provide some necessary background information to blockchain. Smart contracts, oracles, Non Fungible Tokens (NFTs) and Decentralised Autonomous Organisations (DAOs) represent the underlying infrastructure or blockchain “toolkit” which as they develop, enable the digitisation of real-world assets and facilitate the emergence and evolution of new real estate linked crypto based economies.



## 2.2 What is blockchain technology?

Blockchain is a distributed, append-only ledger of provably signed, sequentially linked, and cryptographically secured transactions that is replicated across a network of computer nodes, with ongoing updates determined by software-driven consensus.<sup>2</sup>

Blockchain is the architecture that enables users to transfer value digitally.

In general, when we refer to blockchain we can refer both to technology (or technological paradigm), and/ or to a specific main underlying blockchain architecture (eg [bitcoin](#), [Solana](#), [Ethereum](#), [Algorand](#), [Cosmos](#), [wax](#)).

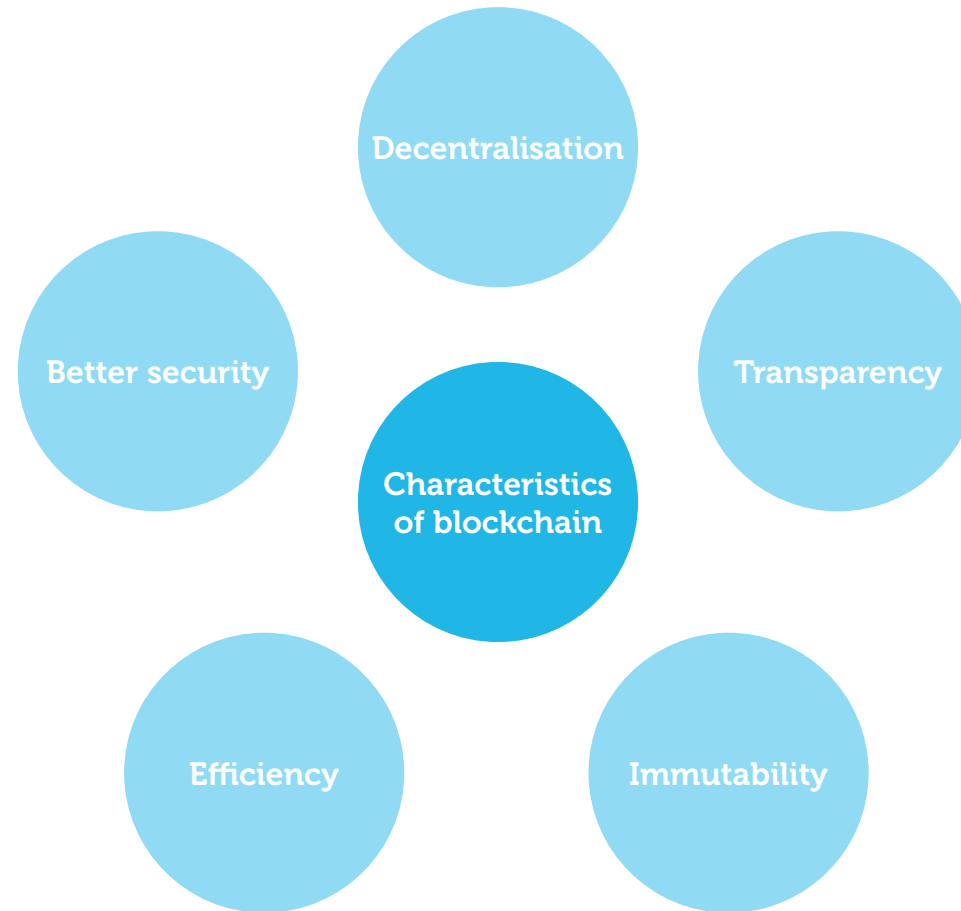
<sup>1</sup> Allen, D.W. and Berg, C., 2020. Blockchain governance: What we can learn from the economics of corporate governance

<sup>2</sup> Davidson S, De Filippi P, Potts J, Blockchains and the economic institutions of capitalism, J. Inst. Econ., 13 (4) (2018), pp. 639-658

Blockchains are a specific type of distributed ledgers which at its core is a shared list of “blocks”, wherein each additional “block” of data is appended to the ledger only once the majority of participants on the network agree that it is valid.

Agreement between the participants (or nodes) on the network about the validity of the block is determined via a “consensus mechanism” of which there are a few depending on the blockchain in use (see Appendix 1). The new block of data is cryptographically chained to the previous block, and due to the lack of a centralised single authority to validate transaction, there is no single point of failure and unauthorised alternations become more difficult than they would otherwise be using a traditional centralised ledger.

One of the key features of transactions stored on a Blockchain ledger is that they are immutable and are logged with a timestamp. Other benefits include greater efficiency due to information flow, transparency as all participants can see the ledger, and security due to the absence of a single point of failure. Trust among the nodes comes as the transactions are secured by cryptography.



There is more than just one type of blockchain. In a public blockchain, anyone can read and write the blockchain and participate in the consensus process.

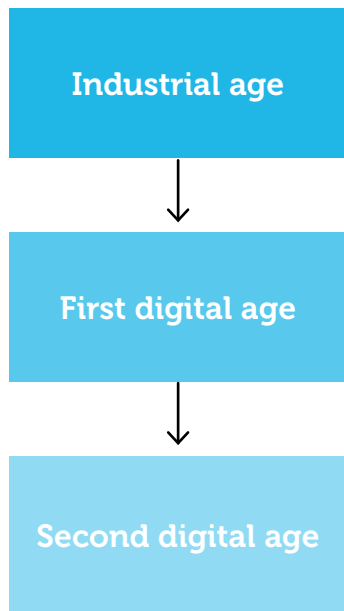
Bitcoin for example is backed by a public blockchain where everyone in the network has equal authority. Consortium blockchains however, allow only a few of the nodes to take part in the consensus eg IBM food trust.

### **2.2.1 Blockchain – disruptive technology creating a new economic infrastructure**

Businesses and governments are increasingly realising the need for the use of digital channels to interact with their stakeholders. While micro level decision-making with respect to technology adoption is occurring within organisations, at a macro level a much more fundamental transformation is occurring. Technologies such as blockchain are transforming the mechanisms of economic organisation, co-ordination and governance itself. Before delving into the pros and cons of specific technological solutions for specific industry- based problems however, it is interesting to apply an economic lens and consider blockchain not just as a new production technology, but rather as a new institutional infrastructure.

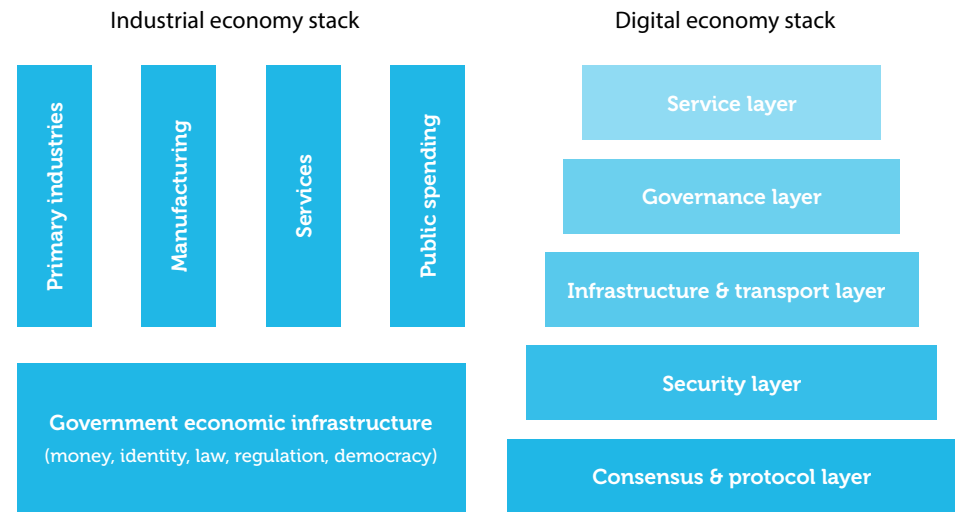


“Blockchain is the true beginning of the digital age and it represents the emergence of a new type of economic system that is post-industrial in a very specific sense: it is analysis of an emerging and evolving digital economy that is digital all the way down.”<sup>3</sup>



Economic changes driven by cheap computation and near costless communication

Economic changes driven by digital economic infrastructure, structured around the 'digital economy stack'



Digital platforms are driving down search costs, transaction costs, networking, and verification cost, changing the economic value of data and information and disrupting industrial patterns of production.

We are somewhere between the first and second digital age, transitioning from the information age where there was a rapid shift from traditional industry to one driven by computers, cheap computation and communication, to a world where blockchain (or decentralised shared immutable ledgers) integrates with the digital technologies of automation including artificial intelligence, the Internet of Things, and 5G. What this means is that the structure of the economy fundamentally shifts from the industrial economy stack which has dominated since the industrial revolution to the new digital economy.

<sup>3</sup> Potts, Jason, Evolution of the Digital Economy: A Research Program for Evolutionary Economics (November 23, 2020) Forthcoming, The Research Agenda for Evolutionary Economics, Kurt Dopfer (ed) (Edward Elgar), available at SSRN: <https://ssrn.com/abstract=3736320> or <http://dx.doi.org/10.2139/ssrn.3736320>



## 2.3 Why blockchain?

Advocates of Web3 technology believe the next wave of innovation will be built on decentralised technology offering an alternative to the big technology platforms that have dominated Web2.

As we transition to Web3, cryptocurrency provides the incentive mechanisms for network development and maintenance. The pace of development will be dependent on collaboration between regulators and the private sector to maintain innovation while managing the inherent risks associated with disruptive technology.<sup>4</sup>

	Web1	Web2	Web3
Interact	Read	Read-Write	Read-Write-Own
Medium	Static Text	Interactive content	Virtual economies
Organisation	Companies	Platforms	Networks
Infrastructure	Personal computers	Cloud & Mobile	Blockchain cloud
Control	Decentralised	Centralised	Decentralised

Web2 changed how we used the internet. This led to changes in products, services and companies which then led to changes in business models, culture and politics. Web3 is predicted to do the same.

By providing a decentralised, peer-to-peer network of information, blockchain can create reliable, transparent, and secure networks.

“Blockchains enable users to directly interact with one another, without the need for centralised servers or third parties to broker and facilitate any services.”<sup>5</sup>

It has the potential to reshape business models, as well as change the way organisations are funded, managed and how they create value.

**Key attributes of blockchain include:**

- Transparency and provenance
- Immutability
- Disintermediation
- A new architecture of trust

Although transparency is a key attribute of blockchains, privacy is also very important to maintain.

New areas of cryptography ensure certain information can be validated without providing the information itself.<sup>6</sup> This will ensure that privacy can be maintained while regulatory compliance is met.<sup>7</sup>



<sup>4</sup> Grayscale report - [https://grayscale.com/wp-content/uploads/2021/11/Grayscale\\_Metaverse\\_Report\\_Nov2021.pdf](https://grayscale.com/wp-content/uploads/2021/11/Grayscale_Metaverse_Report_Nov2021.pdf)

<sup>5</sup> Wu, H 'How the coming privacy layer will fix the broken web 2022 <https://future.a16z.com/a-privacy-layer-for-the-web-can-change-everything/>

<sup>6</sup> “Zero proof knowledge” solutions. A zero-knowledge proof is a protocol that allows one party (the prover) to convince another party (the verifier) that they possess some private data without revealing that data to anyone

<sup>7</sup> Wu (n 5)



### 2.3.1 Blockchains as a technology of trust

Blockchain technology can be considered as infrastructure designed for the recording of actions in conditions where mistrust prevails.<sup>8</sup>

Werbach<sup>9</sup> refers to the development of blockchain as the implementation of a new trust architecture: Blockchain enables trust in a system without necessarily trusting any or all its parts.

The distributed ledger architecture of blockchains and their tamper-proof qualities make them suited to activities where information needs to be shared among parties who may not trust one another particularly and where credibility, provenance and authenticity need to be established. This facilitates new forms of property rights and new markets that arise of those changing forms of asset ownerships and mechanism of transfers.

**Transparency is an ongoing concern in the global real estate industry**

“The 2020 Index reveals that transparency is progressing across most countries and territories, but overall improvement is the weakest since the period directly following the Global Financial Crisis. With growing pressure from investors, businesses and consumers, real estate transparency will need to improve further and faster to compete with other asset classes and meet heightened expectations about the industry’s role in providing a sustainable and resilient built environment.”<sup>10</sup>

In a fast-changing regulatory environment and a real estate industry under pressure to comply to a net zero carbon future, digital tools boosting available data and a renewed focus on social relations, blockchain presents as a useful institutional infrastructure to build trust. The economic significance that blockchains act as a trust machine that convert intensive computation into economically valuable trust.

