

Improvement of the real estate transparency through digitalisation

Elena IONAȘCU

*IROVAL – Research in Valuation, Bucharest, Romania
elena.ionascu.a@gmail.com*

Ion ANGHEL

*Bucharest University of Economic Studies, Bucharest, Romania
ion.anghel@cig.ase.ro*

Abstract. *Taking into account that the transparency is a quality of communication of sustainability information, as well as the role of digitalisation in ensuring the transparency, we proposed to study the perception of real estate entities related to promoting transparency in the relationship with stakeholders and the integration of information and communication technology in their business models. Applying a qualitative approach, we critically analysed the sustainability reports published by real estate companies from the EU, which represent important non-financial information sources for stakeholders. Transparency is mainly reflected in corporate governance, as real estate entities are increasingly concerned with maintaining open relationships with stakeholders and knowing their expectations to integrate them into the business strategy. We have noticed a broader approach of transparency in REIT entities and in reports that include an assurance statement. New digital technologies serve the purpose of improving transparency, which, although still poorly explored in real estate, offer new solutions to increase the efficiency and productivity of real estate activities. Property technology can improve real estate market transparency and liquidity, bringing lower transaction costs, which should positively impact the value of investment assets.*

Keywords: real estate, digitalisation, PropTech, transparency, sustainability, innovation.

Introduction

Globalisation and consequences of the economic and financial crisis of 2007-2008 have stimulated the interest of stakeholders for the transparency of real estate markets. However, the low transparency of real estate markets remains a problem for most countries, affecting the level of real estate investment. One of the causes is the poor transparency of real estate transactions that serve as sources of information in estimating the market values of properties. In the current context of dynamic stakeholder expectations, sustainable reporting and digitalisation are important tools for increasing real estate transparency. Both sustainable reporting and digitalisation have expanded in recent years following numerous criticisms of the real estate industry for the slow reaction and reduced contribution to sustainable development (Ionașcu, 2018) and the slow adoption of new technologies (Baum et al., 2020).

The fourth industrial revolution determined by the information and communication technology has revolutionised the production, storage, distribution and consumption of information, radically changing the business models. Using information and communication technologies (ICT) to improve the business processes defines the concept of digitalisation (Redlein & Höhenberger, 2020), which enabled by software technologies, has fundamentally changed society. “The scale of the impact and the speed of the changes taking place have made the transformation that is playing out so different from any other industrial revolution in human history” (Schwab, 2016, p. 109).

The digitalisation of the value chain is a real challenge for all industrial sectors, and the COVID-19 crisis has highlighted this fact, accelerating the need for a rapid adaptation to digital

technologies. The real estate industry has generally been slow in the adaptation to the novel technologies to automate the manual procedures (Baum et al., 2020; Braesemann & Baum, 2020), especially the construction industry which is considered among the weakest digitised industries (Agarwal et al., 2016). This has reduced the productivity and efficiency of the construction industry over time (JLL, 2018a), but the internationalization strategy by larger construction companies, the supply chain pressure, the disruptive innovations, the new construction industry parties have significantly contributed to the reorganization of the construction industry in the last years (Deloitte, 2018). Furthermore, the digitalisation is a key area of the EU strategy for the sustainable competitiveness of the construction sector and its enterprises (European Commission, 2012).

Due to the economic, social and environmental importance, the corporate social responsibility practices in real estate may play the most critical role in sustainable development, because the construction sector generates almost 10% of GDP, provides 20 million jobs (European Commission, 2012), and in the same time is the world's largest consumer of energy and producer of carbon dioxide (CO₂) emissions (accounting for 36% of global final energy use and 39% of energy-related CO₂ emissions) (Hsieh et al., 2020, p. 1). In the last years, it has increased the interest of the real estate entities in sustainability practices, integrating the 17 sustainable development goals (SDGs) in their business strategy, and thus contributing to the real estate transparency improvement (Ionaşcu et al., 2020).

Taking into account that the transparency is a quality of communication of sustainability information (Fernandez-Feijoo et al., 2014), as well as the role of digitalisation in ensuring the transparency (GRI, 2015), we proposed to analyse the perception of real estate entities related to promoting transparency in the relationship with stakeholders and the use of ICT in their business models. Thus, in the end, the research results allowed the appreciation of the insertion level of transparency innovations in real estate practice. As there is a lack of studies analysing the practices of real estate entities to adapt to technological changes, the research will fill this gap and also will encourage the real estate companies to become more involved in improving transparency through the use of digitalisation activities.

The reminder of this paper is organised as follows: the literature review provides the theoretical background of the real estate digitalisation and transparency; the research methodology describes the sample and research methods; the most important results are discussed in the section dedicated to the results and discussions; and the last section provides the conclusion of the paper.

Literature review: real estate digitalisation and transparency

PropTech segmentation

The technological and innovation perspectives laid the foundation of a new field – real estate technology, also called PropTech (property technology). RICS defines PropTech as a concept that “refers to all aspects of technology and how it impacts the built environment”. More often, this term refers to the start-up companies that use technological innovations to solve real estate problems (Aihie, 2019).

The financial technology (FinTech) provides the foundation for a large part of the PropTech revolution (Baum, 2017), this is why they get often confused. Although the PropTech and FinTech closely collaborate, they are two distinct industries. FinTech, being “a contraction of “finance” and “technology””, is defined as “the use of technology and innovative business models in financial services” (World Economic Forum, 2015, p. 7). Due to its function, the FinTech assures the

financial services for the funds required to real estate transactions. Baum (2017) and Baum et al. (2020) illustrate the relationship between the PropTech with its sub-sectors and the FinTech through a Venn diagram (Figure 1). According to this diagram, the sub-sectors of the PropTech are the real estate FinTech, the smart real estate, the real estate shared economy and the data analytics, driven by the construction technology (ConTech), the legal technology (LegalTech), the shared economy movement information, the financial technology (FinTech) and the exogenous technology (exogenous tech).

