



University of Oxford Research

# The Future of Real Estate Transactions

## Report Summary



## **THE FUTURE OF REAL ESTATE TRANSACTIONS:** *Technology, innovation and the real estate conveyancing process*

*“If you always do what you always did, you will always get what you always got.” (Anon)*

For many, this quotation could be fairly adopted as a criticism of a technology-averse and outdated real estate transaction process in England and Wales.

This summary report seeks to provide an objective view of the short to medium term potential for change. We highlight inefficiencies within the current transaction and conveyancing processes in England and Wales, we examine the reforms that are possible given recent and upcoming technological and social transformations, and we identify the blockages that are most – and least – likely to be overcome through digital innovation.

This report has been compiled with the assistance of Bryan Cave Leighton Paisner, CBRE, Reed Smith and Her Majesty’s Land Registry. We are sincerely grateful for their expert support and would like to thank all who have contributed to this report. We would like to clarify that any stated opinions, and any remaining errors, are our own.

This is a summary of the full document, which is available via <https://www.sbs.ox.ac.uk/research/oxford-future-real-estate-initiative>.

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The Oxford Future of Real Estate Initiative at the Saïd Business School is led by Professor Andrew Baum and is a collaboration between Oxford academics and industry-leading organisations that aims to advance knowledge in real estate. Our research is grounded in real-world business questions.

Any reference to specific companies or organisations does not constitute a recommendation and is included solely for illustrative or case study purposes. For a list of references and acknowledgements, please see the full report.

We welcome reader feedback and comments, which can be sent to us via e-mail at [realestate.reports@sbs.ox.ac.uk](mailto:realestate.reports@sbs.ox.ac.uk)

Andrew Saull and Andrew Baum

Saïd Business School

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[Read the full Oxford Saïd The Future of Real Estate Transactions report here.](#)

# 1. Introduction

Land shelters us, feeds us, and provides us with space for recreation, for shopping, and for work. With total global real assets valued at US \$238tn (Savills, 2017), land as an investment is a significant component of the global economy, accounting for between half and three-quarters of each individual economy's wealth (World Bank, 2004). How we as a society transfer ownership of this vital commodity is a matter of political and economic consequence. This report investigates how technology can help make this process faster and less expensive.

A commercial land transaction broadly consists of five clear processes involving a host of actors. Sellers and their agents are responsible for the *preparation period* and the *marketing period* required to establish an asking price and negotiate a deal. One set of solicitors acting for the buyer and another for the seller are then responsible for the conveyance, which is the administrative process by which rights over land are created and transferred, with funds moving in the opposite direction. This includes all necessary legal works during the *due diligence period* and *post-exchange period*. Finally, a land registry must collect land taxes and record the legal ownership during the *post-completion period*. The transaction process is then complete.

Advances in computer performance have created new 'digitised' methods of transacting real estate, currently prevalent in commercial conveyancing. Digitisation is the means through which we convert paper hard copies into unintelligent digital soft copies; data held within digitised documents are unable to be extracted through computer programmes and require human interpretation. In practice, digitisation can be thought of as scanning a page, uploading a photo, or creating a pdf, so as to have a digital copy of an original document.

By contrast, 'digitalisation' is the act of converting anything into a digitally readable format. Digitalised data enable computer programmes to automatically execute tasks without the need for human intervention. In practice, this means completing forms online to enable software processes to act upon the machine-readable, 'intelligent' information.

While many PropTech companies currently offer digitalised platforms which could streamline the property transaction process, the real estate industry is slow at adopting these new technologies, and it is arguable that the most significant transformation yet to take place is the normalisation of technologies which automate current manual procedures. For this to occur, a step beyond digitisation must prevail and the data upon which the industry runs must be digitalised.

With many within the industry calling for change, this report will first examine the current use of digitised technologies and outline the key causes for delay within a commercial property conveyance. It will focus on the extent to which emerging digitalised technologies could solve these causes of delay and speed the property transaction process, before revealing the barriers to adoption which exist for these emerging technologies. Conclusions will aim to highlight some of the pre-requisites needed before any real 'disruption' to the current process of a commercial property transaction can occur.

## 2. Conveyancing and registration processes

Land is a unique commodity: it is indestructible and immovable, and it is possible for many people and the public to have a multiplicity of interests over the same piece of land. Conveyancing is the practical application of land law, the business of creating and transferring rights in land. Her Majesty's Land Registry (HMLR) is responsible for recording the mapping and legal ownership in England and Wales in order to establish the legitimacy of any such interests.

The success of a property transfer can be measured by how closely the conveyancing process conforms to initial expectations, and the most important determinant of a successful property transfer is probably whether settlement occurs at its intended time. Expectations may be unrealistic, or intended time periods may be over-optimistic, but there is little doubt that delays (over-runs in transaction times beyond expectations) are a common feature of the current paper-based systems which operate around the world. In the UK, a report by The New Statesman (2018) found that delays occurred in close to 40% of all transactions surveyed.

A previous study into the commercial transaction process identified that, while the marketing period naturally takes the longest time, delays most often occur in the due diligence stage of a transaction (Crosby and McAllister, 2004). The use of debt was found to result in an additional due diligence process which could cause major delay or a re-assessment of the offer price. They also discovered that the value of the property has very little effect on how long it takes to sell and that the various components of the process are not correlated: a long marketing period is not followed by a long due diligence or completion period. There are also delays during the post-completion period connected with the processes by which we register new land ownership.