Blockchains internalise opportunism<sup>11</sup> costs that could otherwise prevent economic exchange occurring.<sup>12</sup>

Consensus mechanisms applied in blockchain, ensure validators are incentivised to validate and record transactions although they themselves are not party to the transaction.

This creates three distinct groups of users that must be simultaneously satisfied:

1. buyers who transact;
2. sellers who transact; and
3. miners/validators who record and validate those transactions.

This reduces opportunism and the costs associated with it.

Through these mechanisms blockchains:

- reduce the cost of verifying, identifying, and networking without intermediaries – creating new markets and reducing costs in existing ones
- provide decentralised technology for co-ordination of economic activity
- represents a new type of economic institution that competes with current known institutions such as firms, markets, and governments

The decentralised nature of blockchain facilitates new models of economic governance and co-ordination which can change the boundaries of organisations.<sup>13</sup>

<sup>8</sup> Allen (n 1)

<sup>9</sup> Werbach, K., 2018. The blockchain and the new architecture of trust. Mit Press

<sup>10</sup> [JLL RE transparency report 2020](#)

<sup>11</sup> Opportunism is Defined by Williamson 1985. 47 “as calculated efforts to mislead, distort, disguise, obfuscate or otherwise confuse” – inclusive of two well-known economic problems adverse selection (one party in a transaction has superior information) and moral hazard (a party changes behaviour because of entering the market)

<sup>12</sup> Berg, C., Davidson, S., & Potts, J. (2017). Blockchains industrialise trust. Available at SSRN 3074070

<sup>13</sup> Potts, J., Davidson, S. and Berg, C., 2020. Blockchain innovation and public policy. Journal of Entrepreneurship and Public Policy



The role of trust in blockchain differs from trust in traditional centralised industrial contexts as trust is now in a decentralised network of actors rather than individual actors.

Companies have traditionally employed humans to act as interfaces and intermediaries with the external world yet blockchain enables new means of alliance formation relating to innovation and production. As the boundaries of organisations shift, the role of trust intermediaries shift, evolve or disappear.

### 2.3.2 Digital property rights system

Blockchains record property rights which lie at the intersection of law, economy, the state and culture. We can then think about blockchain as a digital property rights system. Blockchain ledger entries can record any data structure including property titles, identity and certification, and allow for their transfer digitally via smart contracts such as:

Digital assets (eg cryptocurrencies)

- Physical property (eg ownership titles)
- Digital assets with a set of unique attributes (digital twin of a house)
- Utilise related technologies (eg sensors or devices) to interact with smart contracts

### 2.3.3 Blockchain as trade infrastructure

Trade is often held back by trade costs (eg transportation costs, regulatory costs etc). Technologies of trade reduce trade costs (eg shipping containers). So can blockchains.

Today the major costs of trade are information costs – ie supply chains face a problem of coordinating trusted data between supply chain participants. This information flow is further complicated by the need to capture environmental, social and governance information across the full supply chain usually involving different national and legal jurisdictions.

The World Economic Forum estimates that reducing supply chain barriers to trade could increase global GDP by 5% and global trade by 15%.<sup>14</sup>

Blockchains offer a new economic infrastructure to coordinate data resulting in more trusted, granulated information about the goods in an economy.

Real estate supply chains are increasingly faced with information costs such as:

- the costs of coordinating trusted information between distributed parties who may not trust each other such as information about enforcing contracts; and
- the characteristics and provenance of inputs into real estate developments which has become particularly important with respect to environmental, social and governance reporting requirements and expectations by investors, shareholders and consumers.

<sup>14</sup> [The World Economic Forum](#)

Blockchain as a

## Technology of trust

Reduce opportunism and transactions costs via new forms of trust:

- Cost reduction – co-ordinate market information
- Sharing information across agencies (and to consumers – if low trust)
- Global asset distribution
- Transfer and recording of property rights

Blockchain as

## Trade infrastructure

Reduce trade (information flow) costs and improving traceability of attributes:

- Data accessibility and transparency (property construction)
- Process automation and efficiency
- Industry certification and tracking
- Non Fungible Tokens/Digital Twins to real assets

Blockchain as an

## Institutional technology

Creates new forms of economic interactions and new forms of governance of those interactions:

- Co-ordination of local knowledge to act as a trusted third part for KOS
- Secondary market opportunities
- DeFi/DEX/DAOs/DAPP REIA provides data services via trusted oracles

### 2.3.4 Concerns with blockchain adoption

However, there are ongoing issues with use of blockchain. Where does the data that is recorded on a blockchain come from? The use of sensors or incentives need to be reliable and incentives well designed or it may result in the problem of “garbage in – garbage forever”.

It is important to consider the paths to adoption and dispute resolution processes should they arise. Blockchain applications are therefore developing with robust governance structures, exchange and reputation built in. Paths to blockchain adoption will depend on ecosystem readiness.<sup>15</sup> Other concerns include:

- Governance: How do parties pay for and build digital infrastructure? How do they manage that ongoing?
- Regulation: Government recognition and integration of blockchain-based data.
- Interoperability between blockchain: How do tokens go across chains?
- Dispute resolution.



<sup>15</sup> Lustenberger, M., Malešević, S. and Spychiger, F., 2021. Ecosystem readiness: blockchain adoption is driven externally. *Frontiers in Blockchain*, 4(720454)





**Blockchain**

**in real estate**



### 3 Overview – why blockchain awareness is needed in real estate

Blockchain can facilitate digital property rights transfer in a trusted environment and improve information flow. This in turn can generate new forms of economic interactions and disrupt the status quo.

Why should blockchain be given attention by real estate practitioners?

Let's consider this from a macroeconomic, property sector and industry perspective.

#### 3.1.1 The real estate market context in Australia and New Zealand

Real estate is the world's most significant store of wealth and is estimated to represent almost four times the global domestic production or GDP.

The total value of the real estate industry globally was estimated to be US\$326.5 trillion in 2020, a 5% increase from 2019.<sup>16</sup>

The revenue of real estate companies worldwide was valued at US\$9.5 billion in 2021 and is predicted to increase between 2021 and 2030.

With a growing demand for industrial and commercial infrastructure and the recovery of the global economy regarding the Coronavirus (COVID-19) pandemic, the global real estate market size is expected to grow from US\$3,386.1 billion in 2021 to US\$3,741.06 billion in 2022 at a compound annual growth rate of 10.5%.<sup>17</sup>

Both New Zealand and Australia have seen unprecedented housing market price rises over the last two years although this growth has tempered in Q1 2022.

As at Q2 2021, New Zealand and Australia along with the United States of America and Canada, had growth rates in excess of 15% with many cities experiencing growth in excess of 20%.<sup>18</sup>

CoreLogic estimated the total value of residential real estate in Australia in March 2022 to be over AUD\$8 trillion.<sup>19</sup> The New Zealand market was NZD\$1.72 trillion at the end of Q4 2021, up from NZD\$1.35 trillion at the end of 2020.<sup>20</sup>

Stimulus packages, higher savings, lower interest rates, supply constraints and lifestyle re-evaluations have fuelled the price growth and this has created further housing affordability concerns and significant barriers to home ownership for younger generations.

The development of new assets anchored in the crypto economy coupled with affordability issues create push factors for investors and potential home owners to diversify away from traditional real estate assets. Recent media reports suggest that younger generations are looking to digital assets such as cryptocurrency as an alternative to real estate assets.<sup>21</sup> Research commissioned by DACXI<sup>22</sup> (Crypto company) suggest that millennials are becoming sceptical of housing long term returns and are looking for alternative routes to build wealth away from traditional assets that have spiked in price such as the housing market.

Interestingly despite concerns about a housing bubble, 17% of research respondents said they are considering crypto investment to assist them in funding a house deposit. This suggests a diversification of investment choice in younger generations to include crypto assets but a genuine interest in how to create a bridge between the different asset types.

<sup>16</sup> Savills 2021

<sup>17</sup> The Business Research Company

<sup>18</sup> Knight Frank Global index 2021

<sup>19</sup> Core Logic Australian housing market surpasses \$8 trillion valuation

<sup>20</sup> Core Logic Property market and economic update wraps up 2021

<sup>21</sup> Sridharan, A 2021 Bubble Trouble: Australians look to crypto for wealth building as four in ten see real estate bubble 6 December 2021

<sup>22</sup> DACXI

### 3.1.2 Real estate industry challenges

In addition to housing affordability concerns, the real estate sector faces other challenges – predominantly relating to inefficiencies, lack of transparency and illiquid markets. Some real estate transactions are conducted in private markets, and most by nature are less efficient than other asset types as outlined by Shanaka & Maier’s review of informational inefficiencies:<sup>23</sup>



1. Real estate is a Heterogeneous product – value is based on a range of criteria including location, supporting infrastructure and amenities in addition to a bundle of housing attributes which can create a complex information set and segmented markets.
2. High transaction costs and infrequent transactions in the form of both public and private expenses such as stamp duty and other taxation, fee for registration and other mandatory administration fees, appraisals, real estate agent fees, due diligence costs, conveyancing and notaries fees.
3. Regulation and policy – real estate markets are often subject to specific policy interventions and regulations which can vary greatly across jurisdictions and can impact on the speed and efficiency with which market signals are reflected in pricing. Differential levels of public housing across regions and jurisdictions can also impact on real estate markets. Price controls and other mechanisms to ensure access to housing markets can result in delays in changes in market fundamentals flowing through to price.
4. Production lags – real estate cannot respond quickly to changes in market demand given the time lags associated with production phases from design, planning and build process. Process inefficiencies can delay the process further such as planning delays, supply chain access, environmental and sustainability reporting process, skilled labour shortages etc.
5. Other information asymmetries in the sector – differential between utility value and investment objectives of buyers are not always clear, maybe unequal sharing of information.
6. Long term contracts – long terms contracts may limit price adjustments.

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Real estate is a reliable means to boost personal wealth and as an asset class has many advantages such as, tangibility and utility, investment leverage, inflation hedge, low risk and often high returns, it is also an illiquid asset in an imperfect market with high barriers to entry. Property settlements in Australia are typically 42 days and in New Zealand average 4-6 weeks.

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<sup>23</sup> Herath, Shanaka, and Gunther Maier. "Informational efficiency of the real estate market: A meta-analysis." (2015): 117



Technology is being developed to address these inefficiencies:

Proptech developments such as eConveyancy systems and electronic lodgement network operators such as PEXA, (and Sympli, Purcell partners) have allowed registered conveyancers, lawyers and financial institutions to use a digital platform to prepare, sign and lodge the legal documents needed for this transfer of ownership and to complete financial settlement, essentially eliminating manual processes.

While this has reduced costs such as bank cheques and removing a three day wait for funds to clear, the settlement process remains a lengthy one. ELNO and Land registry systems remain slow and centralised which can increase risk of cyber attacks.

Costs faced by those trying to enter the market are high due to legal, insurance, due diligence, taxation such as stamp duty but in addition to high costs access to credit has implications for wealth division and intergenerational wealth transfer.

In addition, there are hardening reporting requirements at both corporate level (investment, Know Your Customer (KYC)/Anti-Money Laundering (AML) and property level (sustainability, circular economy).

**Blockchain based solutions are evolving to reduce barriers to entry, increase liquidity and reduce costs associated with information flow and trust concerns across many sectors of the property industry**





### 3.1.3 Macroeconomic and social trends driving adoption

Many current concerns in the real estate industry are macroeconomic in orientation. These include global issues such as COVID-19's ongoing impacts, the speed and rate of economic renewal post COVID-19, capital market risk and volatility, the local nature of fiscal and monetary stimulus and resulting impact on both expenditure and indebtedness, creating flow on effects for residential and commercial real estate.

These macroeconomic concerns coupled with ongoing housing affordability issues, changes in patterns of migration, urban planning and maximisation of space utilisation to best meet consumer wants, infrastructure to support sustainability, liveability and commerce, and an increasing focus on environmental, social and governance as an input to real estate investment are all both societal and real estate sector concerns.<sup>24</sup>

In addition to keeping up with the aforementioned macro trends real estate practitioners also need to keep up with the latest technology. Why is monitoring technology developments so important in the context of broader macroeconomic shifts? The digital landscape is constantly innovating and evolving to provide solutions to the major social, economic and environmental challenges society faces and as these solutions evolve, they will be embedded as norms in what we can refer to as the new digital economy stack.

The fourth industrial revolution represents the fusion of advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, quantum computing and other technologies of which blockchain is the youngest.<sup>25</sup> The significance is that "we are observing the convergence of innovations which are changing the technological basis for our industrial systems at their most fundamental level".<sup>26</sup>

This convergence of technology will create opportunities for extending human capabilities to improve efficiencies, but will also present deep challenges for individuals, communities and organisations anchored in the old industrial economy and disrupted by these new technologies. Artificial intelligence and 5G can be thought of as general production technology that improves productivity while blockchain could be considered institutional technology that allows for new modes of governance evolving on internet platforms which in turn create new forms of socio-economic interactions.