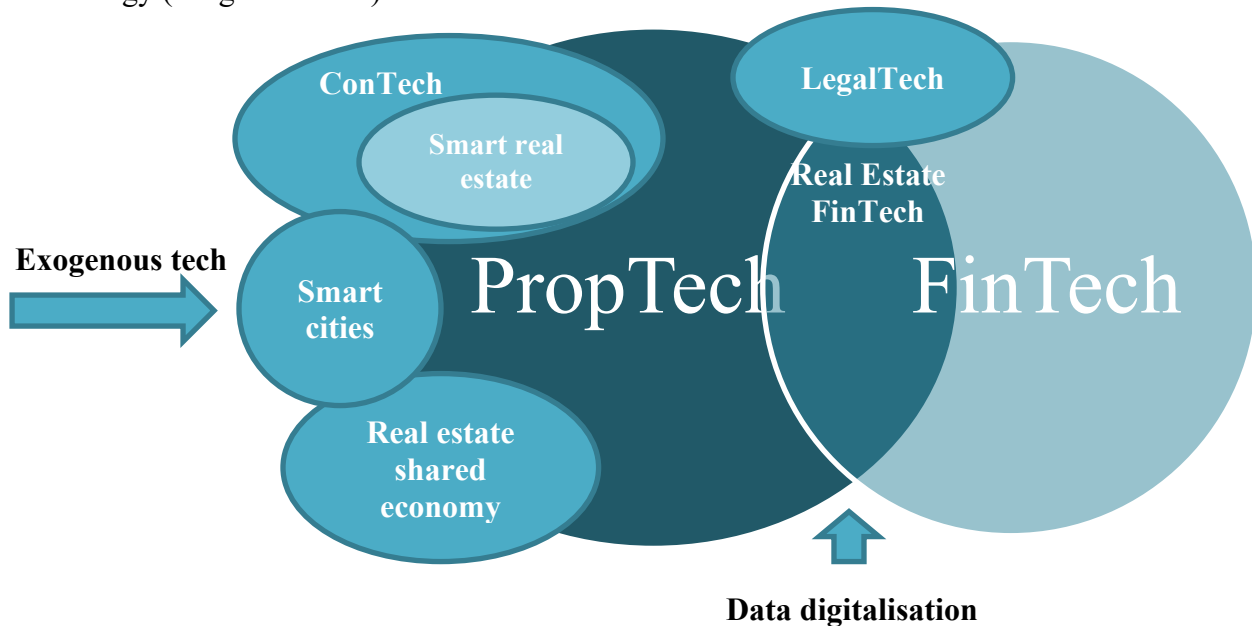


Figure 1. The PropTech roots

Source: Baum et al. (2020, p. 96)

The real estate FinTech sector supports (sale or leasing) transactions of real assets, facilitating the transactions in the capital markets, reducing the illiquidity of real estate, stimulating the research and information businesses, ensuring crowdfunding, equity raising, debt and mortgage tech platforms, relieving the commercial property leasing and portfolio management, creating perspectives for disposal and secondary market exchanges (Baum, 2017). The real estate FinTech offers diverse services and solutions for financing and investments in real estate, such as real estate transaction services, digital lending platforms for construction and real estate owners and lenders, online real estate investments options for individuals, or investments in single-family homes for institutional investors (Collinson, 2018, p. 2). The legal technology, through smart contracts, blockchain, lease information extraction and loud-based data rooms, is underpinning and transforming the real estate transaction process (Baum et al., 2020).

The smart real estate is founded on the technology developments that facilitate the control and the efficient management of a single property or an entire city. The background of the smart buildings is expressed by the sustainability which is no longer a marketing issue, but a demanded attribute of the property assets (Baum, 2017). The smart buildings connect the operational technology with the management information systems to ensure superior efficiency for real estate.

The main characteristics of the smart buildings are based on efficiency and healthy, dynamic operability, responsive energy system, renewable energy uptake, dynamic and self-learning control systems (De Groot et al., 2017). Considering these characteristics, the smart buildings represent a category of sustainable buildings that include all elements of the triple bottom line perspective (economic, social and environment) (Lowe & Ponce, 2009). The study of De Groot et al. (2017) shows that the existing building stock of Europe is far from being considered smart and that all countries need to take important measures to assure a smart building environment. In this regard, the EU agreed on the new rules on the energy performance of buildings to create economic opportunities in the construction industry, to combat energy poverty, to strengthen the energy performance of new buildings and to accelerate the renovation of existing buildings, making them smarter (European Commission, 2020).

Smart cities utilise widespread sensors and data analytics to manage urban resources, from which a range of industries could benefit, like utilities, transportation, retail and more. The new start-ups of connectivity through the wireless network infrastructure, smart mobility, energy grid management, parking, water management, traffic and navigation, environmental sensors, public safety and urban planning are making cities smarter (Altman, 2018).

The smart building tech is strongly related to ConTech that supports the planning, design and construction of buildings or infrastructure. Because the ConTech refers to the use of new technologies during the construction process, it constitutes a strong determinant of the smart buildings, thus the definition of the PropTech excludes the ConTech (Baum et al., 2020). Wearable technology, 3D printing, computer-aided design (CAD), construction robots, internet of things, drones, building information modeling (BIM), virtual reality and artificial intelligence are some of the applications in ConTech which influence the real estate sector in areas such as project development, renovation and maintenance (Aihie, 2019; Weatherley, 2020).