Inefficiencies in global registration systems have been characterised by the World Bank since 2013 under three separate categories: the number of procedures, the overall time taken and the cost as a percentage of total property value. In 2018, England and Wales was ranked 47th out of 190 global registries, requiring six procedures which took an average of 21.5 days to complete and at an average of 4.8% cost of the total property value (World Bank Database, 2018). Property transfer taxes contribute significantly to the illiquidity of real estate as an asset class and negatively to the World Bank score. Maximum efficiency property transactions require the abolition of transfer taxes and their replacement by annual property taxes, as recommended by many, including the Adam Smith Institute (2017).

In 2017/18, 94.9% of service requests to HMLR were placed in a digitised format through electronic channels (HMLR, 2018c). The majority of these requests are lodged as PDF documents which limits opportunities for process efficiency and cost improvements through automation (digitalisation). Scanned records, while a big step up from paper-based databases, still rely on manual interpretation to extract information.

The comprehensive and accurate identification of exactly which rights are recognized over exactly which parcel of land is a key challenge for conveyancers. While the UK government has been keen to categorise and tax property holdings, the process by which the buyer and seller get what they believe they have contracted for is not straightforward.

Those close to the conveyancing process suggest that the real estate conveyancing world has experienced more changes during the past 15 years than in the prior 300 years. The pressure for change is now constant. The establishment of a single system connecting all the agencies that supply

information involved in property transfers can ease the conveyancing burden for firms or individuals. This single portal system is what is generally known as 'e-conveyancing', where all documents needed for a transaction are accessible to parties in a transaction through a single online platform.

However, e-conveyancing has yet to take off in England and Wales as an internet-based solution to transaction delays as anticipated by HMLR's 2006 'Chain Matrix' pilot. Problems included a lack of critical mass, industry pushback and poor software integration. Chain Matrix proved that any system is only as strong as the weakest link, and any non-digital procedure will slow down the entire chain of transactions. A further e-conveyancing attempt from the Law Society in 2016 called VEYO also stalled, this time due to competition from start-ups outside of the conveyancing world. One global example of a functioning e-conveyancing platform is Australia's PEXA, which only achieved success after being mandated by the government.

The Chain Matrix and VEYO cases introduce a key thesis to the effect that profit-driven private businesses may be more likely to introduce radical change than established industry consortia, but PEXA shows that government action may impose change from above. The actions of all three actors (business, government and institutions) plus the public are all needed to contribute to radical change.

### 3. Causes for delay in the current transaction process

Data is fundamental at every stage in a property's lifecycle. When buying an asset, investors need information about building operations, cash flows, maintenance and capital expenses, potential risks, market assumptions, tenancy schedules and more. This data needs to be transferred efficiently from and to previous and current owners, legal advisors, property managers and others, but this process is commonly subject to inefficiency and delays.

At their most extreme, the perceived inefficiency of established practices include professionals re-digitalising already digitalised documents: printing from a digitalised file, and then signing, scanning and returning the paper document to a counterparty who uses lease information extraction technology to re-digitalise the necessary data. To what extent are these practices the major causes of transaction delays? Where are the bottlenecks in the transaction process?

To reveal the previously unexplored causes behind the delays in the current process of commercial conveyancing, we brought together HM Land Registry, two major law firms (BCLP and Reed Smith) and a leading real estate advisory firm (CBRE) to construct a process map outlining the individual steps required for the hypothetical transaction of a small office building. With 150 required actions identified, these seven identified causes for delay are those which represent the biggest current blockages to efficient commercial transactions.

#### *The preparation period*

This period begins with a trigger event – the vendor decides to sell. The vendor assembles the relevant data in consultation with his/her lawyer and real estate advisor or property manager and instructs the adviser or a third party to act as broker/selling agent and to prepare some marketing materials.

#### **Cause for delay #1: the vendor may not have maintained accurate or digital records of relevant information**

This first problem arises when the selling agent, in conjunction with the seller's lawyers, attempts to collect as much relevant, accurate, up to date information about the property as possible in order that an asking price can be set. This process may also help to reduce the transaction time and minimise the risk of a price chip, or worse still, an aborted purchase.

Data is often not readily available, is sometimes lost, and is held in numerous formats across several organisations. Some of this information will be outdated and found in the completion pack from the vendor's original purchase of the property. With many vendors providing information which has been stored in paper format, or composed of varied quality scanned documents, the extraction of relevant data can become a tedious, manual, unsatisfactory process.

Mistakes creep in when property managers or lawyers fail to read leases accurately and overlook critical dates and/or lease clauses. This will impact the tenancy schedule content and details. While the terms of leases often change over the duration of the tenancy, the lease schedule is rarely updated to reflect the revised position.

If the seller were required to warrant that the tenancy schedule is correct, this would serve as motivation to keep details up to date and a lot of the duplication of processes during this pre-sale stage could be avoided. But the seller is not required to do this – *caveat emptor* means that the burden

rests with the buyer.

### *The marketing period*

During this stage the vendor's agent makes the marketing data available to the potential buyers and their advisers. Prospective buyers will generally visit the property and may carry out non-intrusive surveys, but they may now also use drones, GPS and/or virtual reality to avoid the need for or to supplement visits. The seller's solicitors will make some basic information available to the potential buyers through the data room, a single portal connecting all parties involved in a transaction. Data rooms are currently the technology of choice for the commercial real estate sector.

#### **Cause for delay #2: inconsistent approaches to data rooms**

Even within an individual firm, many of the software packages used during a transaction do not match up. The lack of integration between the software used to produce spreadsheets and tables with that used for creating detailed legal information packs is compounded by individual firms having their own systems for logging the extracted information and uploading documents for file sharing.

Despite the best efforts of the seller's solicitor to consult their own historical database as well as all holders of relevant property information, there is still a view that the information provided will fall short of the information requested by the buyer's solicitor.