Blockchain will prove particularly disruptive for intermediaries whose business models are based on third party verification. Blockchain creates greater transparency by design and as a result, will likely disintermediate market arbitragers, price-reporting agencies, benchmark providers, and others whose businesses create value by capitalising on information asymmetry.<sup>27</sup>

Blockchain already exists with many realworld implementations beyond cryptocurrencies, and finance. This is likely to grow drastically over the coming years.



<sup>24</sup> CRE 2020

<sup>25</sup> The Fourth Industrial Revolution. Geneva: World Economic Forum (2016). ISBN 978-1944835002

<sup>26</sup> Johnson, Nicholas., and Brendan. Markey-Towler. Economics of the Fourth Industrial Revolution : Internet, Artificial Intelligence and Blockchain. Milton: Taylor & Francis Group, 2020. Print

<sup>27</sup> [Capturing the value of blockchain](#)

# The blockchain ecosystem is growing and impacting a range of sectors





## Why is there so much predicted growth in blockchain applications?

The power of blockchain is that it can reframe discussion of how to do things across society and the economy.

Blockchain applications are increasingly playing a role in improving sustainability by fostering information flows between consumers, producers and regulators.

Blockchain can improve transparency, and proof of activities along the supply chain (or other stages – think circular economy) thus avoiding “greenwashing”. BHP for example is using blockchain to digitise multiple operations, including tracking ESG (environmental, social and corporate governance) attributes and verifying suppliers’ identities. BHP completed its first iron ore blockchain trade with China Baowu Steel in June 2020.<sup>28</sup>

In addition, technical advances (blockchain included) are driving rapid change in the global payments and risk assessment landscape. For example, China Construction Bank has built BC Trade 2.0, where 75 financial institutions can quickly identify risky borrowers as well as compete to offer lower rates to more desirable borrowers.<sup>29</sup>

As a consequence of tech developments and the potential of faster and more efficient payments rails, many central banks are developing central bank digital currencies – some of which leverage blockchain technology. The RBA is currently exploring a retail CBDC – see Project Atom and Project Dunbar,<sup>30</sup> as is the Reserve Bank of New Zealand. Te Pūtea Matua state:

“A CBDC would provide a platform for economic and financial innovation, including competition in the payments and settlement sector, cross-border transfers, and financial inclusion and capability building tools.”<sup>31</sup>

With these innovations and tech driven developments in payments, settlements are likely to have direct implications for the modus operandi (and globalisation potential) of real estate transactions. Adoption of central bank digital currencies will also be accompanied by a push for digital inclusion and education, often cited as a barrier to widespread cryptocurrency adoption.

Blockchain implementations in various contexts (both financial, non-financial), will require knowledge, partnerships and discussion around what transparency, inclusion, privacy, and multilateral approaches to big problems look like.

The Real Estate Institute of Australia (REIA) and Real Estate Institute of New Zealand (REINZ) as the respective national organisations representing practitioners in the real estate industry, recognise that change is coming and believe it is important to provide informed research on where and how a multiplicity of changes across a range of fronts – when considered as a collective – might impact on their members and the real estate sector more broadly.

<sup>28</sup> [Blockchain 50 2021](#)

<sup>29</sup> [Ibid](#)

<sup>30</sup> [Central Bank Digital Currency](#)

<sup>31</sup> [Innovation key to the future of money and cash](#)

### 3.1.4 Blockchain in the property industry

Beyond the macro trends, there are some applications of blockchain in the broader property sector which have relevance to real estate practitioners indirectly.

Examples include blockchain impacts on buildings design and construction, virtual energy trading platforms where real estate can be used as capital in renewable energy production and traded locally with neighbours such as [Powerledger](#) (based in Western Australia). Smart city applications support resource management and efficiency in urban planning and other property related markets such as property insurance.

The changing digital landscape accelerated by COVID-19 restrictions, presents both challenges and new market opportunities in the property sector. Commercial real estate has been particularly challenged during COVID-19 and specialist software and products have evolved to manage space optimisation to accommodate a new hybrid working model – [Spaceflow](#), [JLL Technologies](#).

Virtual office spaces are being built by online global builders like [Gather](#), [Teamflow](#) and [Virbela](#) with the objective of reducing real estate office costs by shifting the workplace to the metaverse. But what is the metaverse?

#### 3.1.4.1 The metaverse and digital real estate

The metaverse is an emerging immersive virtual reality version of the internet where people can interact with digital representations of themselves and others and move around from one environment to another. Real estate in the virtual world (ie the metaverse), has been selling for millions and with developments in NFT functionality the metaverse may develop into a platform to trade “real” real estate.

Some of the top metaverse projects that have attracted real estate are the Sandbox (SAND), Axie Infinity (AXS), Decentraland (MANA), Enjin (ENJ). [Metaverse property](#) is an example of a virtual real estate company that facilitates the acquisition of virtual property along with a suite of virtual real estate centric services that are provided by pioneers of the crypto, blockchain and NFT industries.

The services they offer mirror those in physical real estate and include buying and selling property, consultancy, land development, rental, property management and marketing and advertising.

A study released by Metametric Solutions said real estate sales on metaverse platforms Sandbox, Decentraland, Cryptovoxels, and Somnium surpassed US\$501 million in 2021. The four platforms have a total of 268,645 parcels of varying sizes on them. Real estate sales are projected to reach US\$1 billion in 2022.<sup>32</sup>

[Metaverse mortgages](#) – Terrazero provide mortgages to those looking to acquire virtual land and homes on decentraland.

“The deed is essentially an NFT. We hold that in the company’s cold storage until the loan is paid off. But we give developer rights to the land so that the person can build whatever they want. If the customer doesn’t pay, then obviously we have that as our collateral.”



<sup>32</sup> [Bitcoin.com](#)

### 3.1.4.2 Blockchain integrating other forms of proptech

Another interesting innovative example of technology developments with potential to impact on various dimensions of the property sector (when combined with blockchain based co-ordination mechanisms) is a Melbourne based company [propella.ai](https://propella.ai), who combine AI & Geo spatial data to provide property market insights.

Some trends in the proptech space, such as virtual home tours, digital signatures, virtual notarisation (eg [matterport](https://matterport.com)) will benefit agents, saving time while others combined with other proptech elements may reduce the need for disintermediation and may be highly disruptive to real estate agents.

For example, consider a virtual home viewing coupled with a virtual signature which then activates a blockchain based smart contract to transfer property ownership, in a blockchain based digitised land registry system.



### 3.1.4.3 Property insurance

Blockchain technology could make insurance claim processes three times faster and five times cheaper. The insurance industry is also exploring blockchain. For example [B3i](https://www.b3i.com) is a consortium of insurance and reinsurance companies working to implement and develop distributed ledger technology in the insurance industry.

[Lemonade](https://www.lemonade.com) is a blockchain company who combine distributed ledger technology with artificial intelligence to offer insurance at low prices. For instance, its renters insurance and term life policies start at under \$10 per month. According to Lemonade, their business model takes a fixed fee from each monthly payment, then allocates the rest towards future claims. When a claim is made, the blockchain's smart contracts verify the loss immediately so the customer gets paid quickly. KPMG and Mirvac are currently exploring a blockchain based platform that will allow insurers, investors and owners to rate and compare the trustworthiness of their buildings.<sup>33</sup>

### 3.1.4.4 Smart construction and the use of blockchain

Recently there has been a surge in the application of blockchain in managing provenance across the supply chain for building materials, the maintenance and asset management of buildings, and as urban planning and smart city development tools. A report by Aurecon includes blockchain in one of its four key trends in smart construction of infrastructure.<sup>34</sup>

What's interesting is the proposed value add when you combine the different components of modular design, design for manufacture and assembly, as well as automated construction, with blockchain functionality.

Blockchain is perceived as increasing return on investment due to improved efficiency, accuracy, accountability, and robust design documentation – linking the supply chain from planning to implementation through smart contracts.

Blockchain when connected to other digital design and construction software can enable greater collaboration, transparency, real time data sharing and design changes.

<sup>33</sup> <https://www.afr.com/property/commercial/how-trustworthy-is-your-building-20210621-p5830v>

<sup>34</sup> Forde G



### 3.1.5 FIBREE Australian industry scan

The 2021 FIBREE (Foundation for International Blockchain and Real Estate Expertise) industry report on blockchain ranks Australia third in terms of engagement with blockchain in the real estate sector.<sup>35</sup> They identified 21 blockchain product offerings across real estate domains in Australia, the majority of which were related to investment and finance such as:

- Manage and operate: Energy Storage Rights
- Transaction and escrow services: [Benext](#)
- Building technologies: [Serenity Source](#), Powerledger
- Investment and finance: Investix, bricklet, deedcoin, fractonium, Gifang, GREIT, KonKrete, Liquid token, Tokenised, Mnotes and Piptle

Although no specific product offerings were referred to, other applications of blockchain mentioned in the report were:

- Research and evaluation
- Plan and build
- Smart city solutions



### 3.1.6 Blockchain for real estate practitioners

This report aims to give a taste of some property related blockchain capabilities.

A comprehensive coverage of all blockchain based applications relevant to the property industry is beyond the scope of this research, yet in the following sections we present a sample of use cases in practice across the property industry and the real estate industry more specifically.

The global and national significance of the real estate industry is clearly indicated in the market size however the real estate industry, particularly residential, is highly localised by nature and at its core is a human centric business.

The micro context will examine how and if this local, people to people based industry, will be severely disrupted by blockchain or if new markets and opportunities might be created in the process.

The focus will be on blockchain applications that relate to real estate buying and selling processes (including financing options and registering of titles, tokenisation and fractionalisation etc), property management, certification and identity management.

What is interesting is that despite the growing internationalisation of real estate digital platforms, there is an ongoing need for knowledge and property appraisal services at a local level.

<sup>35</sup> [2021 FIBREE Industry Report](#)



**Frontiers of  
Economic organisation**

## 4 Frontiers in the forms of economic organisation

Why blockchain in real estate? Why now?

New infrastructure to support the real estate cycle – from co-ordinating production and supply chain information, transfers of property rights via digital twins through to new forms of asset management and governance – are rapidly evolving. In this section we introduce the rapidly expanding frontiers of the blockchain ecosystem – DeFi (2020), NFTs (2021) and DAOs (2022).

### 4.1 DeFi explainer - Decentralised Finance

A new form of real estate finance?

Decentralised Finance (DeFi), refers to decentralised applications for finance. DeFi presents a global, open alternative to the current financial system, at the intersection of blockchain, digital assets and financial services. Users can borrow, save, invest, and trade assets directly on a decentralised blockchain network.

Decentralised applications or 'dApps' are code written in a series of smart contracts which are often collectively known as 'protocols'.

The DeFi movement champions decentralisation and is accessible to anyone in the world with a smart phone and an internet connection. DeFi dapps allow users to lend out money, earn interest on crypto, take out a loan, exchange one asset for another, go long or short assets and implement investment strategies.

[Sid Coelho prabhu](#) provides a good summary of what differentiates DeFi from traditional finance:

1. Once the code is written DeFi dApps can run themselves with little to no human intervention
2. The code is transparent on the blockchain for anyone to audit
3. dApps are globally accessible
4. Anyone can create and use DeFi apps – no gatekeepers
5. Interoperable: DeFi applications can be built by combining other DeFi products – [money Legos](#)



As of April 2022, over US\$75 billion was locked up in DeFi applications ([DeFi Pulse](#)). These features of global open access, commitment to open source code, lower fees and transparent accountable governance model are likely to disrupt traditional finance sectors. Some examples include [Aave](#), [compound](#), [Yearn finance](#), [Uniswap](#) [MakerDAO](#) and [Curve Finance](#).

DeFi applications could be used to increase flexibility and transparency for property owners, developers and managers. DeFi also uses data such as pricing from the real world. DeFi applications with respect to tokenisation of property, use for property relates loan and mortgages, use of real estate as collateral will be explored in Section 6.

## 4.2 DAO explainer – a Decentralised Autonomous Organisation

Decentralised Autonomous Organisations (DAOs) are a coordination tool that bring a community together around a central problem, idea, movement, asset or ideology.

A DAO is a group organised around a “mission that coordinates through a shared set of rules enforced on a blockchain”.....“A club with a bank”



All actions and funding in the DAO are viewable by participants and more powerfully DAO ‘assets’ can be controlled by stakeholders directly via a token. These assets are increasingly including real estate assets.

DAOs are decentralised by nature meaning that the ownership of the organisation is held by its participants and not a centralised party. DAOs represent a flat organisational structure where consumers and creators can come together collectively to manage a project or product.

This enables everyone to have a voice and those who participate in a DAO contribute to the decision making of the organisation. This allows consumers to have more of an equal say in how an organisation operates and actively encourages experts in their respective fields to contribute.

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One example is the “[The one DAO](#)” where a collective group are wanting shared ownership of a mega mansion in the USA and are pooling resources to bid at auction and subsequently form a team to manage the shared resource over time.