The real estate sharing economy describes the sharing of the use of real estate assets or space through tech platforms. The home affordability has forced the millennials to reconsider the need for house ownership, preferring the short-term housing rental, co-living and hospitality, while the shared workspace and co-working have changed the traditional workplaces, driven by the growth of the creative and tech industries and the changing nature of work (Baum, 2017). The sharing economy facilitates the efficient allocation of space by identification and exploitation of the spare capacity, reduction of the associated search, bargaining and enforcement costs of a transaction (Baum et al., 2020).

The real estate analytics and digitalisation, having the role of producing digital data that generates added value for users and/or owners of real estate, represents the new perspective of the current PropTech market (Baum et al., 2020). The real estate digital data, being considered the central of the PropTech innovations, have become a tradable commodity with the expansion of the big data phenomenon (Braesemann & Baum, 2020). Analysing data about more than 7,000 PropTech businesses, Braesemann and Baum (2020) demonstrate that the digital data are central to the network of property technologies and the firms that apply such technologies have more success in attracting foreign venture capital.

Real estate transparency in the context of digitalisation

The acceleration of cross-border real estate investment in the mid-2000s significantly influenced the increase in transparency of European real estate markets (Figure 2). The launch of new criteria

for assessing investment performance, financial reporting under IFRS and better management of listed instruments have stimulated transparency in real estate (JLL, 2014). In 2006, the global real estate transparency index (GRET), developed by JLL company, improved on average with 5.4% compared to 2004 in the EU, but the largest increase of 7.4% was registered in the group of Eastern countries under the influence of EU integration requirements. The financial crisis of 2007-2008 significantly slowed the progress of transparency, but since 2012, as real estate markets have recovered, transparency has continued to improve, being influenced by the measures of the authorities to protect against banking and real estate risks. The credit crunch has motivated regulators, central banks, foreign investors and real estate practitioners to contribute to increasing transparency by publishing data, improving transaction procedures, efficiently managing listed instruments and closely monitoring lending. Meanwhile, open data access and technological innovations have become the new determinants of real estate market transparency.

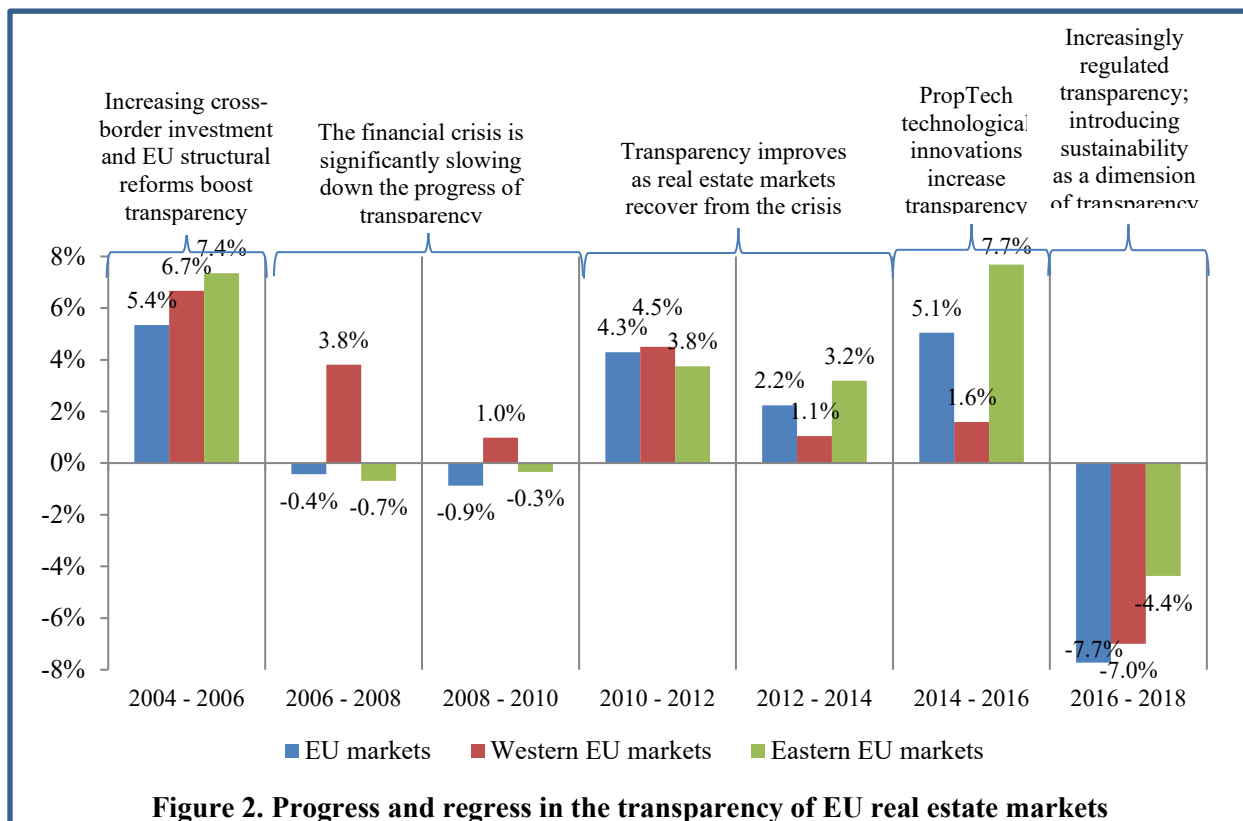
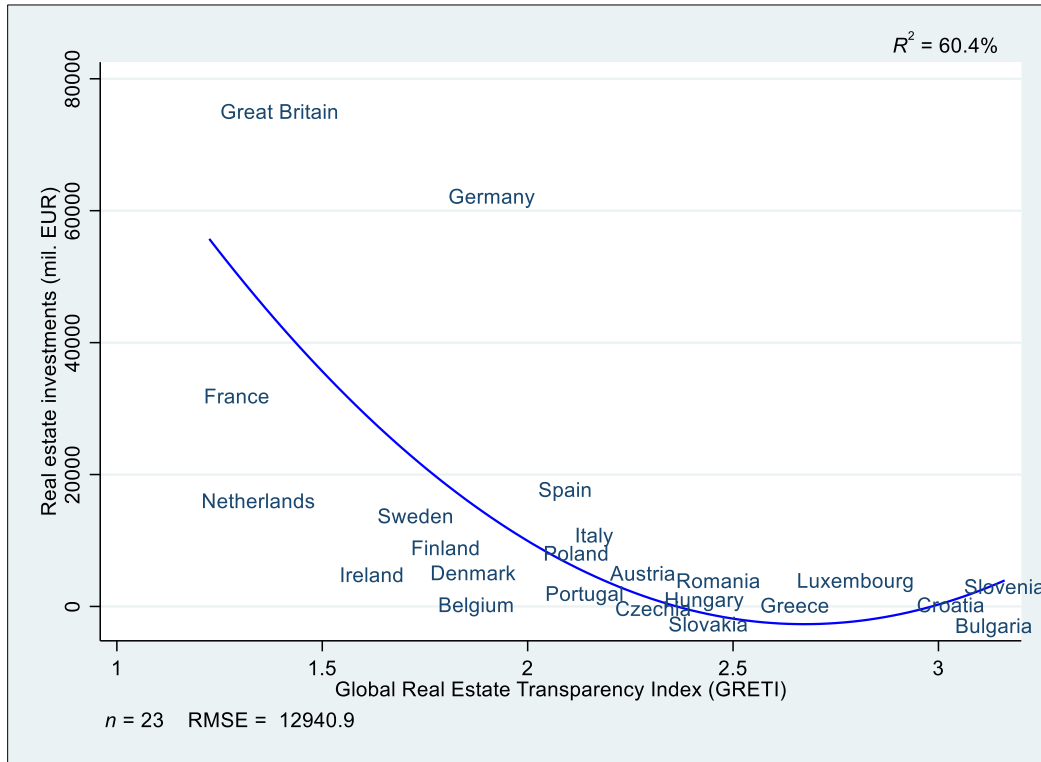


