

An aerial night view of a city, likely Tokyo, with a network overlay of blue lines and white Wi-Fi symbols connecting various points across the skyline. The text is overlaid on an orange rectangular background in the lower-left corner.

# Technology in the real estate sector

PropTech reduces risks and increases value

# Key findings: PropTech reduces risks and increases value

## Restrictions for innovation in real estate

The real estate sector is not known as an innovative sector. The growth in labour productivity in the sector has stagnated for a long time and, in comparison to other sectors, there is hardly any investment in R&D. Important explanations are:

- **Long operating life of real estate:**  
which means that new technologies are slow to replace the old.
- **Capital intensive:**  
This makes entry difficult for starting entrepreneurs with good ideas.
- **Intransparent market:**  
Each real estate object is unique. This means that there is less direct competition on the real estate market, which reduces the drive to innovate.

## New technologies increase innovation in the real estate market...

New technologies (such as sensors, big data and data analytics) enable the real estate market to innovate more. Under the name PropTech, there are new technological applications to improve the use, sale and hire of buildings and make this more efficient. That's why investments in PropTech companies increased considerably in recent years and the expectation is that these will further increase in the coming years.

### ...this really makes the market more transparent...

PropTech really makes real estate more transparent. Further development of digital market platforms for real estate will enable market parties to find each other more easily, resulting in lower transaction costs. Data analytics also makes it easier to determine the value of buildings.

### ....and results in improved occupancy and additional services through Smart Buildings

Considerable steps can also be taken to digitise the administrative process. Occupancy in offices can, for instance, be further optimised and service provision improved (such as indicating via an app where free workstations are still available in an office).

## Opportunity for higher value through PropTech

PropTech can ultimately increase the value of real estate through:

- **Higher rental returns** because the tenant is prepared to pay a higher price per m<sup>2</sup>. Efficient occupancy means that fewer m<sup>2</sup>s are needed, the quality improves and Smart Buildings result in lower energy costs.
- **Lower risk** for real estate investors. Big data improves real estate valuation. What's more, the liquidity of real estate increases through the further development of platforms. Finally, Smart Buildings reduce the risk of vacancies, as these buildings are made more attractive to tenants.

### Mainly the user benefits

If we look at all the PropTech applications, we can see that it's mainly users who benefit. A Smart Building better matches their requirements and can better manage the occupancy. Leasing platforms enable shorter leasing periods and lower transaction costs.

### Threats and opportunities for real estate agents

The traditional role of real estate agents is most under pressure. Platforms can further digitise and take over this role. Real estate agents can attempt to operate as a platform themselves and digitise transactions.

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## Introduction

The real estate sector is digitising. Sensors measure, for instance, the building occupancy and the paperwork involved in transactions is slowly disappearing. Such technological innovation has a huge impact on existing structures. Business models are changing, mainly because of digitising and applications under the PropTech name.

PropTech are applications of new technologies that make the use, sale and lease of real estate more efficient and offer new functionalities. What is the potential, how will things change in the real estate sector and particularly the office markets and what will this mean for real estate yields?

We used our current economic knowledge of technology from the ING Economics Department to answer the above questions, combining this with our knowledge of the real estate sector. We also conducted desk research and interviews with those directly involved in the market to enrich and test our findings. This is how we help you gain new insights and provide information for strategic discussions.

By “real estate sector”, this report means all companies involved in the lease and sale of immovable property. Real estate agents and owners of immovable property who lease commercially fall under this. It concerns both homes as well as commercial property that is not intended for own use. Housing associations are also part of this group. Building companies (contractors) do not fall under this.

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## Chapter 1 | Innovation in the real estate sector

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## Innovation in the real estate sector

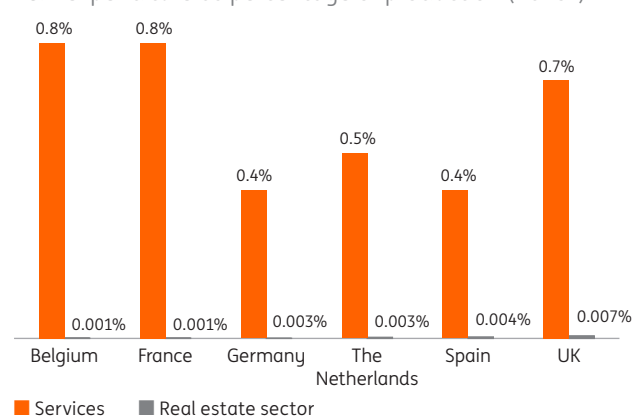
# 1.1 Fact: Little innovation in the real estate sector

### Extremely low expenditure on R&D

The real estate sector is not known as a very innovative sector. This image is clear also when you look at the figures. Investments in R&D are very low in different European countries. This is much higher in other sectors, such as services.