The lack of standardised format within data rooms leads to disorganised headings for folders uploaded by third parties. This makes locating any relevant uploaded information a more difficult process than is necessary. Differing software systems at individual firms may have blocks on downloading files whose names contain certain characters which do not meet the requirements of their cyber security firewall. This is particularly pertinent in cases where the seller's solicitor does not have the capabilities to host a data room and instead uses a generic file sharing platform such as Microsoft's Dropbox.

### *The due diligence period*

During the due diligence period, the buyer's legal team runs searches of utility providers, local authorities and others who hold or may hold information relevant to the value or future utility of the property. They will normally use a specialist agent to do this (a firm such as Search Acumen, for example).

#### **Cause for delay #3: performing adequate searches via under-resourced or non-motivated authorities and utilities companies**

The search process may create significant delays. This may be due to inefficiency and under-investment in record-keeping; cutbacks in the government funding of local authorities; or a lack of motivation where the search fee (if there is one) does not cover the work involved.

Every property deal requires the same basic set of standard searches, while more complicated properties and transactions will require additional information. A wide range of data needed for either scenario is held by third party organisations, the majority within local governments' land charge departments. Depending on the operational structure of these different departments, each unique to the local authority in which the property is located, this information could be held in a manner of mixed formats.



Necessary search information still needs to be individually requested from each department in order to achieve the degree of due diligence required for a property transaction.

#### Cause for potential delay #4: identifying the correct parcel: no single, true plan

Because HM Land Registry is not digitalised, there are inconsistencies between the paper and/or digitised maps held by HMLR, the plans given to conveyancers, the parcels of land identified on any site visit and the boundaries provided by geolocation or satellite imaging technology.

Establishing authoritative data is compounded by HM Land Registry's use of the *general boundaries* principle. Historical registry techniques identified these general boundaries using a pencil outline drawn upon a low-resolution map. Subsequent manual copying of these historical maps along with more modern digitisation and subsequent transference between online data rooms has created the potential for varied interpretations of the same 'truthful' boundary.

There are several ways to locate a single parcel of real property, regardless of any boundary variations, such as postal address and post code, grid reference, Land Registry identifier, Unique Property Reference Number (UPRN), or utilities account reference numbers. None of these is precisely fit for the purpose of connecting boundaries with ownership.

#### Cause for potential delay #5: completing standard enquiry forms: caveat emptor

Standard Enquiry Forms or CPSEs were introduced in 2002 to reduce bottlenecks during the due diligence period. They provide an interesting case study in the context of this report.

The rationale behind the CPSEs is that if known information about any potential risks involving the transaction of the property were disclosed by the seller prior to exchange of contracts and as a part of their readiness for sale process, this would speed up the due diligence process on the buyer's side and create a more efficient timeline by avoiding any late re-negotiations. The CPSEs should also reduce the time and effort necessary in transactions burdened with a lack of transparency, while also reducing the number of uncompleted transactions.

Disappointingly, CPSEs have served to cause further unwanted bottlenecks, due once again to the nature of the responsibilities imposed by *caveat emptor*. Although sellers do have a duty of care not to misrepresent any issues that affect the property, some sellers lack the motivation to go through the burden of attempting to locate information relating, for example, to fire safety deficiencies or the presence of asbestos and potentially reducing their negotiating power. Although there is still a risk of misrepresentation, many enquiries on this form are completed with terms to the effect of "the buyer should rely upon its own searches and enquiries".

#### Cause for potential delay #6: reviewing and reporting using non-integrated software

In reporting to the client, the buyer's solicitor will consolidate all necessary information into one report including planning advice, rights of and burdens on the title and key information on the occupational leases. Extracting the relevant information for this report once again throws up the issue of data formats.

The siloed operations of each party within a transaction has led to the growth of specific technologies focused on one specific aspect of a real estate transaction, showing little understanding or consideration for other, related industries' data requirements.

While technology has been designed which can smooth certain operations, many tasks still rely on archaic platforms, designed with no real estate specific purpose. Many additional enquiries have no



standardised structure or platform and instead rely upon an individual's preferred habits and often the use of Microsoft Word and Outlook.

The most up to date, and by no means universally used, lease information extraction technologies use machine learning systems to identify the relevant terms and clauses from a contract to create a digitalised, machine readable copy, saving human data inputting time and error. However, these systems are unable as yet to deal effectively with complexity. Crucially neither do they register (at any meaningful level) with similar technologies on the agency side of the transaction.

### *The post-exchange period*

In many transactions there is a period of time between exchange of contracts and completion/closing/settlement. During this post exchange period the parties will have time to comply with any conditions precedent (conditions that must be complied with before completion can take place). This will often include gaining the consent of a third party to the transaction. They will also tidy up administrative details and accounting records, agree completion apportionments and move money to the right place in readiness for completion.

### *The post-completion period*

After completion, Stamp Duty Land Tax is required to be paid within 14 days of completion. Title is then registered using HMLR form AP1, generally submitted electronically by the purchaser's solicitor. HMLR aims to return this form within five days.

#### **Cause for delay #7: filing for registration: a lack of transparency over requisitions and delays in registration**

When a transfer of ownership takes place, it is required by law that the new ownership of the property is registered with the government through Her Majesty's Land Registry. This process is done through the online portal or business gateway provided by the Land Registry.

To ensure the validity of any transfer of title, HMLR must first run checks on the information provided and consult their database for any prior issues (for example, disputes between previous owners) which have not been resolved and which may prevent them from legally registering a new owner. HMLR must also deal with applications in the order in which they are received – this means that complicated titles can often create large backlogs. Where title registration cannot be validated and therefore processed, a query known as a requisition is raised of the buyer's solicitor.