Figure 2. Progress and regress in the transparency of EU real estate markets

Source: Authors' own compilation based on JLL data and JLL (2016)

In recent years, the authorities have paid more attention to real estate transparency, following the recognition of the role of transparency in facilitating new real estate investment, supporting wellbeing and social inclusion. Figure 3 illustrates the curve of the variation of real estate investments depending on the market transparency ($R^2 = 60.4\%$). This function highlights the increase of capital invested in real estate as the transparency of markets increases. The United Kingdom, with the most transparent markets in the world, is distinguished by the highest average annual commercial real estate investments made in 2013-2017, equal to EUR 75,091.60 million,

followed by Germany with EUR 62,230.42 million, France with EUR 31,954.10 million and the Netherlands with EUR 16,076.10 million. On the opposite side are the semi-transparent real estate markets, where the average annual investment varies from 138.78 million EUR in Slovenia to 229.20 million EUR in Greece, EUR 289.18 million in Croatia and EUR 467.02 million in Bulgaria. This evidence is in agreement with the results of the study of Ionaşcu et al. (2019) and Sadayuki et al. (2019) which demonstrate that countries that ensure good access to market information and consistent enforcement of regulations attract more foreign real estate investments.



Note: GRETI varies from 1 – highly transparent markets to 5 – opaque markets, based on which the markets are assigned to one of five transparency tiers: highly transparent, transparent, semi-transparent, low transparency and opaque (JLL, 2018b).

Figure 3. Real estate investments under the influence of real estate market transparency

Source: Authors’ projection based on data published by JLL and Cushman & Wakefield, 2013 - 2017

The emergent PropTech industry has fuelled expectations of a significant improvement in transparency, as the PropTech generates large volumes of data that increase the transparency of the property market, and the efficient use of this data leads to higher returns on real estate investments. The USA, the Netherlands, Canada and Australia, considered leaders of the real estate market transparency, are situated on the top positions in the adoption of real estate technology, according to the score developed by JLL (2018), which takes values from 1 – high level of technology adoption to 5 – low level of technology adoption (Table 1). Among the countries with transparent real estate markets, Switzerland and Spain stand out, which have several entities focused on very specific market niches, from a technological perspective (JLL, 2018b). Several semi-transparent real estate markets, such as those in Brazil, the United Arab Emirates (UAE) and Mexico, have

recorded high scores for real estate technology adoption. Markets characterised by semi-transparency are more attractive for PropTech instruments, because these markets lack traditional data sources, compared to non-traditional sources, which involve storing large volumes of unstructured data and collected from different sources (big data). An example is the United Kingdom, which has the most transparent real estate markets in the world, but due to the strong development of traditional data sources, the use of PropTech technology is lower (JLL, 2018b).