If the DAO is successful at auction all events and plans for the megamansion will be decided by voting within the DAO.

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The benefits of using blockchain technology, smart contracts and DAO tools is that it provides transparency to stakeholders around voting, funding decisions and other actions taken by the organisation.

Additionally, it is far cheaper and easier to spin up a DAO around a collective mission comparatively to traditional corporations, thanks to the new suite of DAO tools. These tools enable the community to collectively manage funds.

Decision making in a DAO is organised via smart contracts, where polls can be created to allow members to vote. Members will vote using what is known as ‘governance tokens’, which represent their financial stake in the organisation. As a result, DAOs can replace traditional top-down hierarchical corporate structures using this suite of technology and collaborative approach.



## 4.3 NFTs explainer - Non Fungible Tokens

The ways in which we can buy and sell products in a digital landscape is changing. Real estate is seeing a shift towards the creation of tokens that represent physical properties, almost like a digital twin of real world assets.

So what are NFTs?

NFTs are unique tokens issued on a blockchain to represent a unique asset. Non-Fungible Tokens describe things that are not interchangeable for other items because they have unique properties (for example a property).

NFTs facilitate the creation of a digital replica of a physical item and have a broad range of possible applications. For example, in the property sector they could be used in supply chains to individually authenticate goods ensuring a given quality or assigned certification such as an energy rating.

NFTs have rapidly developed in recent months, increasingly being used to represent ownership of physical items in the real world.

### 4.3.1 NFTs in real estate

Blockchain technology and DeFi clearly present a myriad of benefits to the real estate industry, through reduced transaction fees, settlement times, access to loans and insurance etc.

However, for the real estate industry to tap into these benefits, a way to represent ownership of assets on the blockchain is required. NFTs can either be a digital representation (digital twin) of a tangible asset or a purely digitally native asset with intangible properties.

NFTs can replicate the properties of physical items like scarcity, uniqueness, and proof of ownership making them the perfect use case for the real estate industry.

Experimental uses of NFTs have been popping up in the real estate industry, such as NFT mortgages in the form of home equity loans. For example, Loansnap has minted residential mortgages as NFTs through its bacon protocol.

Fractional ownership tokenisation is already being used in limited cases in the real estate industry.

Ironically NFTs can facilitate making real estate 'assets' fungible. An example of the use of NFTs to generate additional returns in a real estate secondary market can be seen via [landshare.io](https://landshare.io).

The challenges of using NFTs as a digital twin for property is firstly the NFT creation process, which has been solved by switching the property ownership from single ownership to a 'legal' entity. This enables transfer of the ownership of the entity (which in turn hold the property rights) via an NFT. This also saves on transferring the title. A blockchain protocol then transfers the asset from one wallet to another, collecting details and identify checks to ensure the transaction integrity and KYC compliance.

The implementation of NFTs within blockchain based marketplaces has globalised the real estate industry. Real estate is a notoriously illiquid asset, especially in regional areas where property sellers are limited to the buyers in their geographical area. Naturally, discrepancies between the bid-ask spread between buyers and sellers arise, frequently leaving purchasers to opt for a long-term hold investment strategy.

Globalising the real estate industry provides a new level of liquidity to the market and therefore a new pool of investors.

When NFTs are used in real estate with DeFi, it opens the industry up to a range of new opportunities.



## 4.4 Behind DAOs, DeFi and NFTs - Smart contracts explainer

### 4.4.1 Smart contracts

Smart contracts are digital agreements, coded into blockchains, that are triggered when certain conditions are met.

“Smart contracts on the blockchain allows for contractual agreements to be automatically, autonomously and securely executed. Smart contracts can eliminate an entire class of work that currently maintains, enforces and confirms that contracts are executed via accountants, auditors, lawyers and indeed much of the legal system.”<sup>36</sup>

They can support automating processes that stretch across corporate boundaries, involving multiple organisations. When applied to multi-party digital agreements, smart contracts can reduce counterparty risk, increase efficiency, lower costs and increase transparency into processes.

Smart contracts can automate various real estate transactions, products and markets using external data inputs and traditional settlement outputs.

Smart contracts can be used to:

1. Transfer ownership based on certain predefined conditions
2. Lock up real estate NFTs as collateral for loans
3. Facilitate recurring rental payments
4. Facilitate derivative products based on real estate market trends

One problem is dispute resolution (See Allen, Lane, Poblet 2020) and the blockchain oracle. As blockchains are closed networks they don't have the ability to call external APIs, therefore it is necessary to connect smart contracts to external (traditional) data and systems infrastructure, known as oracles. Oracles exist as a bridge between the blockchain (on chain) environment and the external (off chain) environment.

### 4.4.2 Blockchain oracles

Oracles are the layer that queries, verifies and authenticates external data sources and then relays that information, enabling smart contracts to execute based upon inputs and outputs from the real world.

Blockchains are isolated networks as this increases security. How does a smart contract really know whether all the conditions of a contract have been achieved in the real world? There is a necessity to facilitate the “transfer of information from the world of atom to bits”.

For smart contracts to reach 90% of their potential use cases they need real world information and data.

How an oracle operates is dependent on what it is designed for:

- Source: does the data originate from software, hardware, or human?
- Trust: is it centralised or decentralised?

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For example, [Provable](#) & [Chainlink](#) are blockchain oracle providers. Chainlink is a prominent oracle provider which demonstrates how they can facilitate getting high quality real estate data on chain for use in DeFi markets.

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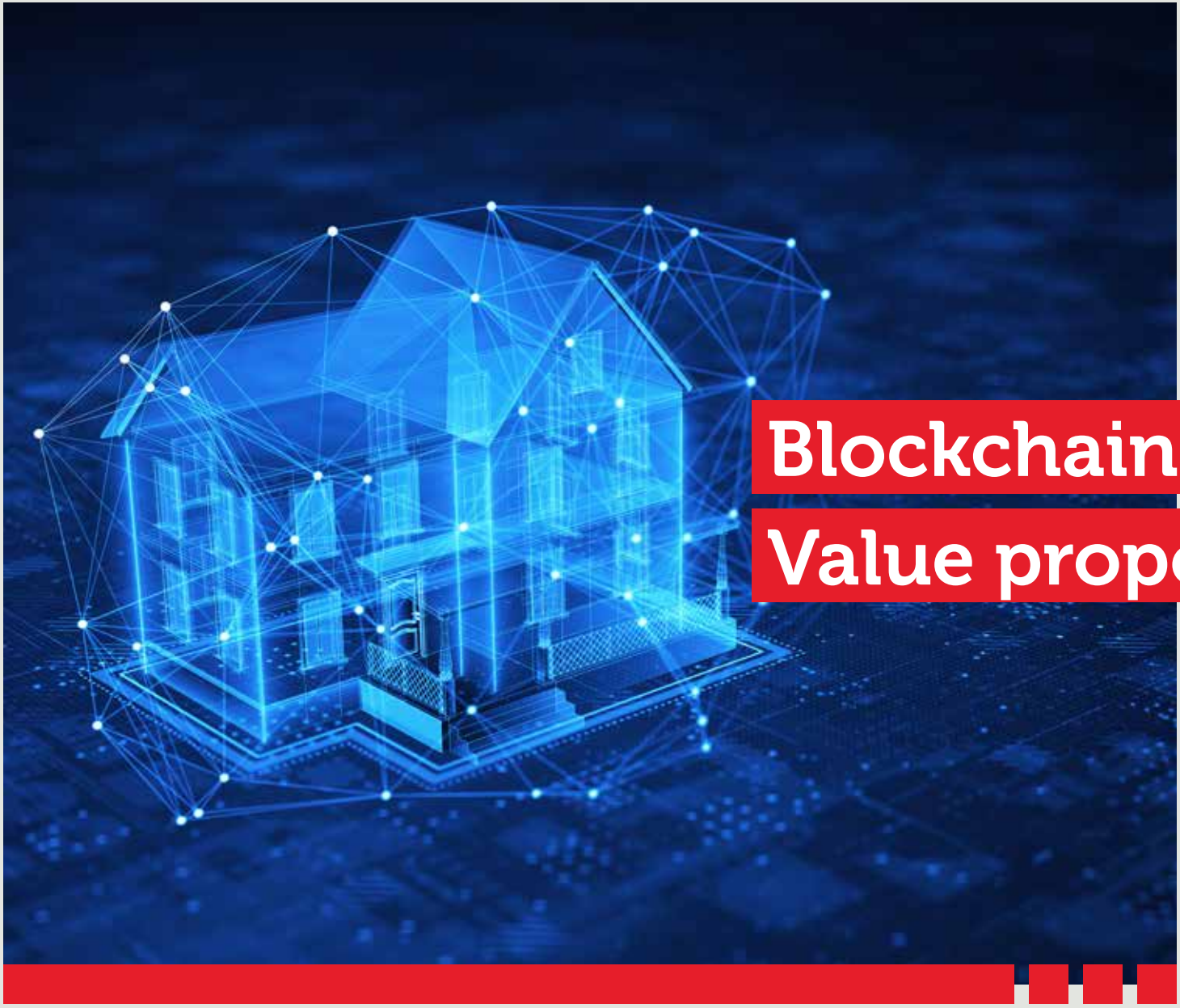
### 4.4.3 Blockchain utility integrates with digital technology of automation

These emerging frontiers position blockchain as an economic infrastructure for next generation autonomous digital technologies encompassing many of the nine pillars of Industry 4.0 – the process of embedding intelligence and connectedness in manufacturing and supply chain.

Blockchain can be an integrating infrastructure for big data and data analytics simulation, IoT, robotics, AR and 3D printing.

It provides a digital platform for decentralised digital currencies, digital assets, digital identify and smart contracts and allows the digital transfer of value without relying on third party intermediaries. These in turn have enabled developments of novel organisational structures combining DeFi, NFTs and DAOs.

<sup>36</sup> [The Blockchain Economy: A beginner's guide to institutional cryptoeconomics by Cryptoeconomics](#)



**Blockchain**

**Value proposition**



## 5 How blockchain value propositions relate to the real estate industry



### 5.1 Value proposition, opportunity, whose doing it and where

In this section we examine the value proposition of blockchain for given real estate use cases and consider the opportunities and challenges this may present for the industry stakeholders. We also present examples of relevant blockchain projects that are currently practicing or developing applications for each use case.

In addition to examining the use of blockchain for the exchange of property rights and buying and selling real estate, the industry scan will be grouped under the following broad headings.

1. Asset management – loan and mortgage securitisation
2. Project financing – payments, leasing and real time accounting
3. Property management – investor and tenant identity
4. Land and property registries
5. Urban planning – property development and construction

The proposed advantages of the use of smart contracts and blockchain in real estate are often summarised as producing the following benefits for users:

- Utility: digitised real estate assets can be easily used in other markets without complex overheads and costs
- Liquidity: real estate assets can be global from inception, creating more liquidity in markets
- Efficiency: automated payments such as rents etc can be integrated with existing systems
- Risk management: on chain derivatives and hedging place/region related risk. Facilitates a user to hold a balanced portfolio of stocks, crypto and real estate that doesn't have to be that big. (Unlike real estate investment trusts, properties can be chosen by the user and not bundled in an opaque way)
- Provenance: blockchain provides an immutable ledger and can track provenance along the supply chains from real estate asset construction, an audit trail of ownership and updates on full transaction history



Cryptocurrency such as Bitcoin and Ethereum have been used to trade property in Australia and New Zealand where there have been publicised sales where sellers said they would accept bitcoin.

Examples in 2020 include a home in [Reservoir Victoria](#) which was listed for sale with Bitcoin and in 2019 another home in [northern NSW](#) which hosted the world's first crypto auction where bidding occurred in Bitcoin.

Platforms such as [Bitcoin real estate](#) list properties for sale and rental around the world with a crypto price tag.

In 2019, a north Auckland home in Unworthy Heights went on sale where the vendors were happy to accept New Zealand dollars or Bitcoin equivalent.

More recently a house in Tampa Bay Florida was auctioned as a NFT – selling for 210 Ethereum. This demonstrates a leap in the underlying infrastructure needed to develop new markets as it illustrates the functionality of NFTs acting as digital twins and enabling real asset exchange digitally. Blockchain Real estate start up [Propy](#) was responsible for co ordinating the sale.



## So what are some of the current major use cases for blockchain applications in real estate?

## 5.2 Asset management

### 5.2.1 Real estate tokenised fractional ownership and project financing

Fractionisation of real estate can be facilitated through a variety of mechanisms such as joint ownership, physical sub-division, time shares, leaseholds, tranching and syndication – all of which have different legal implications which can differ across jurisdictions. How then might blockchain facilitate fractionalisation through tokenisation? One of the early implementations of real estate tokenisation was in Switzerland in 2019.



#### 5.2.1.1 "Hello World" case study

In March 2019, the first Swiss property (in Baar in the canton of Zug), was tokenised via the blockchain transaction platform blockimmo.