While requisitions relating to the incorrect completion of required documentation are generally easily resolved, a key frustration for the conveyancing community is with the delay in receiving a substantive response to an application and perceived inconsistencies in the approach taken by HMLR, coupled with a lack of practical guidance to allow solicitors to prepare applications in such a way as to avoid the requisitions in the first place. There are also issues when third parties refuse to give consent for the evidence required to clear titles of historic charges and encumbrances. Free-format requisitions are those which cannot be easily categorised and currently make up 25% of all cases (Robertson, 2017).

A major implication of this delay between completion and registration (often referred to as the 'registration gap') is that during this period the new owner is not able to raise debt or finance the property, and holds no official rights over its occupation. So common is this delay that clauses exist in most contracts for the seller (and registered legal owner) to act on behalf of the buyer while the

requisitions are dealt with.

### *Causes for delay: analysis*

The most causes for delay exist within the due diligence period of a commercial real estate transaction.

Current levels of technology within the commercial conveyancing profession do little beyond digitising the current workflow, offering a more efficient transfer of information than a paper-based process, but not currently capable of automating more arduous tasks. It is evident that many of the causes for delay represent either a data storage or transfer issue.

All participants in the mapping process agreed that an openly accessible, single pool of up to date, standardised property information could reduce most of the causes for delay highlighted, although concerns over the implications this would have for data security would remain.

It was suggested that not all information need be standardised, but if each property carried with it an industry-defined set of required up to date information, this would be a good start. This information could be traded along with the title of a property and form a necessary foundation upon which technology can be iteratively laid. This leads to ideas about 'property passports' or data 'log books', where all the information relating to an individual property is stored its own unique digital data file.

However, the impact of technology will (in the absence of top-down regulatory change) be restrained by old-fashioned risk aversion and conservatism. If we can imagine the veracity of the data held in a property passport being guaranteed and backed by insurance, then the due diligence phase may be significantly quicker. Insurance packages will seek to provide protection against false or missing information. Lower insurance premiums could be offered to landlords in exchange for accurate information, enabling a more accurate predictor of risk. Similarly, enhanced terms could be offered by lending organisations who have a vested interest in compiling as much accurate and up to date information about a property as possible.

## 4. Applicable technology

In Chapter 3, we identified the causes for delay in commercial real estate transactions. It is clear that removing these bottlenecks would speed up property transactions. The aim of this chapter is to explore how this may be achieved. Amongst others, Dijkstra (2017) points us towards digital technology: *“Contracts, transactions, and the (associated) records ... are fundamental for the commercial real estate industry. However, the management of those assets has not kept up with the economy’s digital transformation.”* (Dijkstra, 2017).

Before we embark on what may appear to be an optimistic vision of the near future, we should attach a couple of reservations. First, some of the potential solutions are being developed specifically for the high street conveyancing firms and the commodity-like residential markets. Second, the size and complexity of larger institutional transactions, and the capital sums involved for both equity and debt investor, may severely limit the appetite of the major actors to transfer risk management measures away from trusted human and towards machines.

Notwithstanding these reservations, we believe that the correct regulatory environment coupled with a group of currently available or emerging technologies could facilitate an openly accessible, single pool of up-to-date, standardised property information, which will act as a foundation for more efficient transactions. In this chapter we will draw on an extensive literature review and interviews to highlight the operational, regulatory and social barriers which need to be overcome before technology can flourish.

There are several technologies which might be applicable in the broader transaction process. These include automated valuation models; satellites and drones allowing boundaries and property conditions to be inspected through emerging imaging methods and location data; lease information extraction software using machine learning image recognition software to digitalise hard and soft copies of documentation required for the transaction process; virtual and augmented reality for efficient inspections. Those which we have identified as having the largest potential to fully resolve one or many of our identified causes for delay are: blockchain-based transaction platforms; property passports; and blockchain land registries.

### *Blockchain transactions: smart contracts*

Deloitte (2017) state that a serious inefficiency under the present conveyancing process is that *“auditors, banks, financial authorities, appraisers and owners each individually have to validate the data which they receive. All these validations result in higher transaction costs in the brokerage, legal, recording, and banker fees”*.

Blockchain has the capability to transform all global ownership records and transaction processes for every conceivable asset type. It has spawned a generation of apostles within real estate, in part due to its ability to power ‘smart contracts’.

A ‘smart contract’ is the name given to a piece of computer code that is capable of monitoring, executing and enforcing an agreement (Szabo, 1996). It has been suggested that smart contracts, in conjunction with blockchain technology, would be a way of revolutionising real estate transactions. For example, a smart contract could simultaneously transfer funds from buyer to seller while registering the buyer as the new real estate title holder once all contracts had been digitally signed, exchanged and validated.

Residential-focused smart contracts are being piloted to varying degrees of success by start-ups ChromaWay in Sweden, and Propy, predominantly facilitating cross border transactions, as well as HMLR in England and Wales.

ChromaWay, based in Sweden, has developed a private blockchain-based transaction system to eliminate the need for individual data verification. Under their system, a live demonstration of a fully integrated blockchain transaction was revealed on June 2018 in Stockholm. Two key barriers emerged from this process. The first involved problems around identity verification, with the demonstration using existing centralised technology to validate signatures throughout the chain of transactions. The second related to the legal recognition of blockchain-based contracts, with the necessary contracts still needing to be converted into an EU standard format to be independently evaluated.

Propy are one of several companies credited with the world's first ever blockchain-based property transaction. However, at present, Propy are obliged to follow the existing structure of a real estate transaction while recording each phase in a parallel blockchain process. While this is a necessary iteration to help gain trust in the underlying system, the duplication of processes currently occurring with blockchain property transactions eliminates a lot of the potential efficiency gains of this new technology.