#### Real estate sector hardly invests in R&D

R&D expenditure as percentage of production (2015\*)



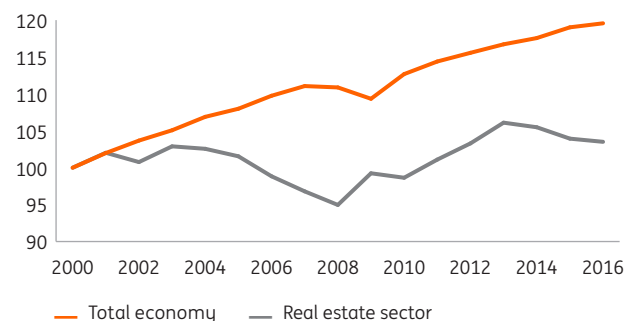
Source: OECD, edited by ING Economics Department

### Low innovation explains low growth in labour productivity

That innovation in the real estate sector lags behind the other sectors can be seen in the development of labour productivity. This measures how much work is done by people employed in the real estate sector, for example, how many lease contracts one administrative worker processes and how many home sales an estate agent supports. Labour productivity in the real estate sector expanded by less than 5% in Europe this century. In the total European economy, this grew by almost 20%.

#### Growth in real estate sector labour productivity lags behind

Labour productivity of the added value per hour worked in EU28 (index 1990=100)



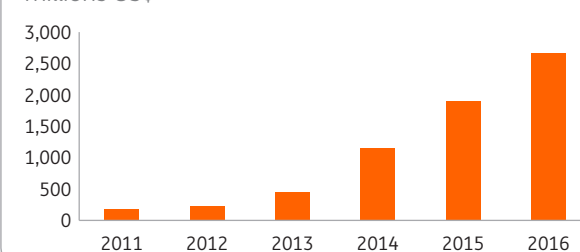
Source: OECD, edited by ING Economics Department

### Opportunities for innovation through global investment in PropTech

New technological developments, however, ensure that the real estate sector will start to make significant innovations in the coming years. PropTech\* companies attracted more and more money for growth in recent years. The globally invested capacity in PropTech increased from below \$200 million dollars in 2011 to over \$2.5 billion in 2016. In 2017 WeWork alone attracted \$4.4 billion in financing for further growth. These figures also have an impact on the European market as a lot of PropTech is easy to scale-up internationally.

#### Considerable increase in investment in PropTech companies

Investment in PropTech companies worldwide, in millions US\$



Source: CB Insights

What PropTech is exactly and how the PropTech technologies can influence various parts of the real estate sector will be discussed on the following pages.

\*See page 7 for definition

## Innovation in the real estate sector

# 1.2 Cause: Long operational life, entry barriers and intransparency

So why is there still little innovation in the real estate sector? The traditional culture is often mentioned as a cause. But why is the culture traditional and why has there been relatively little innovation for a long time? This concerns the specific market structure of the real estate sector. This inhibits innovation. The most important factors are:



### Long operational life of real estate

The long operational life of real estate means that new technologies are slow to replace the old. The car fleet, for example, has been entirely replaced with new cars in just one or two decades. For real estate with its operational life of sometimes over 100 years, this process is a lot slower. The addition of new technologies to an existing building is also costly. Although this sometimes does happen, upgrading the total stock is slower than for other goods. When making improvements to leased real estate, for instance making this more sustainable, there is also a problem of 'split incentive'. If it's mainly the tenant who profits from the sustainability investments, the incentive for landlords to invest in this is low.



### High entry barriers

Investing in real estate is extremely capital intensive. This results in considerable entry barriers for property investors. Not every starting entrepreneur from another sector with a good, innovative idea can just enter this sector. This means that it is the current real estate owners who largely determine what is built. As tenants also find location to be much more important than an innovative building, the incentive to invest in innovations is limited. New developments are therefore implemented less quickly. High entry barriers are not present in all real estate sub-sectors, such as real estate agents.



### Intransparent market

Each real estate object is unique. This means that there is less direct competition on the real estate market. For the average market operator it is also difficult to estimate the value of a real estate object independently. The owner of real estate knows more about real estate than the rest of the market. This gives the owner of real estate market power. Moreover, many regulations and complex ownership structures make real estate transactions bureaucratic, complex and intransparent.

### New technology particularly offers more transparency

New technologies such as big data and data analytics particularly improve transparency. The other entry barriers can only be reduced in a limited way. The long operational life of real estate will remain a feature on which new technologies have little impact.