Table 1. Top markets for PropTech adoption

Rank	Country	PropTech adoption score	GRETI score	Transparency tier
1.	USA	1.50	1.37	Highly transparent
2.	Netherlands	1.63	1.51	Highly transparent
3.	Canada	1.63	1.45	Highly transparent
4.	Australia	1.88	1.32	Highly transparent
5.	Switzerland	2.00	2.02	Transparent
6.	Spain	2.13	2.14	Transparent
7.	France	2.38	1.44	Highly transparent
8.	Ireland	2.50	1.93	Highly transparent
9.	Portugal	2.50	2.30	Transparent
10.	Italy	2.63	2.12	Transparent
11.	New Zealand	2.63	1.59	Highly transparent
12.	Sweden	2.75	1.93	Highly transparent
13.	Brazil	2.75	2.75	Semi-transparent
14.	Japan	2.88	1.98	Transparent
15.	UAE - Dubai	2.88	2.79	Semi-transparent
16.	Taiwan	3.00	2.32	Transparent
17.	Germany	3.00	1.88	Highly transparent
18.	Mexic	3.00	2.78	Semi-transparent
19.	UAE - Abu Dhabi	3.13	3.37	Semi-transparent
20.	South Korea	3.13	2.60	Transparent

Note: PropTech score varies from 1 – high level of PropTech adoption to 5 – low level of PropTech adoption, while the global real estate transparency index (GRETI) takes value from 1 – highly transparent markets to 5 – opaque markets.

Source: JLL (2018b, p. 21, 55)

The property listing websites are the most used PropTech tools, being very well developed and in states with less transparent real estate markets (JLL, 2018b). In contrast, the use of blockchain technology in real estate transactions is at an extremely early stage, with pioneering initiatives taking place in Sweden and Singapore (JLL, 2018b). Blockchain projects in the real estate industry are based on the objective of improving the efficiency and transparency of the process of registering the transfer of ownership. The main advantages of this technology are high data quality, transparent relationship between participants, faster transactions, lower transaction costs and increased market liquidity (Baum, 2017).

The big data collected through information technology allowed the development of online systems for automated valuation models (AVM). The AVM model is a computer program based on algorithms that estimate the market value of real estate at a given time. AVMs offer distinct advantages over traditional appraisals, like the rapidity of value estimation, the low costs, the reduction of errors and subjectivity of evaluations (Kok et al., 2017). However, the automatic

valuation of the buildings remains a controversial topic in the real estate industry that requires further research to demonstrate the correctness of the assessed values.

Several researchers believe that the adoption of PropTech technology tools for better transparency is the future of real estate (Ionaşcu et al., 2019). Technology will drive the transition of offline market prospecting processes to the online environment. In this way, real estate demand and supply will have transparent information.

Research methodology

Taking into account that in the context of current and future challenges, the sustainability/corporate responsibility reports represent the main communicating way of sustainability values to the stakeholders (Belluci et al., 2019; Ionaşcu et al., 2020), we chose to study the sustainability reports published by the real estate entities from EU during 2016-2018. In this paper, the real estate companies are considered the entities that buy, sell, develop and manage buildings and/or land for commercial, residential and industrial purposes. As the sustainability has gained a more detailed and realistic outlook by adopting the 17 SDGs (Goubran, 2019), to which more and more entities in various fields align their activities, reporting according to the SDGs was an important criterion for sample selection. The sample of reports was extracted from the Global Reporting Initiative (GRI) database, which contains almost 62,000 reports published by over 14,600 entities since 1999, of which 70% comply with GRI standards and guidelines (GRI, 2020). GRI reporting frameworks are the most widely used sustainability reporting standards in the world (Romero et al., 2018). Following these filters, have resulted in 39 reports published by 16 real estate companies headquartered in EU countries.

The best represented country in the sample is Sweden, with 6 entities and 17 reports (Figure 4). Sweden is one of the leading countries in achieving the 17 SDGs (Sachs et al., 2019) and in reporting corporate social responsibility (KPMG, 2017a), due to early concerns for sustainable development (Rimmel, 2019). Sweden is followed by Belgium with two entities and five reports and by Finland, France, Great Britain, Germany, Netherlands, Portugal, Austria and Greece, with one entity each, which have published between one and three annual sustainability reports (Figure 4).

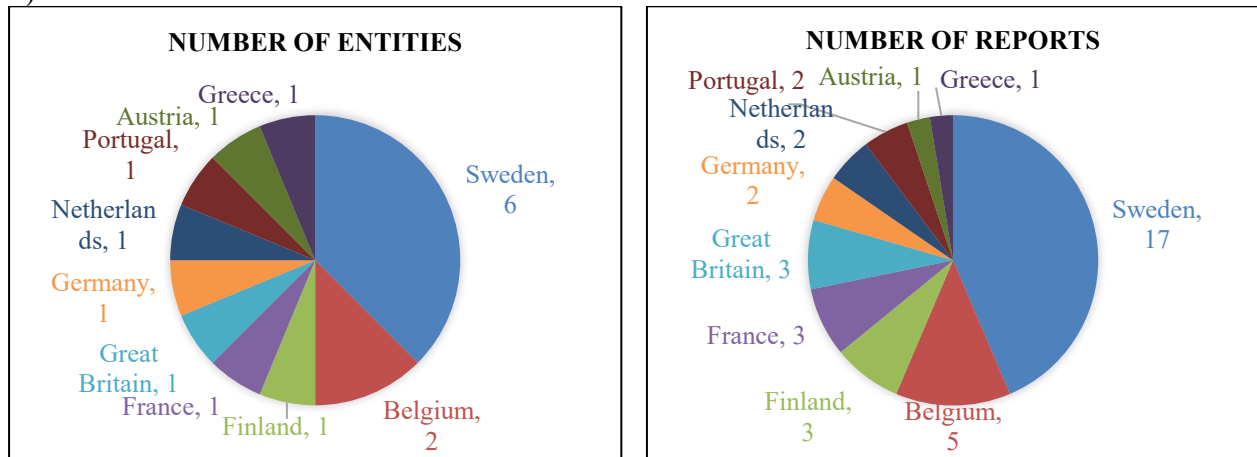


Figure 4. Distribution of analysed entities and reports on EU countries

Source: Authors' research

From the perspective of the regime of organizing real estate activities, 10 are real estate owners and developers, and 6 are real estate investment trusts (REITs). REITs are the listed real estate companies that own, develop and manage real estate assets to make a profit from rental activities and capital appreciation, of which over 90% is distributed as dividends (EPRA, 2018). According to GRI data, 14 of the 16 entities studied are listed, and in terms of company size, 10 entities are large, 3 are multinational enterprises and 3 are small and medium-sized enterprises. All sustainability reports are compiled based on GRI G4 Guidelines and GRI Standards, core level, and 28 reports are externally assured to meet the conditions of consistency and credibility of the studied documents.