Differing legal systems in the jurisdiction of the buyers and seller in a transaction, with few, if any, registries legally recognising blockchain-produced ownership titles in the form of hashes, have created serious blockages to the progress of both ChromaWay and Propy's model.

Digital Street is an HMLR initiative in England and Wales investigating the potential for blockchain to enable users to sign an agreement and deliver the transfer digitally. This process can remove the duplication of ID verification from the buying and selling process (currently a buyer might have to prove her identity to both her lawyer and her mortgage lender). Additionally, the initiative is intended to show that smart contracts can speed automation, for example to move funds and to update the land register (Ledger Insights, 2018). Originally the plan was for HMLR to complete research and development by March 2019, but progress has been slower than scheduled and the timeline has been delayed.

Blockchain-based smart contract transactions are unlikely to become a reality any time soon as this would require the development, use and interaction of blockchain-based systems for all parties in a transaction including registries, banks, buyers and sellers, while there also exist significant difficulties in writing the complex and specific legal requirements of any individual transaction into the code of a smart contract.

### *Property passports: IoT and BIM*

The idea of a property passport is a simple one: to store all the information relating to an individual property in its own unique digital data file, to be maintained by the owner or tenant and transferred along with the title. Some proponents argue that tying the data required for a transaction to the plot of land to be traded in the form of a property passport, rather than distributing this data to and across owners and adviser, could be the most important idea currently being developed.

Attempts have been made in the past to create an industry standard where all information is provided upfront to reduce abortive transactions, such as Home Information Packs (or Sellers Packs) in 2007. This scheme was aborted in 2010, doomed by the principle of *caveat emptor*.

A buyer's solicitor will only rely on a seller's information if the seller is prepared to guarantee the accuracy of that information. In the event of an error in that information, which leads to loss, the buyer will have a recourse against the seller. Similarly, unless the seller is prepared to guarantee the accuracy of its information to a lender, the lender will do its own due diligence to mitigate risk. So property passports will need to be insured.

While iterative steps towards a property passport can be made using current technologies, a comprehensive and transparent property passport will require the integration of many emerging technologies, namely Internet of Things and Building Information Modelling, sitting within the broad smart building buzzphrase.

The smart building movement is based around the ability of technology to record and act upon the data produced within any property. In order for operational efficiency gains to be made, there needs to be a way to capture the data required. Micro-sensor technology provides the toolkit with which emerging PropTech companies have begun to experiment. The real value for the real estate industry comes in the connectivity between the individual sensors and platforms employed by and within an asset. This connectivity between devices and sensors of any sort has been labelled the 'Internet of Things' or IoT.

Another increase in real estate information transparency could come with the further development of Building Information Modelling (BIM) technology. In essence, BIM can be thought of as a digital simulation or 'twin' for any asset, initially associated with the architecture and construction industries but increasingly used throughout a building's lifecycle.

If the development of a comprehensive property passport comes to fruition, it is easy to see how IoT and BIM could be used to automatically deliver real time data relating to the physical condition and functioning of a building. However, the impact of IoT and BIM on transactions will be limited to new buildings for some time. Much of the information on historic developments will be unavailable or held in incompatible formats, and the task of retrofitting is unlikely to be cost effective.

It is unclear how these new product offerings intend to get around the problems posed by *caveat emptor*. Any inaccuracy in the data held in a property passport would lead to a claim against the vendor which would have to be backed by an insurance contract.

### *Blockchain land registration*

Blockchain has the potential to offer a wide range of benefits over even the most advanced current systems of land registration. If blockchain land recording is further developed, the real estate market could become more transparent as the availability and quality of real estate data will increase. The increased liquidity realised from open access to trusted, accurate data could radicalise the way in which we see real estate transacted. The need for title insurance will be reduced, as proof of ownership can be established indelibly on the blockchain. The creation of more complete and reliable property records will provide a valuable tool for analysts, regulators, and land management officials.

The nature of blockchain – a series of data blocks, linked in a chain, implying sequential additions of data every time an asset is sold – appears to mirror the deed system. It is possible, therefore, that blockchain adoption should be expected in countries using deeds rather than the UK common law title system as proof of land ownership. There is no central register of Bitcoin ownership; legal entitlement is evidenced by the last transfer, as with the deed system.

While in principle blockchain technology offers many benefits to the land registration process with positive knock on effects for the real estate industry, procedural elements still need to be addressed. Graglia and Mellon (2018) highlight some of these elements, listing seven pre-requisites needed for any successful blockchain land registry. These are: an identity solution, digitalised records, multi-signature wallets, a private or hybrid blockchain, accurate data, connectivity infrastructure and a technology aware population, and a trained professional community.

Recent blockchain-based land registry pilots in Cook County, USA and Pelotas and Morro Redondo municipalities of the state of Rio Grande do Sul, Brazil, have encountered problems of a lack of critical mass, opposition from officials who feared being replaced, and the high costs associated with implementation.

In England and Wales, while HMLR may be vulnerable to human error, the same will be true of distributed ledger technology. The Chief Land Registrar has some authority to rectify mistakes, and if the mistake is beyond his or her power then application can be made to the appropriate judicial body. It is unclear how this would work with a distributed ledger.

While not covered by our commercial causes for delay, fraud is a major problem for residential conveyancers. It is unclear how distributed ledger technology on its own could guard against fraud. One of the criticisms of the New Zealand land registry, which is more advanced than HMLR in terms of its digital technology, is that it has made itself vulnerable to fraudsters. It is unclear how a fraud will be unwound if the blockchain is treated as the 'one source of truth'.

