

DIGITAL TECHNOLOGY AND THE REAL ESTATE INDUSTRY*Mohd Lizam**Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia**Email : lizam@uthm.edu.my**Submit : 8th August 2019, Revised : 19th August 2019, Accepted : 27th August 2019***ABSTRACT**

. This paper briefly summarises the extent of the technological impact on the real estate industry, in particular, digital technology. As real estate industry is naturally characterized by several disadvantages in comparison to other industry, understanding the impact of digital technology is crucial to the industry on whether this technology will distrust the industry or complement the business process. The emergence of PropTech start-ups has made the industry players to re-evaluate its organisational strategy to align the business process to a possible threat to the present business model. Prior studies suggest that PropTech comes in there waves in which each wave is characterized by the respective period advancement in digital technology. Several studies also indicate that digital technology may not entirely disrupt the industry but do have a significant potential to act as a complement to the industry in improving its productivity and efficiency.

Keywords: Digital technologies; PropTech; disruptive innovation; real estate

I. INTRODUCTION

Technology is the element that disrupts almost every facet of the industry and changing the traditional business model. Real estate industry is no exception to this new element and it starting to change the conduct of how business process being implemented in the whole supply chain of the industry. It may become a threat to the present industry player who failed to adapt to the new business model and at the same time create opportunities for the start-up that are innovating new technology that is efficient and at a fraction of the cost.

As the emergence of FinTech is currently disrupting the financial sector, so do real estate industry. Recently the real estate industries have witnessed the advent of digital technology that promises efficiency and value-added to the industry players. For example, PropTech companies as in [1], offer their technologies often in the form of ‘dashboard’ soft-

ware product offering real estate players services that mainly to reduce the searching as well as administrative costs using. Most of these ‘dashboard’ solutions often accompanied by other supplementary products that promise to fixed problems relating to real estate investment through the application of digital technology.

Nevertheless, do these PropTech innovations can solve problems in the real estate market remain a question. Despite criticism that the digital innovation may only address the industry problems temporarily, [2] pointed out that in 2017 alone, the total investment made into PropTech was at \$12.1bn. This fact is also supported through a survey by [3] which stated 93 per cent agree that real estate business organisation must engage PropTech companies to stay relevant despite on 30 per cent on the real estate companies are currently invest or plan to invest in PropTech start-ups. Considering that other industries that have been disrupted by the computerisation of business process –

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Amazon in logistic, Grab in taxi services, Upwork in outsourcing, and many more – it is about time for the players in the real estate industries to consider threat or opportunity by the PropTech more seriously. Understanding of form of and how future real estate markets operate is crucial in this trillion-dollar market.

PropTech is considered a challenge to the traditional setting of the real estate business, and therefore, it is possible to disrupt the activity of many industry players. This paper is expected to provide a brief overview of the PropTech and whether it could disrupt the real estate industry or merely a tool to make the industry more efficient. Through the lens of disruptive innovation theory proposed by Christensen in his work in [4], [5] and [6] the idea technological disruption may be proposed if there is clear evidence of disruption.

Digital technology is the impetus that propels the development of PropTech. Advancement in the information and communication technology (ICT) in the late 1990s is the beginning of the structural change in the business process. In the early age, the scope for internet use was simply for marketing purposes and product awareness. As technology grows, the internet function goes beyond what would imagine in those days. Today's advancement in mobile technology made it possible for automated data collection and analysis that can provide users with accurate information. Therefore, technology is a game-changer that differentiates players in the real estate industry. It is likely to disrupt the traditional business model in the real estate industry.

II. RESEARCH METHODS

Real estate industry is an industry that is highly regulated. Essentially, it is a business that mediating the transaction in the form of sale or rental of property asset from one person or organisation to another. Nevertheless, it is not a simple transaction-process involving two parties. Take an example of a housing transaction, in a highly regulated market, the transaction typically involves more parties other than buyer and seller, and it can become complicated when the transaction value involve millions usually as in commercial real estate transaction.