The trade volume amounted to around CHF3 million and the transaction was made possible by the combined efforts of three Zug companies blockimmo, Elea Labs and Swiss Crypto Tokens.

1. Elea Labs supplied the complete, validated data for the property and Swiss Crypto Tokens enabled the transaction with the 'CryptoFranc', a stablecoin linked directly to the Swiss franc.<sup>37</sup>
2. Smart contracts on the Ethereum blockchain were used to provide secure and efficient transaction processing and a "single source of truth" between all participants, improving transparency and accuracy of information.
3. The paperwork and compliance to be submitted and reviewed for property transactions by multiple parties was alleviated by requiring potential investors to create their own accounts, fill in a KYC form and upload all necessary documents to the platform.
4. These were automatically processed before payment via wire transfer, with the smart contracts executed upon payment validation.
5. The issuer then authorised the transfer of tokens to the investors through a certificate digitally signed.
6. Upon completion, investors received a receipt with full details of the sale and a link to the transaction on the Ethereum blockchain.

Digitising the investment process provides opportunities to distribute assets more globally, since international investors can access the platform just as easily as domestic investors.

<sup>37</sup> <https://medium.com/blockimmo/hello-world-from-the-crypto-valley-first-real-estate-transaction-on-blockchain-2bf985b0ff3>





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[blockimmo](#) one of the companies involved in the Hello World case study is a regulatory compliant decentralised real estate marketplace based in Switzerland. The types of properties listed on blockimmo include:

- Commercial (non-residential, investment) single owner or multiple owners (Worldwide)
- Plots (developments projects) – single or multiple owners (depending on the project type)
- Residential (investment) – single owner or multiple owners (Swiss citizen or B, C, L-permit)
- Residential (private) – single owner (Swiss citizen or C-permit)

blockimmo aims to eliminate the bottlenecks associated with conventional real estate funding and transactions by moving the process on-chain and removing dependence on intermediaries and mitigating the legal and regulatory complexity.

Once a property is listed on blockimmo, it transitions to on-chain representation and is tokenised. The property rights and ownership is then managed through Ethereum smart contracts.

‘These asset-backed tokens are sold via crowd-sale, where they can be purchased in small stakes across many investors.’

Tokenisation can be thought of as wrapping a real world asset with a digital wrapper.

Property can be tokenised by creating a legal entity around the assets first and then issuing tokens.

New blockchain platforms are beginning to emerge like [harbour.com](#) which aim to use tokenisation to unlock liquidity for traditionally illiquid assets such as real estate.<sup>38</sup>

Tokenisation is the conversion of the value of an illiquid asset (such as property) into a fixed number of liquid tokens, which themselves have a fractional value of the original asset. This application is building Web3 native tools to facilitate the easy creation and management of “legally compliant LLC” investing DAOs.

Once a real estate asset is represented by a digital token and effectively governed by the transactional rules of a given blockchain application, the many frictions of transacting between multiple parties could be reduced.

Property asset tokenisation could represent new investment vehicles enabled by blockchain based security with increased speed and efficiency that allow investors to invest in property assets anywhere in the world.

Tokenisation allows ownership rights to an asset to be transmitted and traded on a global and secure digital platform.

Automating the tokenisation process with blockchain can facilitate:

- Improved access to the real state market and reduced barriers to entry as property can be fractionalised and traded in affordable shares. It allows property investment to become more inclusive.
- Transparency and Liquidity: real estate tokens can be traded transparently on a secondary market facilitating liquidity of the asset. Through increased access it can also create an additional source of liquidity for property developers and building owners.
- Faster and cheaper transactions.

<sup>38</sup> Recently, start up Syndicate.io has taken the concept of traditional investment club to pool capital to create “Web3 Investment Clubs”



As highlighted by Yael Tamar the real estate industry is a US\$317 trillion industry but only \$10 trillion dollars is available for investment as the rest is held privately or via public securities.<sup>39</sup>

However Baum (2020) discuss a number of factors relating to tokenisation of real estate assets that need to be considered for the real estate tokenisation market to develop:

1. There needs to an expressed demand for fractionalisation.
2. There needs to an acceptance and willingness of participants to engage with the underpinning technology, blockchain.
3. Fractionalisation requires an intermediate structure to be established and globally these appear to be predominantly LLCs (alternatives include partnerships, trusts) and setting up these structures can add to the costs associated with fractionalisation. Recent advances using DAO have simplified this process.



4. There needs to be a governance agreement structured around how the asset is controlled.
5. Tokenisation may also have specific use cases in residential, social impact or community assets where investment and risk/return are not the main drivers of behaviour.

Baum (2020) also points to the increased likelihood of adoption of tokenisation / digitalisation of real estate funds preceding single asset tokenisation due to the fact that funds are in essence already fractionalised.<sup>40</sup>

<sup>39</sup> [2021 FIBREE Industry Report](#)

<sup>40</sup> A detailed exposition of tokenisation for real estate can be found ([Baum 2020](#))

## 5.2.2 Examples of current projects tokenising real estate using blockchain

Tokenisation can unlock the liquidity of real estate projects.

Examples of a companies digitising real estate assets are:

[Digishares](#) (protocol agnostic headquartered in Denmark but has a global reach).

[RealT](#) is a US based blockchain platform for residential real estate tokenisation. RealTokens are the purchasable asset; the digital representation of ownership in the LLC that owns the deed to the property. Each property on RealT has its own set of unique RealTokens associated with it.

[Labs Group](#) is another digital investment platform that provides access to fractionalised property ownership and enables the continuous trading of real estate assets-backed tokenised shares on a regulated security exchange – similar to crowdfunding, but with tokens available on blockchain.

[TZero](#) is another case study of real estate assets been tokenised on blockchain. TZero is open to issuers around the globe, subject to US government restrictions (ie OFAC list).

Others blockchain real estate tokenisation platforms include:

- [Red swan](#)
- [Vertalo real estate platforms](#)
- [Reinno](#)
- [IHT Real Estate Protocol](#)

[Blocksquare](#) is a technology company building the infrastructure to transfer real estate assets to the internet. They offer a tokenisation protocol for real estate assets, a real estate investment marketplace, a monitoring and report platform which enables trading and distributes revenues and sends investor reports, in addition to a tender and buyback platform where issuers can repurchase real estate tokens from investors.

The Blocksquare tokenisation system is deployed on the Ethereum blockchain and is a platform allowing any company to launch their own marketplace of tokenised real estate properties. There are already four market operators currently using Blocksquare: [Terramint](#), Bravo, HeroX and [Tokeniza](#) launching marketplaces to provide tokenisation as a service to asset owners in their region.

Blocksquare have partnered with [FIBREE](#) (Foundation for International Blockchain and Real Estate Expertise) to drive the adoption of tokenisation by bringing together teams from around the world to undertake a challenge to tokenise a real estate property.

“With our real estate tokenisation protocol, entrepreneurs can start digitising real estate assets at a fraction of the cost, while our white-label platform offers the quickest way to launch an online marketplace”. Blocksquare

[Vesta equity](#) is a US based platform designed to be a marketplace platform connecting property owners and investors with the tools to transact directly.

Property owners can draw down on their home equity by selling tokenised shares of their homes.

This marketplace will enable homeowners to convert their home equity into digital assets and sell a percentage of it to accredited investors without compounding interest or requiring an outright sale.

The process through which this occurs on blockchain is described as follows:

1. Users undergo a KYC/AML process to ensure 100% regulatory compliance.
2. Properties are vetted, appraised and ownership verified:
  - a. The property is tokenised (using the Algorand blockchain Standard Assets system).
  - b. Legal rights for the owner and investor are embedded in the smart contract.
3. Investor rights are protected by Vesta equity's Deed of Trust instrument with the property owner and the registry office.



### 5.2.3 Tokenisation platforms linking to DeFi

A reader might wonder why we included separate explainers on NFTs, DeFi and DAO and the underlying smart contracts that drive them in the previous section.

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Smart contracts go beyond simply allowing verifiable transactions for specific applications – they can be programmed to interact with each other. This makes them composable, like building blocks. This composability allows those in a network to take existing programs and adapt or build on top of them, thus creating new use cases.

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Blockchain applications can plug into each other like Lego pieces. To give this a real estate context – a real estate blockchain application can plug into a DeFi application without having to build it from scratch. It means that an NFT (real estate) can be combined with DeFi application to be used as collateral in taking out a loan or to rent out to earn interest.

For example, in addition to tokenisation of real estate, Blocksquare is also developing a DeFi Bridge called [Oceanpoint](#), which is an open end DAO. This DAO is designed to potentially own a pool of real estate assets where anyone can participate without legal restriction. In time, tokenised real estate will be added to the platform, which will accrue rent and generate additional cash flow.

[CitaDAO](#) is another example of the bridge between real estate tokenisation and DeFi.

CitaDAO describes itself as “a sustainable DeFi yield farm powered by real estate, built on the Ethereum ecosystem”.

It is permissionless in that anyone can access real estate listed on Ethereum and any resident in a Commonwealth nation can list their real estate on the platform. The governance of the asset is managed through voting rights acquired through staking CitaDAO tokens.

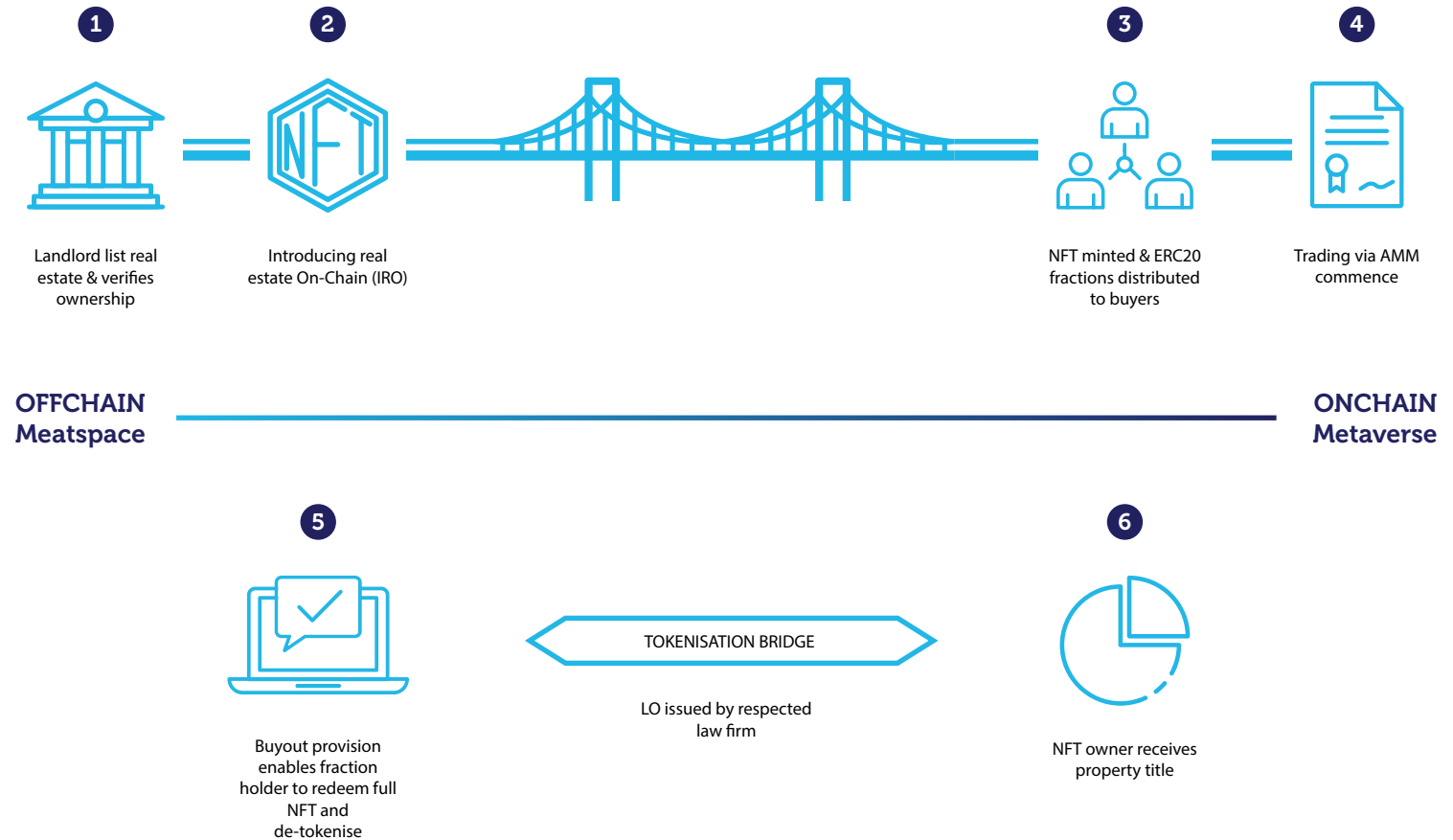
CitaDAO is also planning to be a foundation for a DeFi applications such as collateralised loans, futures, indexes, real estate backed stable coins etc.