## Innovation in the real estate sector

## 1.3 Opportunity: PropTech - New applications for real estate

The word PropTech has already been discussed. You can read exactly what we mean by this in the next paragraph.

**PropTech definition**

**Applications of new technologies that make the use, sale and lease of real estate more efficient and offer new functionalities.**

We have divided PropTech into four sub-categories that we will explain one-by-one in the next chapter:

- Rental platforms and Space as a Service
- Sales platforms and webshops
- Digitisation of administrative management
- Smart Buildings

**Many combinations are possible**

Many of these applications overlap. For instance, some platforms offer both sales and purchasing as well as leasing and hiring. Platforms are also focusing on digitising the administrative management. Another example concerns Smart Buildings that indicate where there is still free space in an office, enabling business models such as 'Space as a Service'.

**PropTech comprises various applications**

List of technological applications in construction and real estate



Source: ING Economics Department

**ConTech: More efficient construction**

ConTech refers to the use of new technologies during the construction process. ConTech is about process innovations that make the construction phase more efficient. This particularly influences building companies. This includes such things as robotisation and 3D printing. (See report [ING Technology in construction](#)). As this is not a part of the use, sale or lease of real estate we do not consider this to be part of PropTech. It can, however, influence the real estate sector as this is a big purchaser of construction during project development, renovation and maintenance.





## Chapter 2 | PropTech applications

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## PropTech applications

# 2.1 Rental platforms and 'Space as a Service': Satisfy demand for flexibility

What does it do?

### Rental platforms: link tenant and landlord

Rental platforms are (digital) marketplaces in which tenants and landlords of real estate can find each other easily, making a better and faster "match" and reducing vacancies. Examples of rental platforms are Funda and Skepp for commercial accommodation and Skepp and Flexas for offices.

### Space as a Service

Companies such as WeWork (pg. 14), Tribes and Spaces are not rental platforms because they do not link tenant and landlord. They rent properties themselves for longer periods and divide these into smaller time and space blocks, with the aim of leasing these. This enables these companies to ensure a better match between supply and demand.

What accelerates it?

### Incentives: flexibility and big data

The trend for further flexibility of the economy is an incentive for rental platforms and Space as a Service. The increase in smaller companies (self-employed persons) is resulting in an increased demand for smaller spaces for shorter periods. Technologies such as the internet, big data and data analytics are lowering transaction costs in matching the tenant and landlord, enabling the growth of business models such as platforms and providers of Space as a Service.

### Owners and tenants benefit from rental platforms and Space as a Service

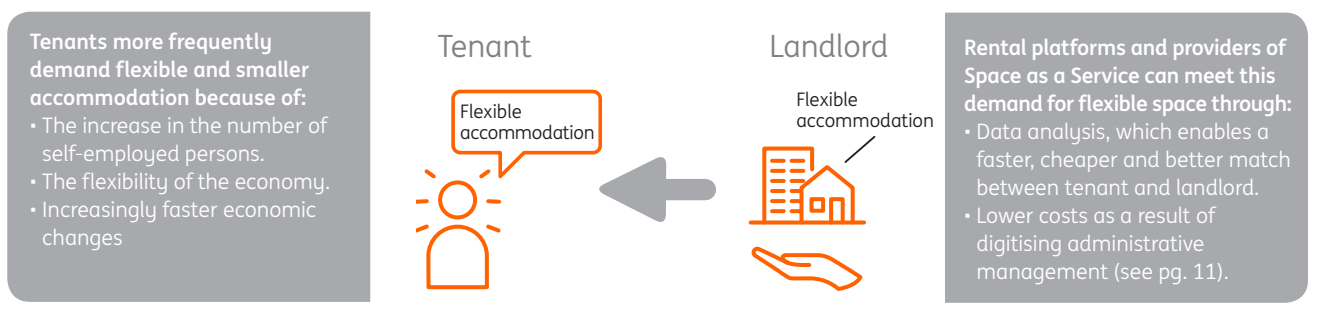
Impact of rental platforms & Space as a Service on the most important market players

Party	Favourable / unfavourable	Most important reasons
Real estate owner	+	😊 Lower estate agent fees and other costs when finding a new tenant. 😊 Fewer vacancies: new tenants are found more quickly. 😞 Offer increases as it is easier to offer real estate.
Real estate agent	--	😞 Tenant and landlord find each other more easily without an estate agent.
Tenant / user	+	😊 Lower estate agent fees and other costs when finding commercial accommodation. 😊 Short lease periods are possible because of lower transaction costs.
Hardly any or no impact on the notary, financier and administrator.		