To put into perspective on the global real estate investment value, Savills, the global real estate

consultant, reported that the volume of capital injected into real estate had increased from \$600 billion in 2008 to \$1.8 trillion in 2018. It is expected that the Asia-Pacific countries will dominate most of the fu-

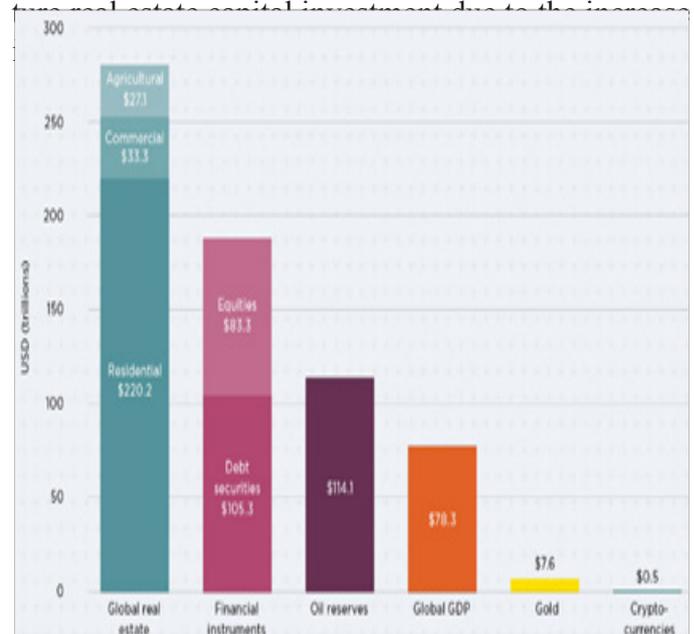


Fig. 1 Comparison of Global Real Estate Value (Source: Savills World Research).

Fig. 1 shows the comparison of the transaction value of different investment asset at the end of 2017. It indicates the total value of the global real estate market is about \$280 trillion with residential real estate accounts for the largest share of the transaction value.

There is a specific characteristic of the real estate market that makes the value of property asset proportionally higher to that of other investment markets. [7] explain the main characteristics of the real estate market. The characteristics of the market include heterogeneity and fixed location, large unit value, high leverage, long term holding nature, require active management, supply depends on the development cycle, depreciation, government intervention, psychological factor determine purchase decision, high opacity, illiquidity, consist of different property types and controlled supply.

There are specific characteristics that make real estate market inefficient and requiring the involvement of many players to complete a transaction. Real estate market is inherently inefficient. Comparing to the stock market where price adjustment to new information is relatively instantaneously, it is

not for the real estate market [8]. The critical characteristic that leads to such generalisation is market opacity. The opacity nature of the real estate market data results in most of the critical market information being held by specific players. In the case of Malaysia's real estate market, the information typically held by real estate surveyors and estate agent. This has contributed to significant search time and cost to determine the market value as well as to match buyers and sellers. This is partly the basis that forms the traditional model in the real estate business process.

Leverage is another part that defines real estate industry, and the role of financial institutions is significant for real estate to work without disruption. Considering the large sum of money needed to purchase a property asset, the majority of the investors or homeowner depends on the financial institution for liquidity. Prior studies such as [9] suggest that leverage may contribute to improving the property market value. [10] also point out that real estate investors prefer debt to enhance the return on equity. The theoretical explanation for the increase in market value is two folds. As demand for leverage continues, demand for property will also increase if the cost for leverage not exceeding the expected rate of return. Since the supply for real estate is constrained due to development lag, it will increase the asset value, at least for a short term. On the return on equity, as shown by [11], within the context of the discounted cash-flow model, the use of leverage will lower the amount equity needed for the real estate investment and increase the size of tax shelter only if the investment's cash-flow show positive leverage.

For investment class real estate, mainly commercial real estate market – office and retail market, the property value is attached to its ability to produce positive cash-flow for the whole investment holding period. Positive cash-flow is directly related to the tenant quality and lease structure. The reason being that rent is the main building block for the income returns in commercial real estate that results from the economic activity of the tenants [12]. Therefore, any change in occupant requirements will have an impact on the stability of rental income. [12] further explain, any proposal towards a flexible pattern of space occupation or shorter leases requirements will increase the risk to the real estate investment to all parties involved. As will be explained later in the following section, this is the sector in the real estate industry

that will be affected the most as a result of technological advancement.