CitiDAO plans to link real estate value to blockchain assets. The process of acquiring digital real estate assets can be described as follows:

1. Interested participants have ten days to commit funds into a pool, which is a smart contract on the Ethereum blockchain, to collect funds.
2. Normally, the sale of a property would include a 3–5% fee for the agency which in this case is given out to contributors to the pool ([distributed like this](#)).
3. If the target amount is reached (to purchase the property), the process is complete and the building will be brought on-chain and tokenised for the participants.
4. It will be transferred to a [registered corporate entity](#) to hold the asset in the non-crypto world while representing its ownership as an NFT on the Ethereum blockchain.

How it works – Citadao enables a 2 way tokenisation bridge for real estate <sup>41</sup>



<sup>41</sup> CitiDAO tokenomics can be viewed [here](#) and a full account of the process of transferring the House to NFT and back again is developed [here](#)



## 5.2.4 Loan and mortgage securitisation

Blockchain technology can enable a streamlined securitisation process, with lower cost, faster transaction processing, and greater security and transparency from loan origination to maturity. The use of blockchain technology facilitates aspects of the securitisation life cycle by bringing the participants on a single platform while allowing more efficient information sharing and auditing thus enabling a more efficient structuring of the security.

Blockchain creates a single source of information to be used for analysis and forecast purposes and allows investors, rating agencies and financial services providers to make decisions on the basis of real time, verified data thus eliminating issues emanating from inadequate transparency and fraud.

Tokenisation or real estate backed NFTs, enables digitisation of securities. When combined with decentralised finance, it creates new financial instruments and alternative asset classes.

Some of these new markets involve loans and mortgages, where users can borrow against their collateralised assets such as cryptocurrency, tokenised silver or real estate much like in traditional markets. The difference is that the barriers to access these loans are substantially lowered. In addition, repayments on these loans are often much lower than traditional markets.

Some examples include:

- [Mata Capital](#)
- [RealT](#)
- [digishares liquid mortgage](#)
- [Republic](#)
- [Helio Lending partnership with Propy](#)
- Miami-based [blockchain](#) start-up [Milo lending](#) has announced its plans to offer crypto-mortgage to US citizens. The program will allow people to leverage their crypto stash and purchase real estate in the country. Currently, they are accepting BTC as collateral for 30 years of mortgage loans.<sup>42</sup>

Other DeFi real estate Blockchain applications and projects gaining traction:

[Centrifuge](#) bridges real-world assets and DeFi. It is a proof of stake blockchain that enables users to bring their assets on chain as NFTs.

[BlockFi](#) provides loans against client's crypto holdings. BlockFi will offer USD and USDC based loans that are collateralised by the crypto assets of the borrower.

[Landshare.io](#) enables a property to be purchased on the blockchain through asset tokenisation.

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[Synechron](#) (US based) provides a mortgage lending application which automates mortgage initiation and the serving and execution for the parties involved in mortgage (lenders, buyers and representatives). They advocate that relative to conventional mortgage financing, the integration of blockchain enhances customer experience through:

- improved loan search and credit qualification checks and approvals
  - faster asset appraisal, insurance and loan security
  - easier document exchange disclosure and due diligence
  - reduced fees along the mortgage value chain
  - increased certainty and reduced fraud during loan funding approval, cash transactions with sellers and intermediaries and completion of asset and title exchange
- 

<sup>42</sup> [Milo launches first US crypto mortgage](#)

## 5.3 Payments, real time accounting, investor investor and tenant identity

### 5.3.1 Payments & real time accounting

Blockchain technology and smart contracts facilitate leases which can be signed and transacted on-chain.

Smart contracts can automate rental and dividend payments to property owners, removing the need for manual reconciliations. Property ownership and cash flow records are kept on-chain, and processes can be automated enabling near-immediate accounting.

As payments, cash flow and property ownership can be recorded on a blockchain, the data updates in real time and therefore so too can financial statements, income and cash flow statements providing better information to stakeholders including regulators.

In a closed or private blockchain system, blockchains could incorporate a “trust node” such as an audit firm or a compliance officer. The process could be audited in real time with the support of smart contracts to verify critical data.

Blockchain could facilitate what is referred to as triple entry accounting wherein an immutable ledger of all transactions can be extracted using reporting tools providing an automatic audit trail in a trustless manner. However, it requires appropriate governance mechanisms and industry consensus on appropriate applications.

### 5.3.2 Investor and tenant identity

Blockchain-based identities allow people to prove their identity online, even pseudonymously if necessary.

Trust in digital identities is pertinent for the real estate industry, especially when transferring ownership of such significant assets.<sup>43</sup>

Without proper identification you can't own property and without a digital identify you can't own digital representations of property.

Many jurisdictions are moving away from paper based identify systems to digital based ones. There are however security and privacy concerns about centralised digital identify management systems.

How might identity work on a blockchain to improve privacy and security?

There is a growing movement for creating self-sovereign identities which is a digital identity where control of the identity resides with the individual or organisation, meaning they have full control over sharing of the data. With centralised cloud services it becomes difficult for companies to offer total security and some platforms offer low levels of security and loopholes which create opportunities for identify theft.

Individuals also face repetitive processes for KYC (Know Your Customer) and AML (Anti Money Laundering) requirements because each application requires data etc.

Decentralised digital management systems via blockchain can provide infrastructure to manage more efficiently and securely, identify and privacy. The identity owner can create a cryptographically secure digital identity where all the identity data is stored on a blockchain ledger. The data can be notarised by a third party.

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[Accumulate](#) is one example of an identify based blockchain protocol that works across multiple blockchain platforms.

[Tykn](#) is another self-sovereign identify application where a user can hold and have control of identity and digital credentials in an individual wallet which are authenticated on a blockchain.

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<sup>43</sup> [Zhang 2021](#)

## 5.4 Property management

Blockchain facilitates secure data sharing, rental collections and payments to property owners and could improve due diligence across a diverse tokenised real estate portfolio and provide oversight of global portfolios. Increased operational efficiency resulting in time and cost-savings creates competition for traditional processes. Blockchain can also generate substantially richer data to facilitate better decision making.

### 5.4.1 Property management

Property management has many stakeholders including owners, tenants, vendors, owners corporations, utility providers and co-ordination across stakeholders can be a complex task.

Blockchain, has been suggested as a technology that can support the complete property management cycle from signing the lease to cash management through a single decentralised application in a transparent and secure way.

Blockchain can facilitate secure data sharing, streamline rental collections and payments to property owners, and provides premium due diligence across property portfolios.

#### 5.4.1.1 Stata titles – disputes in owners corporations

An owners corporation usually involve many parties, living close to each other and sharing common property.

In this setting, people often have different views and disputes can arise. According to Consumer Affairs Victoria, communication is often the best way to prevent disputes, so owners corporations are encouraged to facilitate those with shared property related grievances to talk about their concerns.

In many cases, owners corporations have to develop their own processes for handling disputes and if a problem is not resolved, the matter may be taken to the Civil and Administrative Tribunal.

In addition, owners corporations are required to keep a record of complaints for seven years. Anecdotally many disputes that arise are due to a lack of transparency between property managers, owners and ownership corporations.

The use of a DAO structure to manage shared property could greatly increase transparency and facilitate voting mechanisms to support changes in process and reduce complaints.

Although not a DAO structure [Easycorp](#) is an Australian based app that facilitates the smooth running of ownership corporations and enables owners to participate in the management process. Its blockchain based functionality includes:

- An online community where neighbours can communicate about anything they want.
- Building news.
- Digital documentation: users can read private body corporate documents.

The Blockimmo platform has a fully functional dividend payout option. Investors can log in and receive a notification to claim their share of the payout, and within three clicks the transaction is executed on the Ethereum blockchain. The investor receives the dividend payout into their wallet.

- Notifications: receive notifications in real time.
- Secure data record: using blockchain as an immutable ledger.

Although not yet currently available, the app is looking to add digital voting mechanisms where users can submit resolution, committee or election votes. Decentralised applications such as this could greatly improve transparency and reduce disputes in what can often be perceived as a fractious and trust less environment.

## 5.4.2 Project financing via tokenisation

The use of tokenisation can reduce overheads and specialised knowledge required for funding real estate projects.

By using smart contracts on a decentralised blockchain, the process of writing, authenticating and auditing agreements can be executed in real time. Tokenisation can extend property related funding to a global scale without the need for intermediaries, therefore keeping value between the parties involved.

Blockchain allows for new and efficient ways of project finance through tokenising of real estate projects. Tokenisation lowers fees and costs associated with real estate investment for individuals while mitigating capital constraints and unlocking new investment avenues for retail investors and organisations.

In the conventional real estate development model, the property developer would undertake a small investment into the property and raise the remaining amount through a bank loan and unit pre-sales.



Tokenisation would permit the developer to raise funding through security tokens administered through a blockchain. The developer could divide the property into many small units which can then be sold against tokens. The tokens held by each investor would represent the amount of fractional ownership into the property.

Blockchain could provide further value addition for homeowners looking to tap into additional funding against existing real estate assets whose value is appraised by the bank. In this case tokenisation would allow homeowners to pool funds from a variety of blockchain verified counterparties. Tokenisation could also enable portioning of the property and allow rent sharing where token holders could receive rights to rental cash flows in proportion to the tokens held.

The tokens exist on blockchain and provide a more efficient investment process by:

- eliminating the obligation to raise funding in excess of the initial investment (down payment) in case the investor is unable to secure a timely sale of the property
- mitigating the transaction overhead associated with selling the unit(s) in the secondary market
- reducing the risk of capital gains loss in a bear market due to higher liquidity of the property tokens
- eliminating delays, high costs and intermediaries typically involved in real estate transactions

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[Republic](https://republic.com/real-estate)<sup>44</sup> is an example of a blockchain platform offering real estate investment opportunities. When an individual invests through Republic's ecosystem, they provide capital in exchange for a financial stake in a company, fund or project. [Landshare.io](https://landshare.io) is another.

[Vonovia SE](https://vonovia.se) is a German real estate group based in Bochum managing around 400 000 homes – the first in the German market, with a real estate portfolio worth around EUR 56B.

Vonovia, a DAX 30 company, recently [issued](#) its first fully digitally registered bond. The bond issuance was completed fully digitally and is solely represented by security tokens issued on the Stellar blockchain. The transaction took place in partnership with Firstwire, M.M. Warburg and Bitbond.<sup>45</sup>

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<sup>44</sup> <https://republic.com/real-estate>

<sup>45</sup> <https://www.bitbond.com/resources/digital-assets-in-action-vonovias-blockchain-based-bond-issuance/>



## 5.5 Land and property registries

Land conflicts are a significant issue in developing countries and disputes over ownership can result in unused productive land. The title insurance industry (supposedly worth 14 billion) exists to protect consumers from claims against homeownership after sale due to errors in public records.

Digital cloud based platform companies like Qualia are emerging to facilitate digital transformation of title, conveyancing and closing processes. However, blockchain-based smart contracts present an alternative to record land titles. Moving documentation into a decentralised and secure ledger could be a more efficient way to manage land ownership, increasing transparency and ensuring that records are not manipulated or lost.

So where can blockchain add value to land registry?

Blockchain could replace paper deeds with secure digital assets on an immutable ledger that creates a secure shared source of truth for documents between multiple parties and organisations. Through simplification and streamlining the transaction process, blockchain could reduce transaction costs and optimise efficiency. Advocates suggest that a blockchain based land registry will smooth information flow, increase liquidity because it supports fractionalisation and therefore support foreign investment and liquidity.

Blockchain won't fix poor data or consensus on who owns pieces of land, however the value in a blockchain registry is that it can enable multiple parties to conduct a transaction, particularly if there is no trusted party.

Countries such as the UK, Sweden [Lantmäteriet](#), Ukraine, [Georgia and Ghana](#) [Malta](#), UAE, Switzerland and regions such as Andhar Pradesh, have been testing blockchain applications to record national transaction aided by blockchain companies such as [Ubitquity](#) and [Chromaway](#).<sup>46</sup> Ubitquity has recently joined the [American Land Title Association](#).

Yapicioglu & Leshinsky<sup>47</sup> set out an argument for using blockchain technology as a land registration tool for Cyprus and other disputed land contexts. It could be a tool that creates trust over land titles in a low trust or contested environment.

In a UK case study, blockchain was found to significantly shorten the traditionally lengthy procedure of transferring and registering real estate titles. Oleksii Konashevych of the Australian Institute for Digital Transformation presented a case for an Australian blockchain based registry to the Australian Senate in 2021.