😊 = Advantage    😞 = Disadvantage

### Rental platforms and Space as a Service satisfy demand for flexible real estate

Changing demand for rental and leasing of real estate



## 2.2 Sales platforms: More transparent real estate market

What does it do?

### Sales platforms: link seller and buyer

Sales platforms are (digital) marketplaces where buyers and sellers of real estate can meet. Examples are Funda, Jaap.nl, Pararius and Jumba. Estate agents can also offer real estate via their own website.







What accelerates it?

### Incentives: big data and data analytics

Many real estate platforms currently on the internet are still relatively simple websites in which property is offered in a kind of “digital window”. By using (big) data, data analytics and artificial intelligence, these can much better match supply and demand. This makes the real estate investor market even more transparent and can increase the liquidity of real estate through lower transaction costs.

### Owners and financiers benefit from sales platforms

Impact of sales platforms on the most important market players

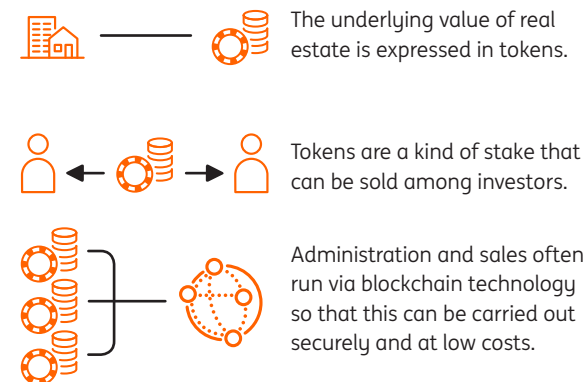
Party	Favourable / unfavourable	Most important reasons
Real estate owner	+	 Lower (real estate and taxation) costs in buying and selling.  Demand increases through more transparent market.  Offer increases because it is easier and quickly profitable to offer real estate.
Real estate agent	--	 Buyer and seller can find each other more easily without real estate agent.
Notary	+	 More transactions.
Financier	+	 Risk is reduced: financiers estimate the value of real estate better through improved information.
Hardly any or no impact on administrator and tenant / user.		

 = Advantage     = Disadvantage

### Selling real estate via tokens in the blockchain

To facilitate an increase in the sale and liquidity of real estate, companies are developing various new platforms, including Atlant, Bloqhouse and Brickex. Some platforms aim to go somewhat further than just bringing together supply and demand. In this way, real estate is subsumed under a kind of fund and investors can sell their stakes (among themselves), dividing up the real estate investment. For the administration blockchain technology is sometimes used to sell the stakes (so-called tokens). If agreements are made, a blockchain can safeguard the ownership of the stake. The price risk does, however, remain and can fluctuate. An additional advantage of the blockchain is that investments can be divided up into smaller sections and transaction costs can be reduced dramatically.

### Selling real estate via tokens in the blockchain



## 2.3 Administrative management: Further digitisation

What does it do?

### Lower transaction costs through more efficient administrative process

Applications that ensure that the entire administrative process for sales and purchasing and/or rental of all (legal) forms runs faster, more efficiently and cheaper. The large number of involved parties means that this is currently often rather complex. That is why many transactions are recorded on paper and are at most distributed by e-mail as digital PDF. Digitising forms, contracts and signing offers a solution for this.








What accelerates it?

### Incentives: digitisation, big data and blockchain

Digitising makes the sales and purchase and rental processes much more efficient, faster and cheaper. Various market participants benefit from this. For example, the cost of valuations is reduced by using big data. In some cases, blockchain offers a solution to optimise processes.

### Many parties benefit from lower administrative costs

Impact of digitising administrative management on the most important market players

Party	Favourable / unfavourable	Most important reasons
Real estate owner	+	 Liquidity of real estate increases and therefore also the demand.  Vacancies are reduced because of faster completion of rental and sales contracts.
Real estate agent	-	 Less demand for supporting role in handling transactions.
Notary	-	 Digitising puts the traditional role of the notary under pressure. Legislation can reduce this impact.
Tenant / user	+	 Lower transaction costs enable shorter lease contracts.
Financier	+	 The funding risks are reduced through efficient processes.
Administrator	+	 More efficient work process.

 = Advantage     = Disadvantage



### Vesteda digitises the rental process

Vesteda staff used to have to print out the hire contract, send it, rescan it after signing and send it out again. Now the entire process takes place digitally, including the signing, via [ondertekenen.nl](https://www.ondertekenen.nl). All related documents, such as the general conditions and tenant guide are also sent digitally. Employees used to spend a lot of time on basic administrative tasks, such as walking to the printer, scanning and taking to the post. It is estimated that this saves three FTEs.