Further, in England and Wales, property rights can be created informally. An example of this is proprietary estoppel, which arises when one party has relied on another's representation with regard to a piece of property. It is thought that blockchain would not be able to accommodate this valuable mechanism, just as it would not be able to address issues such as rescission for misrepresentation or undue influence. Clearly, there would be a need for flexibility to be built into the architecture, so that judicial orders could be given effect. This, however, is at variance with the ethos of the blockchain where the code is the law. Just as with HMLR, blockchain architects will have to find a way to accommodate the difficulties of the description of rights over property and their inherent complexity.

### *Technology: a summary*

The following graphic shows the applicability of different technologies to our identified causes of delay. We should stress that where we have identified the applicability of any technology, this does not mean that the cause for delay will be fully resolved, only that the given technology may help to streamline the process.

As we can see from this analysis, the property passport concept seeks to resolve most of the causes for delay in the commercial transaction process, and our analysis would indicate this is the biggest enabler of real estate liquidity currently being developed.

The cause of delay with the greatest quantity of applicable technology is #1: the vendor may not have maintained accurate or digital records of relevant information. This is closely followed by our cause for delay #5: completing standard enquiry forms: *caveat emptor*. This is likely due to the fact that the same technologies which seek to provide transparency and accuracy surrounding the condition of a property are replicable in both the marketing period and for completion of the CPSEs.

	Blockchain transactions: smart contracts	Property passports: IoT & BIM	Satellites & drones	Lease information extraction	AVMs & instant mortgages	VR/AR	Digitalised land registry: chatbots	Blockchain land registration
#1: the vendor may not have maintained accurate or digital records of relevant information	✓	✓	✓	✓	✓	✓	✓	✓
#2: inconsistent approaches to data rooms	✓	✓		✓				
#3: performing adequate searches via under-resourced or non-motivated authorities and utilities companies		✓				✓	✓	✓
#4: identifying the correct parcel: no single, true plan		✓	✓				✓	✓
#5: completing standard enquiry forms: caveat emptor		✓	✓		✓	✓		✓
#6: reviewing and reporting using non-integrated software	✓	✓						
#7: filing for registration: a lack of transparency over requisitions and delays in registration							✓	✓

Figure 1: The applicability of technology to our causes to delay in the commercial transactions process



## 5. Barriers to the adoption of technology

There are several technologies which are being developed to reduce the time and cost of an average property transaction. However, the existence of a relevant technology alone does not automatically lead to its implementation. Regulation, innate conservatism, and a perfectly reasonable reluctance to commit to untried innovations all play their part in holding back change.

In the case of complicated, institutional sale and purchase transactions, conservatism appears easily justified. With larger commercial transactions, the negotiation of contractual terms may be protracted, and due diligence contains many additional variables. Combined with this are the legitimate concerns of the lenders who construct sophisticated, deal-specific lending packages. The same may not be the case for residential transactions, where there is less variation in property types and financing structures.

The barriers to the adoption of applicable technologies can be categorised as operational, regulatory and social.

Operational barriers identify the process changes needed in either the legacy systems of the real estate industry or the platforms developed by technology start-ups.

Regulatory barriers highlight the legal issues which new technologies have overlooked, or issues which the industry must confront in order to deliver successful technological adoption.

Social barriers relate to the more behavioural and emotional limits to the adoption of any new system of transacting property.

We gathered evidence of these barriers to adoption through conducting interviews with a group of start-ups and a second group of real estate technology professionals. Any similarities in the perceived barriers common to each group we took to be significant.

### *Operational barriers*

Software process integration: any new system must integrate with existing legacy practices and software.

Standardised digital data: there is a need for up to date, accurate digitalised data before technology can bring efficiencies.

Critical mass: efficiencies are only realised once a new system becomes widely used. One legacy actor in a transaction can reduce the whole process to analogue techniques.

Transition costs: there is considerable financial expense in upskilling the existing software, hardware and labour force. Technologies should not simply focus on the adoption of a new system but must also concern themselves with the difficulties in discharging the old.

Data security: it is vital to ensure that new systems are resilient in the event of physical disaster or cyber-attack.

### Regulatory barriers

Legal framework: any solution must not bypass existing legislation, while there is a need to ensure current legislation is not stifling innovation.

Technology transparency: technology solutions must be transparent as to their data sources and the reasoning behind any outputs.

### Social barriers

Damaged revenue: new technologies attempting to bring process efficiencies must do so to the financial benefit of their target users. The long term financial benefits a technology can bring must be clearly understood.

Risk of disintermediation: we need to develop a clear understanding of the winners and losers of any new technology, with aligned incentives for potential adopters.

Trust in innovation: there is a lack of trust based on a lack of understanding of new technology solutions which are able to bring increased efficiency to certain stages and processes. The misuse of data by multinational social media businesses, and healthy suspicion about the dangers of fuelling potential data monopolists, holds back many private sector data collaborations.

Collaborative attitude: real estate organisations are unwilling or unable to allow open access to their data.

### Analysis of findings

The graphic below uses a traffic light system to highlight whether we perceive that a previously identified applicable potential technology has managed to overcome our identified barriers to adoption.

		Blockchain transactions: smart contracts	Property passports: IoT & BIM	Satellites & drones	AVMs & instant mortgages	Lease information extraction	VR/AR	Digitalised land registry: chatbots	Blockchain land registration
Operational	Software process integration	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
	Standardised digital data	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
	Critical mass	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
	Transition costs	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
	Data security	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
Regulatory	Legal framework	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
	Technology transparency	Yellow	Green	Green	Red	Yellow	Yellow	Yellow	Green
Social	Damaged revenue	Red	Yellow	Green	Red	Green	Yellow	Yellow	Green
	Risk of disintermediation	Red	Yellow	Green	Red	Green	Yellow	Yellow	Red
	Trust in innovation	Red	Yellow	Green	Yellow	Green	Yellow	Yellow	Red
	Collaborative attitude	Yellow	Red	Green	Yellow	Green	Yellow	Yellow	Green

  

Has the technology overcome the barrier?	No	Somewhat	Yes
	Red	Yellow	Green

Figure 2: The extent to which applicable technologies have overcome barriers to adoption

From this analysis, those technologies which face the lowest remaining barriers to adoption and are therefore most likely to impact the commercial transaction process in the near term are:

- *Satellites and drones* - allowing boundaries and property conditions to be inspected through a multitude of emerging imaging methods and location data.