The research method used to assess the extent to which real estate entities participate in the transparency and digitalisation of sustainable real estate processes is content analysis. The qualitative analysis is a continuous reflective process (Erlingsson & Brysiewicz, 2017), based on “a systematic and objective means to make valid inferences from verbal, visual, or written data in order to describe and quantify specific phenomena” (Downe-Wamboldt, 1992, p. 314). Content analysis is a very popular method among researchers in various fields due to the flexibility and systematised structure, being frequently applied in studying the non-financial information reported by entities (Belluci et al., 2019). In real estate research, this method was applied mostly to evaluate the sustainability levels in terms of sustainability practices amongst property companies (Laposa & Villupuram, 2010; Glass, 2012; Warren-Myers, 2012; Razali et al., 2017; Rashidfarokhi et al., 2018; Ionaşcu et al., 2020).

Starting from the research purpose, the methodology is based on an inductive-interpretative perspective and a summative content analysis approach, proposed by Hsieh and Shannon (2005) (Table 2). This approach supposes identifying and quantifying the basic concepts of research to understand their contextual use (Hsieh & Shannon, 2005). One of the requirements of this analysis is the repeated reading of documents for a better knowledge of the data (Hsieh and Shannon, 2005). Initially, the reports were read in full to know the content and identify the sections dedicated to the discourse on transparency and the digitalisation of the real estate processes. The sections thus delimited were reread several times to correlate the text of the reports with the perception of transparency, ways to promote transparency improvements, use and perspectives of digital technologies. NVivo qualitative data processing software (version 12) was used to organise the content. Also, we used the analysis of variance (ANOVA) with the post hoc Tukey test to compare the perception of transparency depending on the type of real estate entity, company size, listing/non-listing and externally assurance.

Table 2. Analysis of the contents presented in the sustainability reports

Summative content analysis	<i>Transparency in the discourse on corporate responsibility</i>
	a) perception of transparency in relations with the stakeholders;
	b) ways to promote transparency
	<i>Digitalisation of the real estate processes</i>
a) use of digital technologies;	
b) perspectives in the application of digital technologies.	

Source: Authors' research

Results and discussions

Studying the context in which real estate entities approach the concept of transparency in sustainable reporting, we noticed that the frequency of the words “transparency” and “transparent” varies from 0 to 36 appearances in sustainability reports, the average number being 10.85. Following the direct relationship between the frequency and importance of the subject expressed by a series of terms (Stepchenkova et al., 2009), the variation in the number of appearances illustrates the different perception of the real estate entities on transparency. According to the ANOVA analysis, there are statistically significant differences in perception of transparency depending on the organization regime of real estate activities in real estate entities and REITs ($F(1, 37) = 13.77, p\text{-value} = 0.0007$) and the existing of an independent assurance for the sustainability reports ($F(1, 37) = 4.85, p\text{-value} = 0.0339$). The Tukey test shows a significantly higher number of appearances of the “transparency” concept by 8.60 ± 2.32 appearances ($p\text{-value} = 0.0010$) in the reports of REITs companies and by 5.99 ± 2.72 appearances ($p\text{-value} = 0.0340$) in the reports that present an assurance statement. These results are in line with the fact that REITs are more transparent and liquid than normal real estate companies due to legislative pressures related to the activity conducting and the way of financing. Danielsen et al. (2014) demonstrate that REITs companies that invest more in the communication ways of financial and non-financial performance are more liquid. Regarding the provision of non-financial information, the literature recognises the role of the external assurance mission in increasing the transparency and credibility of entities’ stocks (KPMG, 2017). In terms of entities size ($F(2, 36) = 1.24, p\text{-value} = 0.3023$) and listing on a stock market ($F(1, 37) = 1.37, p\text{-value} = 0.2487$), the analysis of variance does not present differences, statistically significant, of presenting the role of transparency in real estate activities.

Analysing the content of sustainability reports, we deduce that, in general, real estate entities consider transparency a basic pillar of corporate governance, through which they present in detail the principles, management structure, diversity policy, corporate social responsibility, internal control system, management risks, shareholder structure etc. This situation is normal because, through transparency, stakeholders ensure about the good governance of the entity (Fung, 2014). Therefore, most entities base their real estate business on the relationship with stakeholders, whose expectations assessed according to the degree of significance are integrated into the value chain. For this purpose, businesses regularly engage in a dynamic and transparent dialogue with stakeholders, which helps the entities to develop a better perspective on the expectations of stakeholders, focus on important issues, manage risks and opportunities and take correct decisions for the sustainability strategy anchored in their general business strategy. They are also concerned with the transparent communication of financial and non-financial performance to increase the stakeholder confidence in the company’s business model, which is why they invest in certifying sustainable buildings according to the most advanced and well-known rating systems like Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Methodology (BREEAM). In over 50% of sustainability reports, the entities report about their sustainable buildings certified BREEAM, which is the most used rating system in Europe (Goubran & Cucuzzella, 2019). The green building rating systems increase the transparency of property markets, informing the demand about sustainable characteristics of the listed buildings on the market (Leskinen et al., 2020).