Source: Vastgoedjournaal & Vesteda



## 2.4 Smart Buildings: Digital services in the building

What does it do?

### Smart Buildings: meet user requirements

Smart Buildings are about digital and other services in building efficient buildings which ensures:

- more efficient use of space;
- lower energy consumption;
- a healthier indoor climate and additional services for user convenience. Through the use of technology, a Smart Building senses what the user requires and facilitates this. Extra services and improved occupancy deliver added value, which means that the tenant may be prepared to pay a higher rental price per m<sup>2</sup>.

### Smart Building: Improved occupation, lower energy consumption and a healthier building

Impact of Smart Buildings on the most important market players

Party	Favourable / unfavourable	Most important reasons
Real estate owner	+	😊 Higher value of the real estate through better occupation, lower energy consumption and satisfying user requirements.
Real estate agent	+/-	😊 Due to the technological complexity, advice on Smart Buildings from specialised estate agents ensures added value. 😞 Big data of Smart Buildings supply insight and knowledge which makes the market more transparent and the traditional role of the real estate agent becomes secondary.
Tenant / user	++	😊 Better occupation and thus less m <sup>2</sup> needed, lower energy consumption, 'healthier' building. 😞 Rental price per m <sup>2</sup> may be higher.
Financier	+	😊 Big data means more knowledge of the use of the building which results in lower risk for financing.
Administrator	+	😊 Better insight of user requirements and meeting these (through additional services).

😊 = Advantage    😞 = Disadvantage

What accelerates it?

### Incentives: changing customer requirements, big data and IoT

Sustainability, 'healthier buildings' and more efficient use of space are becoming increasingly important tenant requirements. The rise of the Internet of Things (IoT), computing power and big data enable this through Smart Buildings. The combination of connectivity with additional computing power and sensor technology results in buildings that generate huge amounts of data. These big data give information about the use of buildings. The huge challenge is to filter useful information from all these data and to do something useful with this for the user.



**LONE ROOFTOP**  
building intelligence

### Lone Rooftop: Google analytics for buildings

Marcel Lamers CEO & Co-founder of Lone Rooftop compares a building with a website. "Online marketers see exactly how many people visit their websites. Real Estate Managers generally don't have this insight regarding the use of buildings, which results in sub-optimal use. That's why Lone Rooftop has designed a 'Google analytics for buildings'. Lone Rooftop measures the occupancy of a building via Wi-Fi signals. They use the existing infrastructure which means that no additional investment in hardware is needed. The result is that organisations can see any inefficiencies in the building at a glance. It can improve building occupancy by 20% or more, which reduces hidden vacancies and offers considerable cost savings. Users in an office can also find an available workspace more easily. Connected to this, there were requests for applications such as cleaning and lighting. Lighting doesn't need to be on in rooms where nobody is present and cleaning can be prioritised according to use. Lone Rooftop does this in cooperation with other companies, with the aim of reducing organisations' footprints. The service is not only for large office users. For instance, Wageningen University also uses these data to timetable lectures more efficiently.

## 2.5 Customer journey: To digital

### From digital window to complete 'webshop'

The real estate process is currently hardly digitised. Only the orientation process takes place digitally via internet (e.g. Funda). All steps after this are generally not digitised. Significant steps can be made in this in the coming years. Consider how webshops (e.g. amazon.com) have currently digitised almost the entire customer process from orientation to returns in the retail trade.