- *Lease information extraction software* - using machine learnt image recognition software to digitalise hard and soft copies of documentation required for the transaction process.
- *Virtual and augmented reality* - using image capture software to enable interactive, remote inspections and viewings.

The biggest barrier to any wide-scale adoption is the operational issue of an absence of standardised digital data. This barrier has yet to be overcome by any single technology. This is closely followed by the social risk of disintermediation and operational problems of data security.

Having identified the technologies most probable to streamline the transaction process in the near term, we can refer to their applicability to our causes for delay and hypothesise where the transaction process will likely become more efficient.

	Satellites & drones	Lease information extraction	VR/AR
#1: the vendor may not have maintained accurate or digital records of relevant information	✓	✓	✓
#2: inconsistent approaches to data rooms		✓	
#3: performing adequate searches via under-resourced or non-motivated authorities and utilities companies			✓
#4: identifying the correct parcel: no single, true plan	✓		
#5: completing standard enquiry forms: caveat emptor	✓		✓
#6: reviewing and reporting using non-integrated software			
#7: filing for registration: a lack of transparency over requisitions and delays in registration			

Figure 3: The applicability of the most imminent technologies to the causes for delay in the commercial transaction process

We can see that our cause for delay #1: - the vendor may not have maintained accurate or digital records of relevant information - is most likely to be resolved in the near term.

It should once again be noted that this chart only identifies which of our identified causes for delay are most likely to be resolved through the adoption of emerging technology, which are not representative of any full transaction period. By way of example, causes for delay #3-6 all take place during the due diligence period.

Extrapolating this analysis to cover our five periods of any commercial transaction, we can infer that imminent technologies are most likely to shorten the *preparation period* and the *marketing period* in the near future. The due diligence phase is the hardest to disrupt.

## 6. The drivers of change

Proptech has the potential to increase market transparency, improve liquidity and bring lower transaction costs. This could have a positive impact on the value of investment assets.

A fully digitalised HMLR could connect all the agencies involved in an individual conveyance, enabling the frictionless access, transfer, automation and validation of required information. This would reduce the reliance on human processes and cut out many of the transaction bottlenecks caused by disparate sources of information. However, HMLR is still in the process of digitising; full digitalisation technologies are being trialled, but full digitalisation is a long way away.

The most talked about technology in the context of real estate transactions is blockchain. Blockchain advocates suggest that it promotes efficiency, trust, security and resilience in the context of current land title recording methods. However, blockchain is clearly over-hyped, would take decades to become established and brings with it many new challenges primarily to do with trust. Meanwhile, practitioners like to grumble about HMLR, but there are no issues of trust regarding HMLR as an institution - if losses are suffered due to HMLR negligence, then HMLR has a statutory duty to compensate the service user.

While fully automated, peer to peer, cross border real estate transactions could be facilitated by the use of blockchain conveyancing software, transactions must comply with existing legislation. At the moment, all we have are pilots and tests under laboratory conditions.

Less radical technologies seeking to digitalise the information needed for the transaction process are having more success, albeit for more specific procedures. These include in particular the property passport, but also (and including) the internet of things, building information models, geospatial technology, artificial intelligence and machine learning.

In the quest to generate a single pool of up to date, standardised property information, investment is needed to first create standardised, digitalised data. As with the wider economic digital transition, real estate regulation and data transformation will be driven by one of four major forces: top down from government regulation, bottom up from tech businesses tending to monopolise, via business and trade associations, or via public democratisation.

Whichever succeeds will determine whether this single pool of standardised property information is either open access for the benefit of the market and the public or held by a private monopoly which will likely exploit its power for commercial gain. Examples of ambitious property data businesses include CoStar, VTS and Stessa. What would happen if Amazon or Facebook were to make a move into the commercial real estate market? The new, tech-enabled world is creating a pointed and general challenge to modern business and society in general. Will we allow technology-owning monopolies to grow and control us (Susskind, 2018)? Or will we rely on mechanisms of social order which govern the behaviour of a set of individuals within a given community, building regulatory institutions identified with a social purpose, mediating the rules that govern living behaviour?

## 7. Summary

In the pursuit of efficiency, it is important to ensure the systems by which real estate – the primary capital resource of any economy - is registered and conveyed are transparent, secure and quick. Those economies best able to harness the economic and social benefits which come with a high quality of land administration and transference have simple fast-track procedures, low transfer taxes, fixed registration fees, digital registries and time limits for administrative procedures.

The UK is currently ranked 47<sup>th</sup> out of 190 global economies on the World Bank's Ease of Registering Property Index, requiring six procedures, which take an average of 21.5 days to complete, at an average of 4.8% cost of the total property value. Stamp Duty is clearly a large component of this measure. Maximum efficiency property transactions require the abolition of transfer taxes and their replacement by annual property taxes, as recommended by many, including the Adam Smith Institute (2017).

Proptech has the ability to bring increased market transparency, liquidity and bring lower transaction costs. This should positively impact the value of investment assets. The digitalisation of both data and current processes is evident within the emerging technologies attempting to embed themselves into the transactions process. Digitalised data enables computer programmes to automatically execute tasks without the need for human intervention. At its most ambitious and radical, the technology world imagines a single, distributed system of recording real estate ownership and transactions - the blockchain world – as the ultimate solution. This blockchain world is decades away, and may never happen unless it is mandated by regulation and/or supported by industry groups.