The proposed Blockchain Estate Registry concept assumes a system that runs in parallel to the conventional registry, based on a centralised database. Proprietors then choose which registry to manage their property rights.<sup>48</sup>

Initial steps to a blockchain registry mean digitisation of land records or a smart land registry: such as codification of parcels of land which are readable by software. There then needs to be a process of change over that registers the enablement of software driven land transaction. Blockchain could be perceived as a mechanism of driving change to a digitised smart land register, with hosts/nodes possibly including the land authority, lenders, real estate agents and any third party organisations acting as validators. Identity services also need to be managed.

<sup>46</sup> [https://static1.squarespace.com/static/5e26f18cd5824c7138a9118b/t/5e3c35451c2cbb6170caa19e/1581004119677/Blockchain\\_Landregistry\\_Report\\_2017.pdf](https://static1.squarespace.com/static/5e26f18cd5824c7138a9118b/t/5e3c35451c2cbb6170caa19e/1581004119677/Blockchain_Landregistry_Report_2017.pdf)

<sup>47</sup> Yapicioglu, B. and Leshinsky, R., 2020. Blockchain as a tool for land rights: Ownership of land in Cyprus. *Journal of Property, Planning and Environmental Law*

<sup>48</sup> [https://symposium-dlt.org/papers/SDLT5\\_1330\\_WhyDoWeNeedBlockchainEstateRegistry.pdf](https://symposium-dlt.org/papers/SDLT5_1330_WhyDoWeNeedBlockchainEstateRegistry.pdf)

## 5.6 Planning, property development and construction

### 5.6.1 Urban planning

Civic participation is an important element of successful urban planning as the process often suffers from mistrust amongst stakeholder groups. In complex and long term planning processes there is limited scope for co-creation and joint decision making given the lack of transparency in the process,<sup>49</sup> DAOs could help with Urban Planning through educational resources, token-based participation incentives, and an information feedback loop between stakeholders to facilitate planning processes. In addition, Blockchain has been lauded as potentially helping developers obtain permits easier and quicker, democratising utilities, waste collection and land use decision making.

In Dubai, city planners have had in place a blockchain strategy to ensure that at least 50% of all transactions are carried out over the blockchain. For example, the Dubai Municipalities Digitisation Strategy seeks to improve services and operations by integrating the technologies of Artificial Intelligence, Internet of Things, Machine Learning, Automation, 3D Printing, Big Data, and blockchain in the enterprise operations.



A recently published report 'The Docklands DAO – Re-imagining precincts in a digital CBD' by Dr Max Parasol from the RMIT Blockchain Innovation Hub, provides some novel and innovative ideas for the application of blockchain to revamp Melbourne's CBD and build towards Smart Cities 2.0.

DAOs can offer cities an innovative way to utilise anonymously pooled data. This includes optimising resource allocation, better overall efficiency, and creating opportunities for strategic placemaking (collectively reinventing public spaces). The report highlights the new frontiers possible in shared ownership of place driven data and application of technology to drive use of community spaces.

- The Participatory Urban Decision-making DApp (PUDD) is an example of a system to collect data from citizens and participatory organisations developed using the Ethereum platform as a DApp (Distributed Application) and tested in a shopping centre in Lund, Sweden. This demonstrated how people could reflect their ideas regarding urban planning processes, how their ideas are processed on the blockchain, and how the results are published for the whole community (Farnaghi & Mansournian 2020)
- [BBBlockchain](#) is an Ethereum blockchain based participation platform to enable more transparency and a say in urban development. It is German based and supported by six municipal housing associations in Berlin. "The aim is to research whether transparency and trust in planning processes can be increased through blockchain technologies... By using the BBBlockchain, information on participation processes is made permanently and reliably available."

<sup>49</sup> Muth, R, Eisenhut, K, Rabe, J, Tschorsch, F 2019 'BBBlockchain: Blockchain-based participation in urban development' 24 June 2019

## 5.6.2 Property development and construction

Blockchain can create value in the built economy through connecting stakeholders via smart self-executing contracts between owners, construction management operators, and occupants, including material tracking and payments.<sup>50</sup>

Blockchain technology can benefit construction through its ability to create a transparent supply chain. The digitisation of processes in combination with the smart contracts that blockchains utilise simplifies sub-contracting, procurement practices, and project management.

Blockchain's transparency enables premium goods to be authenticated easily such as cladding or energy efficiency ratings via a digital twin tied to them in the form of an NFT that acts as a certificate on the blockchain.

- Design: blockchain could be used for commercial arrangements between partners in a building and to distribute payment between partners in a building. As home buildings can be printed in warehouses and be modularised, blockchain can facilitate design data document and connect the supply chain – planning, construction tenders, landlords etc and in the process, use design transparency facilitated through blockchain to improve energy and water infrastructure.
- Construct: smart contracts based on if/then principle for administering and paying suppliers. Eg electrician gets paid on passing inspection.
- Operate and maintain: a building maintenance system could trigger a DAO to order required facilities such as cleaning supplies, accept delivery, notify cleaners and facilitate payment.

Brig (US based – formally Brickschain) is an example of a blockchain application designed for the building construction industry. It uses “Hyperledger” blockchain to help manage financial workflows in the construction industry. Brig has been adopted and used by construction in the Australian context. Brig suggest that via their blockchain technology construction companies can track – in real time– the movement of the materials they will be using to construct the building and will have a living blockchain that details the provenance of materials used in construction “Brig provides an immutable ledger for all data in a project or a company. Much of the data in construction is siloed in applications, or still exists in un-indexed PDFs. Brig’s blockchain-powered Hyperledger database allows that data to be accessed, baselined, and used in training AI and machine learning models to predict outcomes. This ultimately allows contractors to save money, reduce risk, and pursue smarter investments.”<sup>51</sup>



<sup>50</sup> <https://www.aurecongroup.com/markets/property/buildings-of-the-future/easy-life-complex-technology/blockchain-impact>

<sup>51</sup> <https://www.disruptordaily.com/blockchain-real-estate-use-case-brig/>



# Blockchain and real estate practitioners



## 6 Blockchain value propositions and real estate practitioners

The real estate industry has faced a number of challenges in recent years, with housing unaffordability, driven by inadequate supply responses to meet housing demand supported amongst other things by low interest rates and government policies such as those aimed at increasing homeownership. Supply constraints are amplified by high transaction costs such as stamp duty which increases homeowners not committing to a given home/location.

Cities have suffered during lockdown as work from home mandates kept people and resulting economic activity, home based. As highlighted by the REIA Getting Real Report,<sup>52</sup> COVID-19 has accelerated an 'escape from the cities' mentality creating housing pressure in regional areas and offsetting effects in city high rise residential living.



In the previous sections we have examined how blockchain:

- could be used to reboot cities post COVID19 and democratise and enable innovative land use and urban planning strategies (Docklands DAO<sup>54</sup>)
- could assist the tokenisation of real estate assets and provide some efficiencies to increase liquidity in the real estate market moving towards democratising home ownership models for Australians and New Zealanders
- could increase property construction efficiency and supply
- could facilitate new property project finance models
- would improve opportunities for access to credit via DeFi
- creates new real estate backed secondary markets in DeFi

In this section we focus on the opportunities and possible disruptions blockchain can generate for real estate agent managed processes – sales and leasing.

To do this we will compare real estate process mechanisms to a current blockchain real estate platform to identify opportunities and challenges for real estate agents.

How can these new platforms create opportunities or disintermediate? To facilitate this we will focus on two of the (largest) and best known real estate applications:

1. Propy (sales)
2. Rentberry (leasing)

Local information and local partners are of great importance in real estate. Real estate agents must have geographic competency and understand the area.

<sup>52</sup> REIA Getting Real Report

<sup>53</sup> Digital CBD Report 2 The Docklands DAO





Let's consider what is expected from a real estate agent in the selling and rental process:

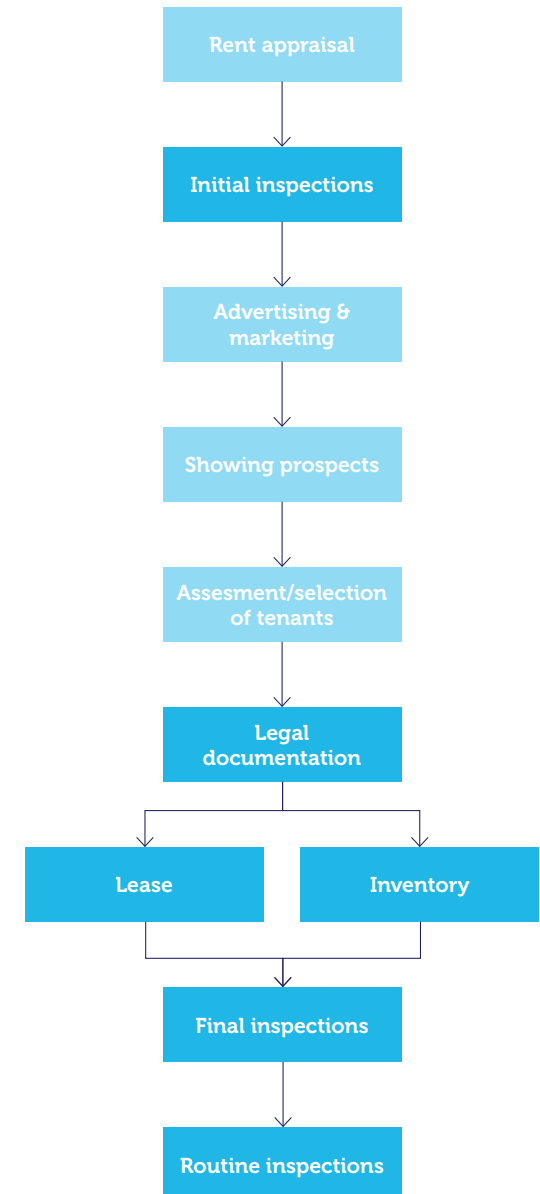
- Provide a comparative market analysis.
- Local Market knowledge – due diligence.
- Understanding best method of sale for the area.
- Ability to attract, screen and manage quality buyers and tenants.
- Collecting rent, bond deposits and ongoing maintenance, managing disputes and understanding jurisdictional legal environment and legislation for tenants and landlords.
- Facilitate open homes / viewings
- Convey offers, handle legal paperwork and facilitate negotiations where necessary
- Understand new technology (virtual tours etc).
- Open communication, trustworthiness, maintain strong professional reputation.
- Competitive marketing strategy.

Can blockchain facilitate a smoother service delivery or will blockchain via smart contracts reduce the need for real estate agent services?

## Sales agent



## Property manager



## 6.1 Challenges in conventional real estate services

Clients hire real estate agents for their local market knowledge and for help with managing the paperwork associated with a real estate transaction. However, in doing so both real estate agents and clients encounter numerous challenges in workflow processes:

- multiple transaction systems
- managing paperwork and associated privacy concerns
- limited ability to edit or track tasks
- transparency into all offers – trust
- universal participation of all involved parties
- legal due diligence – property history fragmented sales records

There has been a growth in cloud based digital solutions such as Moxtra to streamline process flows for agents.

Blockchain advocates would argue that transparency, privacy concerns, trust in multi-party engagement process and immutability of transactions remain unaddressed with centralised service models.

For example, clients are reluctant to share proof of funds and exchange paperwork with people they don't know personally or via emails, which could be easily hacked. Transaction documents are often shared to multiple parties through the settlement process often shared via non-protected links on Google Drive and Dropbox.

The COVID-19 pandemic and the inability of clients to sign paperwork in person, highlighted the importance of secure, private, and protected online environments to sign paperwork and exchange documents.

Propy and Rentberry have emerged as Do-It-Yourself blockchain real estate transactions platforms. The sale, purchase and leasing of properties through blockchain enables them to offer similar services to conventional real estate service providers.





## 6.2 Propy

Propy is a real estate transaction platform that makes property purchase transactions easier by bringing agents and consumers together in a secure online environment, using the Ethereum Blockchain. Propy is Silicon Valley based and offers blockchain services that enables a secure sales process online, from offer to title recording.

Propy made the world's first real estate transaction on blockchain in 2017 and in February 2022 executed the world's first homeownership transfer via a NFT. The 2,164-square-foot house in Gulfport, Florida, sold for US\$653,000 (210 ETH) at auction, with the winning bidder awarded a NFT as proof of the home's ownership.

The token is linked to the ownership of an LLC that owns the physical asset, not the housing deed itself. The NFT can then be used as collateral for crypto borrowers and investors. The company also implemented the world's first government approved title registry on the blockchain. The platform has processed over US\$1bn transactions in sales volume and aided thousands of home purchases.

Propy offers a Transaction Management platform which enables agents to track and manage the phases of a real estate transaction. Documents are uploaded to a secure environment and it eliminates the need for multiple systems and gives processes transparency, continuity, and consistency.

The platform offers a terminal to observe transactions in real-time, making the process transparent for multiple stakeholders including real estate executives, title companies, homebuilders, buyers, and REITs.