### Algorithms help in selection and VR for first impression

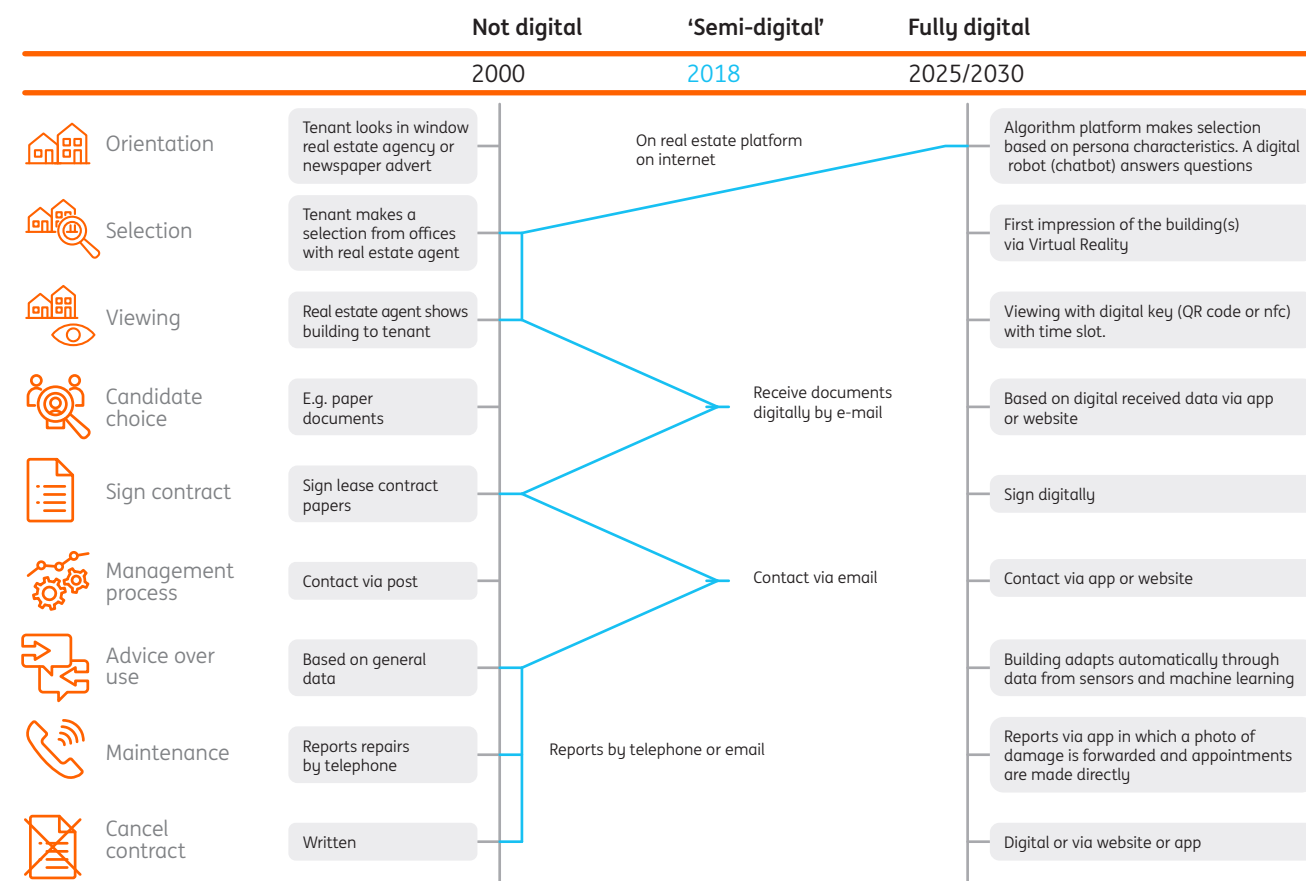
Algorithms from platforms can make selections of buildings based on the personal characteristics of the tenant. Where an individual real estate agent understands a part of the market and can give, for example, 10 suitable objects, an algorithm can overview the whole market and can offer 50. A first impression of a building can take place via Virtual Reality and contracts can be signed digitally.

### Smart Building gives advice for optimum use

The sensors and Machine Learning enable Smart Buildings to give the tenant feedback about their current use of the property and link advice to this to save energy or improve the occupancy. Maintenance reports can take place via an app. Ultimately the lease contract can also be cancelled digitally.

### Tenant's customer journey will be increasingly digitised

Average tenant customer journey in 2000, 2018 and in 2025 or 2030



## 2.6 Success of PropTech: It's all about the combinations

### It's all about the combinations of different PropTech...

This chapter discusses different PropTech applications that can have a huge impact on real estate. Often based on technology that in many cases has existed for years. The strength lies particularly in the combinations of different applications.

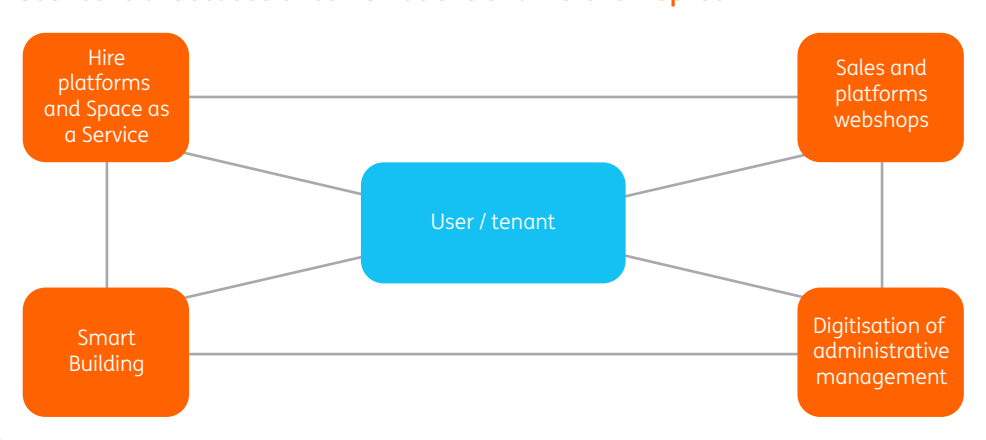
### .... and there's also real added value to be obtained here

Particularly the combinations of different PropTech applications offer additional added value. It offers convenience and time savings for the user. Buyers/tenants are guided through the entire process as efficiently as possible. The focus on one sub-process, such as a more efficient course of the rental process, is more about process optimisation and does not place the customer (user, buyer or tenant) central.