Within the commercial real estate sector, technology is digitising the current workflow, offering a more efficient transfer of information than a paper-based process. However, the lack of comprehensive digitalisation limits the automation of more arduous tasks. This has led to seven key causes for delay in the transaction process, which all broadly represent a data storage or transfer issue. An openly accessible, single pool of up to date, standardised property information could reduce most of the causes for delay highlighted.

An example of standardised property information is the property passport, a digital file containing the legal and physical data relating to an individual property, held and transferred along with its title. The idea of a single property information database somehow attached to the plot of land to be transacted is currently also being explored through the use of geospatial technologies. Using mapping and satellite technology it is possible establish an irrefutable plot boundary identifier upon which to link its legal documentation. Clearly, despite many start-up businesses evangelising about their vision, only a centralised land registry can drive this degree of change.

There is, however, a clear split in the transaction process between the digitally-sensitive preparation and marketing phases, easily capable of digital disruption or innovation, the due diligence phase, which is less easily disrupted thanks to the caveat emptor principle, and the post-exchange and registration phases, which (even assuming considerable government funding and commitment) will take a long time to be digitalised.

In the preparation and marketing phases, the nexus of many technologies developing in parallel will truly 'disrupt' the transaction process. It is conceivable that at some point in time we will rely on automated valuation models with access to digitalised IoT and geolocation data held alongside ownership rights held in a property passport. Virtual reality inspections and viewings would help in

removing risk and uncertainty from buyers, who will need to offer a price close to or at the AVM estimate. Sellers will have no reason to expect a different price and this first phase of the process will look very different in 2030.

However, when we move on to consider the due diligence phase, the impact of technology will (in the absence of top-down regulatory change) be restrained by old-fashioned risk aversion and conservatism. *Caveat emptor* adds a hugely powerful dose of realism when a pension fund is acquiring a very complex commercial property. To reverse this would require a change in contract law - a little unlikely for such a fundamental and deeply-embedded principle - or an institutionally-agreed innovation such as an economical and standardised insurance product. For less complex residential property, if we can imagine the veracity of the data held in a property passport being guaranteed and backed by insurance, then the due diligence phase may be significantly quicker.

Finally, the transfer of title recorded by a digitalised land registry could be rapid, trustworthy and secure. However, this will require a lot of patience, funding and government will.

The existence of relevant technologies which propose to reduce the time or cost of an average transaction does not mean that they will automatically be implemented. Operational, regulatory and social barriers to their adoption must first be overcome.

Start-ups working on highly specific process improvements coupled with data-sharing industry associations and groups, supported by motivated and educated government agencies will help to shorten the time taken to buy and sell real estate; but it is highly unlikely that a new start-up introducing digital technologies will have a radical impact on the transaction process due to the many barriers which still exist.

## 8. Conclusions

In the quest to facilitate an openly accessible, single pool of up to date, standardised property information, investment and innovation will be needed by four groups: government, private businesses, industry associations (institutions) and the public.

It is unlikely that any single group can – or will be allowed to - drive this change alone. Governments have limited budgets (although switching from a transaction tax such as Stamp Duty to an annual property tax might help). Private businesses amassing large digital datasets and tending to monopolies are likely to become increasingly unpopular and subject to pushback. Collaboration will be needed.

Government will need to continue to encourage the digitalisation of national and local authority records and to define clear regulations surrounding real estate data ownership.

Businesses will continue to innovate ways of extracting and transferring digital data across platforms, and creating products which will encourage transaction efficiency (for example insurance backed property passports).

Industry groups will develop standards and protocols encouraging common standards for digital data and record keeping, including the intelligent application of distributed ledger technology.

The public – all of us – will need to develop a much clearer sense of responsibility for collecting and storing data describing our most valuable assets, and a much better sense of the value of this data. This is a basic requirement before we can talk about democratisation.

Some countries are better placed than others to implement new technologies. They have embraced digitalisation partly because they have shorter and less complex ownership histories. That does not describe England and Wales, or the UK as a whole.

Human beings will protect themselves in a *caveat emptor* world by talking their time and being thorough in the research process before committing large capital sums. Until we arrive at the instantaneous transaction, buyers and sellers will wish to pay professional advisors for risk mitigation and, on occasion, risk transfer. Robots dealing with other robots and AI will feel less constrained by risk, but robots need digital data. In England and Wales, in the interim period between the current day and the instantaneous transaction, we will therefore have to digitalise all data, including the precise digital mapping of what are currently general boundaries, removing all disputes and thereby avoiding any need for requisitions of more data.

Blockchain – a limited, private version of a distributed ledger - property passports, geospatial technologies and artificial intelligence-driven automated valuation models have the potential to overcome the majority of these blockages. However, digitalisation of the land registry is the single most necessary reform, and this is not around the corner. To overcome the single most resistant barrier to applicable technology - a lack of standardised digital data - will require a huge effort. Where that effort will come from is a very demanding question.

Can private sector innovation produce an incentive for all landowners to accurately and digitally map their landholdings and agree the boundaries? Will adequate government budgets be made available to cope with a likely torrent of disputes? Will the legal and property professions find a way to create an institutional approach to the digitalisation of ownership records? Will you and I engineer



democratisation by taking responsibility for maintaining our property data? The answer to all of these questions is the same – the capability of the technology will easily outpace the capacity of the system to employ it, and radical change will be slow.

[Read the full \*Oxford Said The Future of Real Estate Transactions\* report here.](#)