### 6.2.1 Competition to legacy real estate service providers

#### Property Purchasing:

Propy's platform uses blockchain technology to simplify purchasing a home and eliminates fraudulent transactions. The idea is to close a traditional real estate deal entirely online. This includes the offer, signed contract (using DocuSign), secure payment and exchange of the property title. Propy claims its platform saves ten hours of paperwork, per transaction.

#### Offer Management and Auctioning:

Propy offers services to parallel legacy real estate service providers through their e-platform for transaction coordination allowing agents to "accept, counter, or reject offers all on the same page" and share all offers with their seller directly & instantly.

#### Transaction Management:

Similar to conventional real estate agencies, Propy's platform offers to track and manage all phases of real estate transactions from managing documents and disclosure for auditing. Propy's transaction management system is focused on facilitating transaction coordinators who may be working with multiple agents/brokerages. It aims to eliminate the need for multiple systems and gives processes transparency, continuity and consistency.



## 6.3 Rentberry

Rentberry is a long-term rental platform that's utilising blockchain technology to streamline the rental process for tenants and landlords. In June 2019, the platform was available in more than 50 countries, including Australia, Canada, Germany, Spain, Italy. Using smart contracts, they provide unique features to users such as crowdsourced rental deposits and auctioned rental prices.

Rentberry's custom offer platform aims to help tenants and landlords find a common price more easily and transparently. Instead of landlords listing prices for their properties, tenants can participate in auctions for the properties they'd like to rent (although this functionality is constrained by jurisdictional legal constraints).



### 6.3.1 Threats to legacy rental real estate providers:

Rentberry is offering real estate investors opportunities to rent both residential and commercial properties to eligible renters. Rentberry's co-signers network operates as a crowdfunding platform for renters and investors with the aim of benefitting millennials internationally. Similar to traditional rental agreements, the tenant makes an upfront payment (10% of the overall security deposit), however, on Rentberry the tenant can crowd source the deposit and anyone who contributes can be incentivised with interest with the landlord will still receiving the full amount of the security deposit.

The network guidelines are designed to benefit both tenants and landlords. It includes having no need for a landlord to lockup this money and gives co-signers a chance to receive the interest up to 3-5%. Community members can help tenants by contributing funds to cover a portion of their rental security deposits in return for monetary rewards. Community members can make an educated choice on who to support based on rental history, reviews, and proprietary Tenant score. The use of smart contracts makes these agreements legally binding and automatically enforced. Additionally, all actions within the platform will be recorded on the immutable blockchain, giving landlords and tenants timestamped indisputable proof of payments, history and correspondence records.



### Tenant Screening:

Rentberry also competes with legacy real estate service providers in offering a tenant screening service. Without any delay or additional expense, Rentberry allows the ability to evaluate a detailed credit report of any prospective tenant.

This automated screening feature is completely paperless and assists in choosing a desirable candidate. Rentberry investigates millions of available records from both state and national databases. Once it's complete, an online report is generated instantly and sent to a landlord for review.

### Rental Payments:

Additionally, Rentberry mimics real estate agencies in providing rental payment solutions through various payment options (a credit or debit card, Apple Pay, or Google Pay) in 50+ countries while avoiding impediments associated with slow wire transfers and settlement delays associated with international transfers.

### Property Purchases:

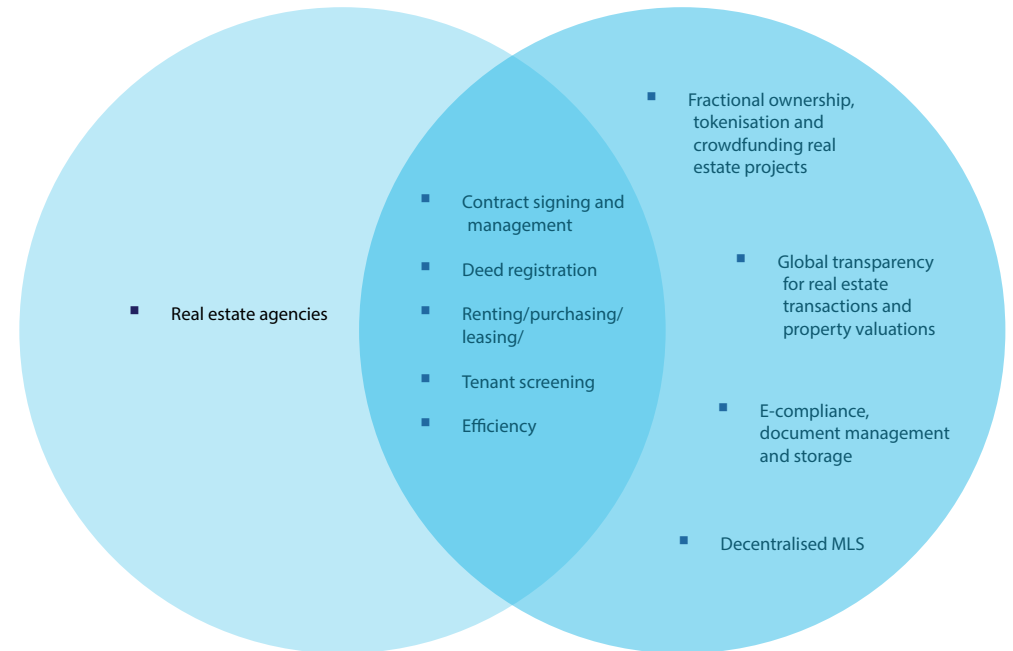
Rentberry's online property marketplace allows prospective buyers to interact with 360° video virtual tours and to digitally scroll through properties across various international locations.

To increase transparency for buyers, Rentberry employs an auctioning protocol. Prospective investors can customise offers based on demand and competition for a specific properties.

### Property Rental:

Rentberry is also competing with real estate service providers in managing property rentals.

Rentberry's proprietary scoring oracle adds another layer of transparency to renter and landlord profiles. The score is calculated as a combination of rental history, reviews and public information to build greater transparency between tenant and landlord. Smart contracts are used throughout the application process in order to automate legal agreements and negotiations and provide complete clarity for renters and landlords.



Rentberry/Propy vs real estate agencies





**Future**

**Directions**



## 7 Future directions

A number of future directions have been identified for the real estate industry that provide a pathway for future exploration and research:

1. Extended Reality (XR)
2. Property in the metaverse
3. Learn-to-Earn incentive models
4. Data Oracles – the potential for the REIA and REINZ to become the leading oracle provider for the industry

Extended reality is a broad term that encompasses both Augmented Reality (AR) and Virtual Reality (VR).

AR is the halfway point between reality and virtual reality, basically a blend of the two. Examples of this are Pokémon GO or IKEA's Place app, where you can virtually decorate the interior of your home using IKEA's catalogue.

Generally, these technologies have been used in the gaming industry or entertainment sector, but the real estate sector is now beginning to utilise this technology to sell and lease properties. Metricon is one of the first companies to take advantage of this and last year launched virtual reality tours for several of their display homes. This will help people still inspect homes with confidence during uncertain times and increase international investors' confidence when purchasing property. Additionally, Virtual Tours of property help renters, buyers, and agents save time when viewing properties. Additionally, it could potentially become a new form of entertainment where users can utilise these technologies as a more immersive form of "house porn" ideating on platforms like Zillow.



### 7.1.2 Property in the metaverse

The metaverse, which has come into the spotlight since Facebook's rebranding to Meta, is utilising VR and AR technologies to create a digital world, can be used to aid home inspections and better facilitate international property purchases.

XR is being used in combination with blockchain technology and NFTs to merge the physical with the digital world where gaming, socialising and commerce are intersecting.

Whilst this is currently a speculative industry, large players like Samsung, Adidas and PwC have bought property in the metaverse. Additionally, last year real estate sales in the metaverse were reported to have topped US\$500 million and are predicted to double in 2022.

Benefits include hosting applications, activity, or events on your land incentivising people to purchase property just like in the real world.

Digital storefronts have been built for users to purchase digital items such as clothes and accessories for their metaverse avatars.

Some of the most popular metaverse platforms are Decentraland and Sandbox, which host these 3D virtual worlds that are home to the virtual property.

With the current real estate market becoming oversaturated and pricing the younger generation out of a lot of the market, we may see people moving into the metaverse instead to chase some of the returns that the previous generations have enjoyed. However, it is unclear yet whether this industry will be sustained and is one to watch in the coming years.



### 7.1.3 Training and education (Learn-to-Earn)

Learn-to-Earn is a new mechanism emerging in the Web3 space that is rewarding people to take educational courses in cryptocurrency. Currently, this is a very nascent industry, and is used by decentralised finance platforms and centralised cryptocurrency exchanges to onboard new participants.

It is predicted that Learn-to Earn will influence the future of learning and will seep into incumbent industries, however the sustainability of these models is unknown.

There may be an opportunity for the real estate industry to utilise this mechanism to incentivise new real estate agents to enter the industry.

Whilst this is on the distant horizon, it is important to be aware of these new mechanisms to ensure the REIA and REINZ remain at the forefront of the industry.



### 7.1.4 Oracles

Oracles are a key piece of middleware and pertinent for smart contracts to be able to interact with the physical world.

The REIA and REINZ as aggregators of data, could position themselves as a trusted oracle provider to the real estate industry. This would help facilitate real estate transactions on the blockchain and create a hub of trusted data that the industry could access seamlessly through blockchain technology.

This would solve some of the transaction costs associated with sharing information. Additionally, it could create a new payment model for the industry when accessing data where users will pay for only the information they require.

#### Top real estate tokens used by the real estate industry



Propy PRO



vEmpire DDAO VEMP



Onooks OOKS



LABS Group LABS



Etherland ELAND



ATLANT ATL



IHT Real Estate Protocol IHT

The ideas in this section, provide some exciting avenues for further exploration.

Whilst these points are yet to be rigorously explored, they are areas to keep an eye on. The interest in XR and the metaverse has gained a lot of traction in the past couple of years and appear to be a great opportunity for the real estate industry.

Additionally, blockchain technology relies on accessing data that doesn't live on the chain – oracles are the bridge that solves this problem. New educational models to incentivise education could onboard new participants and create an industry that supports continuous learning.

Lastly, the real estate industry will need their own oracles to coordinate activity on the blockchain. As industry aggregators the REIA and REINZ are positioned well to fill this gap in the industry.

## 8 Appendix

### Appendix 1

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#### Consensus mechanisms

A consensus mechanism in a blockchain system allows distributed systems to work together and remain secure. Essentially the mechanism facilitates the co-ordination of information flow while deterring opportunistic behaviour. Theoretically an attacker can compromise consensus by controlling 51% of the network and therefore consensus mechanisms are needed to solve this security problem.

Some examples of consensus mechanism in use are discussed below:

**Proof of work:** eg Bitcoin. In this instance, block creation is done by miners who compete to create new blocks full of processed transactions, to do this they have to solve a math puzzle which produces a cryptographic link between the new block and the one that went before it.

**Proof of Stake:** is done by validators who have staked cryptocurrency (eg. Ethereum) to participate in the system. This is a lottery-based consensus algorithm. Nodes are selected randomly to validate transactions and create new blocks and earn rewards in the form of the token. This is computationally less exhaustive than PoW. The staking is the mechanism which incentivise healthy behaviour.

**Delegated Proof of Stake: (DPOS).** In DPOS users of the network vote and elect delegates to validate a block. This is done by pooling tokens into a staking pool and linking those to a staking pool.

**Proof of Capacity** is a consensus mechanism that allows users to decide mining rights and validate transactions into the blockchain with their computer's available hard drive disk space. Examples Burstcoin are [Chia](#), [Spacemont](#), [Storj](#).

**Proof of elapsed time (POeT)** process randomly and fairly decides the producer of a new block based on the time they have spent waiting. It is mostly used in permissioned blockchains like Hyperledger sawtooth. This consensus mechanism only works if the system can verify that no users can run multiple nodes and the wait time is truly random.

**Proof of Identity** compares the private key of a user with an authorised identity. Any identified user from a blockchain network can create a block of data that can be presented to anyone in the network. Proof of Identity ensures integrity and authenticity of created data. Additionally, [smart cities can use blockchain](#) consensus mechanisms like Proof of Identity to [verify the identity](#) of their citizens.

**Proof of Authority: PoA** consensus is essentially an optimised Proof of Stake model that leverages identity as the form of stake rather than actually staking tokens. In this scenario, the identity is the correspondence between validators' personal identification and their official documentation to help verify their identity. These validators stake their reputation on the network. In Proof of Authority, the nodes that become validators are the only ones allowed to produce new blocks. Validators whose identity is at stake are incentivized to secure and preserve the blockchain network.

**Proof of activity** Proof of Activity mechanism is the combination of Proof of Work and Proof of Stake. In Proof of Activity, the mining process is similar to POW . However, the blocks created in Proof of Activity mechanism containing only a header and the miner's reward address. Based on the header details a random group of validators are assigned to sign the block. The validators with larger stakes will have greater odds of being selected to sign a new block. Once the selected validators sign a new block, it becomes a part of the network.





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