In contrast, the digitalisation of real estate processes to increase transparency is very weak, in only 15% of sustainability reports, the entities consider the digital technologies an efficient tool for facilitating transactions. Digitalisation is rather seen as a mega-trend of the current development

that companies need to adapt to, than an instrument of increasing the productivity and efficiency of real estate activities. Thus, to keep up with the dynamic requirements of stakeholders, several entities are exploring technological advances with the purpose to become the leaders of digitalisation in the real estate industry. Among the most common digital innovations encountered in real estate reports are the creation of digital platforms dedicated to customers and employees, the construction of smart buildings using artificial intelligence and the Internet of Things, equipping the parking with electric vehicle charging stations, installing digital panels for the management of energy, water, air quality, traffic etc., ensuring optimal internet connection for space users, price negotiations through blockchain platforms to simplify procedures and protect signed documents etc. In addition, to fully explore technological advances, the real estate entities are investing in the training of digital skills in employees.

Even if digitalisation is a relatively new field for the real estate industry, often considered non-transparent, under the influence of the dynamic requirements of stakeholders, it has great development prospects, a fact that will also improve transparency.

Conclusion

Transparency has become the new paradigm of economic activities, and in real estate, it has a special significance due to the economic, social and environmental importance of properties. Although significant progress has been made in recent years, further action is needed to increase the transparency of real estate markets. Digitalisation has a considerable role in increasing transparency, but real estate has generally been slow in adapting to the new technologies to automate manual procedures.

Taking into account the role of real estate in sustainable transformation, we studied the perception of real estate entities from the EU related to transparency in the relationship with stakeholders and the adoption of digital technologies in their business models. Applying a qualitative approach, we critically analysed the sustainability reports published by real estate companies, which represent important non-financial information sources for stakeholders.

Transparency is mainly reflected in corporate governance, as real estate entities are increasingly concerned with maintaining open relationships with stakeholders and knowing their expectations to integrate them into the business strategy. REIT companies seem to be more concerned with ensuring a high level of transparency to attract investors. Also, entities whose reports have been the subject of an external assurance mission stand out through a broader approach of transparency in business strategy. New digital technologies serve the purpose of improving transparency, which, although still poorly explored in real estate, offer new solutions to increase the efficiency and productivity of real estate activities. PropTech can increase real estate market transparency and liquidity, bringing lower transaction costs, which should positively impact the value of investment assets.

Research regarding the link between property market transparency and digitalisation should continue and develop to help the real estate entities to align easier to the new technologies and thus contributing to the transparency improving. A major limitation of this research is the small number of non-financial reports analysed, based on which the different levels of transparency perception and the low degree of absorption of new technologies were generalized.

References

- Agarwal, R., Chandrasekaran, S. & Sridhar, M. (2016). Imagining construction's digital future, Singapore: McKinsey Productivity Sciences Center.
- Aihie, V. (2019). The PropTech Revolution: The Imperatives for Nigeria's Estate Surveying and Valuation Professionals to Catch Up or Get Left Behind. *Journal of African Real Estate Research*, 4(2), 56-75.
- Altman, W. (2018). *The rise of smart cities*. Intelligence Analyst, CB Insights. Retrieved from <https://www.cbinsights.com/research/briefing/rise-of-smart-cities/>.
- Baum, A. (2017). *PropTech 3.0: the future of real estate*, Oxford: University of Oxford.
- Baum, A., Saull, A. & Braesemann, F. (2020). *PropTech 2020: the future of real estate*, Oxford: University of Oxford.
- Belluci, M., Simioni, L., Acutti, D. & Manetti, G. (2019). Stakeholder engagement and dialogic accounting. Empirical evidence in sustainability reporting. *Accounting, Auditing & Accountability Journal*, 32(5), 1467-1499.
- Braesemann, F. & Baum, A. (2020). PropTech: Turning real estate into a data-driven market?. *Working Paper of Oxford Future of Real Estate Initiative*, Version 1.3.
- Collinson, A. (2018). *Why should companies focus on Real Estate fintech startups?* Deloitte Touche Tohmatsu.
- Danielsen, B., Harrison, D., Van Ness, R. & Warr, R. (2014). Liquidity, accounting transparency, and the cost of capital: evidence from real estate investment trusts. *Journal of Real Estate Research*, 36(2), 221-252.
- De Groot, M., Volt, J. & Bean, F. (2017). *Is Europe ready for the smart buildings revolution? Mapping smart-readiness and innovative case studies*, Brussels: Buildings Performance Institute Europe (BPIE).
- Deloitte (2018). *European Construction Monitor. 2017-2018: a looming new construction crisis?*, Netherlands: Deloitte.
- Downe-Wamboldt, B. (1992.) Content analysis: Method, applications, and issues. *Health Care for Women International*, 13(3), 313-321.
- EPRA (2018). *Listed REITs in the European Union*, Brussels: European Public Real Estate Association.
- Erlingsson, C. & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African Journal of Emergency Medicine*, 7(3), 93-99.
- European Commission (2012). *Construction sector competitiveness*. Retrieved from https://ec.europa.eu/growth/sectors/construction/competitiveness_en.
- European Commission (2020). *Energy efficiency in buildings*, Brussels: European Commission - Department: Energy - In focus.
- Fernandez-Feijoo, B., Romero, S. & Ruiz, S. (2014). Effect of stakeholders' pressure on transparency of sustainability reports within the GRI framework. *Journal of Business Ethics*, 122(1), 53-63.
- Fung, B. (2014.) The demand and need for transparency and disclosure in corporate governance. *Universal Journal of Management*, 2(2), 72-80.
- Glass, J. (2012). The state of sustainability reporting in the construction sector. *Smart and Sustainable Built Environment*, 1(1), 87-104.