### Qil: Not one sub-process but optimise the entire customer journey

Work from a customer perspective with one customer journey. The objective is to create value for the customer. People often choose for solutions that are more efficient, but do not add value for the customer.” said Rutger van Hulzen, founding partner of Qil. In Qil, the entire process of searching, matching, viewing, transactions, hiring, leasing and cancelling takes place in one customer journey and digitally, where possible. The unique combination of data regarding socio-demographic and lifestyle characteristics and consumer behaviour in one ‘Woonpaspoort’ (Living Passport) enables Qil to offer insight into the needs of the tenant, but with the associated privacy. Each subsequent process is optimised and connects seamlessly, resulting in lower transaction costs. Signing a lease contract currently costs a landlord €600 to €800, via Qil this can be reduced to around €300. A next step for Qil is to offer homes services such as a laundrette, cleaning and shared cars. Having satisfied tenants results in reductions in turnover, fewer vacancies and improves returns.

### User central because of combinations of different PropTech



### WeWork: 'Space as a Service' through use of different technologies

WeWork is positioning itself not as a supplier of office space but more as a community in which there is also a workplace. To make a success of this, WeWork uses various technologies and applications. For instance, there is an app in which members can make business or personal contact. WeWork selects new locations based on data regarding the availability of all kinds of services including lunch rooms, shops, restaurants, cafés, hotels and sports clubs. Offices are subjected to a 3D scan and, using the building information model (BIM), WeWork can design buildings 15 to 20% more efficiently and save approximately 10% on building costs. Usage data is analysed through machine learning, resulting in a 40% better estimate of the expected use than when this was estimated by the designers themselves. This results in a reduction in the average floor surface area per member to 4.5 m<sup>2</sup> without them having the feeling that it is crowded. WeWork will add 50,000 - 100,000 m<sup>2</sup> of office space. The number of global locations has grown from 180 in mid-2017 to approximately 300 in early 2018. As well as start-ups, self-employed persons and small companies, WeWork customers now include an increasing number of multinationals, including Microsoft, Amazon and IBM.

Source: CB Insights





## Chapter 3 | Consequences for the real estate sector

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## Consequences for the real estate sector

# 3.1 Real estate chain: Users benefit, estate agents struggle

### Mainly users benefit

If we look at all the PropTech applications, we can see that it's mainly users and tenants who benefit. Through Smart Buildings they get a building that better matches their requirements and they can better monitor and arrange occupancy. Rental platforms enable shorter leasing periods and lower estate agent fees.

### Real estate owners: From “investing in bricks” to entrepreneurship

To respond well to changing demand in the market and the opportunities offered by PropTech, real estate investors will start to operate more as entrepreneurs. This means focusing on more things than just the value of the property, duration of lease contracts and tenant creditworthiness. A real estate entrepreneur will have a rewarding business model in which he/she creates added value and ensures continued demand for his/her (Space as a) Service.

### Real estate agents will struggle but there are also opportunities

The traditional role of real estate agents is under pressure. Platforms are digitising and seem to be taking over their role in the investment market (sales/purchase) and the user market (rental/lease). By supporting administrative arrangements of transactions, further digitisation is likely to reduce the role further. Real estate agents can attempt to operate as a platform themselves and digitise transactions.

### Mainly users benefit from new PropTech applications

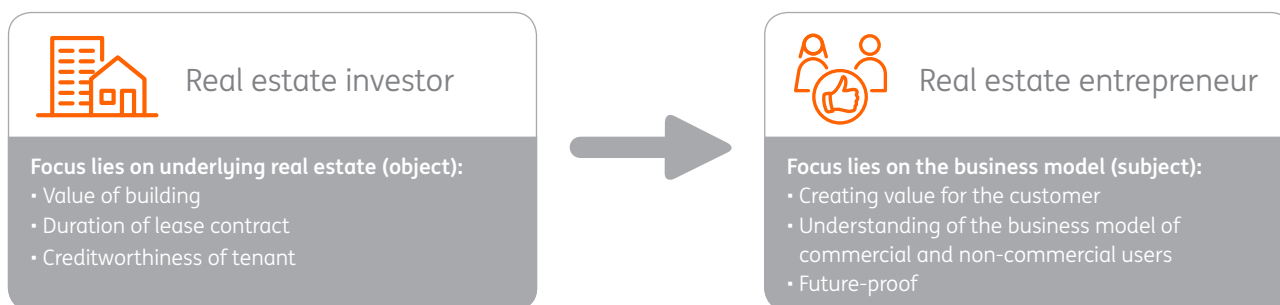
Advantage or disadvantage of new PropTech applications