- Goubran, S. (2019). On the role of construction in achieving the SDGs. *Journal of Sustainability Research*, 1(2).
- Goubran, S. & Cucuzzella, C. (2019). Integrating the Sustainable Development Goals in Building Projects. *Journal of Sustainable Research*, 1(2).
- GRI (2015). *Sustainability and reporting trends in 2025: preparing for the future*, Amsterdam: Global Reporting Initiative.
- GRI (2020). *Sustainability disclosure database*. Retrieved from <https://database.globalreporting.org/>.
- Hsieh, H.-C., Claresta, V. & Bui, T. (2020). Green Building, Cost of Equity Capital and Corporate Governance: Evidence from US Real Estate Investment Trusts. *Sustainability*, 12(9), 3680.
- Hsieh, H.-F. & Shannon, S. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288.
- Ionaşcu, E. (2018). Meanings and interpretations of the information flow transparency in the real estate field. *The Valuation Journal*, 13(2), 5-47.
- Ionaşcu, E., Mironiuc, M. & Anghel, I. (2019). Transparency of real estate markets: conceptual and empirical evidence. *Audit Financiar*, 17(2(154)), 306-326.
- Ionaşcu, E., Mironiuc, M., Anghel, I. & Huian, M. (2020). The Involvement of Real Estate Companies in Sustainable Development - An Analysis from the SDGs Reporting Perspective. *Sustainability*, 12(3), 798.
- JLL (2014). *Real Estate Raises the Bar. Data disclosure and technology lift transparency levels*, Chicago: Jones Lang LaSalle and LaSalle Investment Management
- JLL (2016). *Global Real Estate Transparency Index, 2016. Taking Real Estate Transparency to the Next Level*, Chicago: Jones Lang LaSalle and LaSalle Investment Management.
- JLL (2018a). *The state of construction technology*, Chicago: Jones Lang LaSalle and LaSalle Investment Management.
- JLL (2018b). *Transparency: Data, Disclosure and Disruption*, Chicago: Jones Lang LaSalle and LaSalle Investment Management.
- Kok, N., Koponen, E. & Martinez-Barbarosa, C. (2017). Big data in real estate? From manual appraisal to automated valuation. *Journal of Portfolio Management*, 43(6), 202-211.
- KPMG (2017a). *Non-financial assurance: improving the transparency of you non-financial disclosures*, Auckland: KPMG International Cooperative.
- KPMG (2017). *The KPMG survey of corporate responsibility reporting 2017*, Auckland: KPMG International Cooperative.
- Laposa, S. & Villupuram, S. (2010). Corporate Real Estate and Corporate Sustainability Reporting: An Examination and Critique of Current Standards. *Journal of Sustainable Real Estate*, 2(1), 23-49.
- Leskinen, N., Vimpari, J. & Junnila, S. (2020). A review of the impact of green building certification on the cash flows and values of commercial properties. *Sustainability*, 12(7), 2729.
- Lowe, C. & Ponce, A. (2009). *An international review of sustainable building performance indicators & benchmarks*, UNEP-FI and UNEP-SBCI. Retrieved from https://pdfs.semanticscholar.org/08d3/94c8e68e3293ba98039188a838d246350a73.pdf?_ga=2.56389928.2033674804.1591127983-422728170.1591127983.

- Rashidfarokhi, A., Toivonen, S. & Viitanen, K. (2018). Sustainability reporting in the Nordic real estate companies: empirical evidence from Finland. *International Journal of Strategic Management*, 22(1), 51-63.
- Razali, M., Yunus, N. & Zainudin, A. (2017). Sustainable property development by Southeast Asian property companies. *Property Management*, 35(1), 109-126.
- Redlein, A. & Höhenberger, C. (2020). Digitalisation. In Redlein, A. (Ed.). *Modern Facility and Workplace Management: Processes, Implementation and Digitalisation* (pp. 139-176). Cham: Springer International Publishing.
- Rimmel, G. (2019). Human capital disclosures in Swedish state-owned enterprises - a comparison of integrated reporting versus traditional reporting. In Arvidsson, S. (Ed.) *Challenges in managing sustainable business* (pp. 55-75). Cham: Palgrave Macmillan.
- Roland Berger (2016). *Digitization in the construction industry: building Europe's road to "Construction 4.0"*, Munich: Roland Berger GMBH.
- Romero, S., Ruiz, S. & Fernandez-Feijoo, B. (2018). Sustainability reporting and stakeholders engagement in Spain: different instruments, different quality. *Business Strategy and the Environment*, 28(1), 221-232.
- Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G. & Fuller, G. (2019). *Sustainable development report 2019*, New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).
- Sadayuki, T., Harano, K. & Yamazaki, F. (2019). Market transparency and international real estate investment. *Journal of Property Investment & Finance*, 37(5), 503-518.
- Schwab, K. (2016). *The fourth industrial revolution*. Geneva: World Economic Forum.
- Stepchenkova, S., Kirilenko, A. & Morrison, A. (2009). Facilitating content analysis in tourism research. *Journal of Travel Research*, 47(4), 454-469.
- Warren-Myers, G. (2012). Sustainable management of real estate: is it really sustainability?. *Journal of Sustainable Real Estate*, 4(1), 177-197.
- Weatherley, D. (2020). *Top 10 construction technology trends*. Retrieved from <https://www.constructionglobal.com/top10/top-10-construction-technology-trends-0>.
- World Economic Forum (2015). *The future of FinTech: a paradigm shift in small business finance*, Geneva: World Economic Forum.