	Rental platforms & Space as a Service	Sales platforms	Digitisation administrative management	Smart Buildings	PropTech Total
Real estate owner	+	+	+	+	+
Real estate agent	--	--	-	+/-	--
Notary		+	-		+/-
Tenant/ user	+		+	++	++
Financier		+	+	+	+
Administrator			+	+	+

Empty = n/a

### From “investing in bricks” to entrepreneurship

Role of the real estate owner is changing



## Consequences for the real estate sector

# 3.2 Expectation: PropTech increases real estate value

### Yield requirement under pressure because of PropTech

PropTech can ultimately result in lower yield requirements in the investment market. Transparency increases. This reduces the risk that the real estate value is incorrectly estimated. This also increases liquidity: lower search and transaction costs through platforms. This results in increased supply and demand which means that PropTech also makes real estate more liquid.

Finally, PropTech reduces the risk of vacancies. This can all have a dampening effect on the yield requirement.

### PropTech provides a higher rental price per m<sup>2</sup>

New PropTech on the rental market can result in improved occupation (Smart Buildings), higher quality and lower energy

consumption. This offers the tenant added value in the form of a relatively higher rental price.

### Higher real estate value through PropTech

Lower yield requirements and users who are prepared to pay a higher lease both enable the value of 'PropTech real estate' to increase.

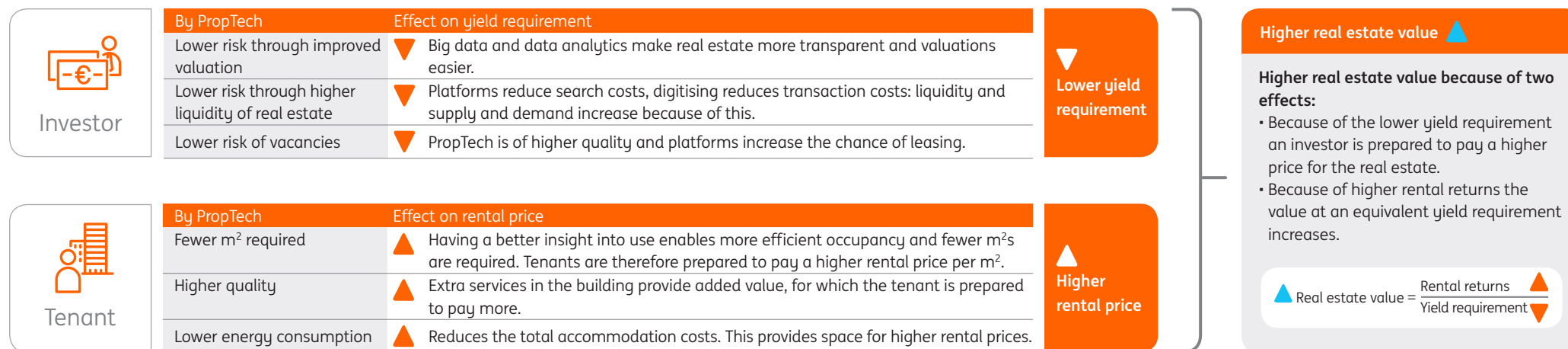
### Division with other real estate

Real estate that is not provided with PropTech may be at a disadvantage. The location of buildings of course remains important, but tenants will be less interested in 'non-PropTech' buildings because the quality is lower, the energy consumption is higher and the occupancy is less efficient.

### Risk of long-term vacancies

Higher occupation in PropTech real estate can ultimately result in fewer m<sup>2</sup> being leased, which will result in vacancies in the less attractive non-PropTech buildings. The high entry barriers, long operational life of real estate and the associated low replacement cycle mean, however, that this process will be slow.

## Consequences of more PropTech in real estate on leasing, yields and value





# This may also be of interest

## Technology in construction (Dutch)

Mass customisation is possible



## Circular corporations (Dutch)

To complete sustainable accommodation



## Circular construction (Dutch)

Opportunities for demolishers and wholesalers



## Release more funding for core task of corporations (Dutch)

Part 2: With value-based management to more social returns



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