As pointed out in the earlier discussion, the real estate industry involves many parties or players. It has been shown that the market is also complicated. With the advancement in ICT as well as mobile technology, all parties will be affected in one way or another. The market players that may be affected by this new development includes the real estate surveyor, estate agent, property and facilities managers, real estate investors, financial institutions, land administrators and legal practitioners. Equip with knowledge in advance digital and mobile technology, the traditional conduct of real estate business is on the verge of fierce competition from a new business organization known as PropTech. The following section will further clarify the PropTech business model and how it may or may not disrupt the traditional model of real estate industry.

III. RESULT AND DISCUSSION

PropTech is an acronym that combines property and technology words. RICS define PropTech as a 'term that refers to all aspects of innovation and how this affects the built environment'. This broad definition includes software, hardware, material or manufacturing that is produced by the small start-ups companies. These start-ups companies create innovation using available technology to solve limitations in the real estate industry as what has been discussed in the preceding section.

It has been noted that the real estate industry is slow in adopting technology in the business operation. Even in present-day, there are services in real estate is manually conducted with minimal assistance from technology. Digital technology set the foundation for PropTech development. PropTech would not be possible without the technological evolution in computing technology. Alongside with technological development, data is the foundation of the real estate industry. Data is needed to decide on various key issues. Data on real estate transaction is needed by property valuer to estimate the most likely the market value of a property that normally a prerequisite by the financial institution prior to approving mortgage financing. Performance data is needed by real estate investors to decide on worthiness on real real estate investment opportunities. Data also needed to con-

duct market analysis as well as to create a property market index for performance measurement. In the field of property management, rental and lease data is required to negotiate the renewal of the lease period and rental rate. Therefore, the real estate industry is data-driven, and the primary concern of the industry is that most of the real estate data is not publicly available [13].

The technological evolution in the real estate industry begins in the same period when the business organisation is being introduced with personal computer and database management system. As pointed by [2], PropTech is introduced into the real estate industry in the three waves. The first wave started in the US in the middle of the 1980s as a result of an increase in computing power and database management system. In this period of time, the advancement in computing power, inline with the development in indirect real estate investment as an alternative to direct real estate investment such as debt and asset-backed securitization, REITs, and growth in derivative markets has created demand for the quantitative analysis which is the main focus is on the performance measurements real estate investment.

Due to the development in alternative real estate investment market, it makes data that is previously proprietary owned become public and readily available for public consumption. With increasing in computing power, this has provided the opportunity for sophisticated quantitative modelling being introduced in property market analysis that previously rather impossible. Consequently, the industry being introduced with valuation software and property and portfolio management start to depend on computer and technology, this has made Argus become the leading provider of software and solutions for real estate investment management. PropTech in the first wave is characterized by the advancement in computing power, the availability of data and the development of software for the advanced market analysis.

ICT has advanced another step in the 1990s due to the introduction of internet technology such as the World Wide Web and e-mail service at the end of the 1990s. In this period, many international real estate firms introducing Internet marketing as strategic tools of their corporate strategies [14]. The link between first wave PropTech and second wave PropTech is the adoption of online advertisement through the Internet by the residential sector of the real estate

industry. [15] shows that in March 2003, close to 10 per cent of the active online population in the US accessed real estate web page. The record also shows several web pages achieve around 700,000 visits each month. The presence of on-line estate agency service started in UK in which Rightmove was established in the year 2000. It is a joint effort of four UK's top real estate agencies – Countrywide, Connells, Halifax and Royal and Sun Alliance. It then followed by Zoopla in 2007 and OnTheMarket in 2015. While in the US it started with Trulia which was launched in 2005 then followed by Zillow in 2006 in which acquired Trulia for \$2.5bn in 2015.

Following first wave PropTech, second PropTech produces an unprecedented growth in innovation, investment and entrepreneurial activity in start-ups. The inherent limitation in the real estate industry provides opportunities to this growth – large, immobile, illiquid and vested interest of the market players that control market information. Another contributing factor that leads to this growth is the technological breakthrough. Advancement in computing and networking technologies spur innovations such as cloud computing, leaner coding, mobile devices and sensors. The economy of scale helps in lowering cost of consuming mobile technology. This has made it possible for ubiquitous connectivity propelled by broadband, Wi-fi and 4G mobile telephony, which in turn increases the internet penetration rate at a global scale.

As pointed, second wave PropTech sees significant investment into start-ups by the venture capitalist. These investments include venture capitalist such as Venture Scanner, Crunchbase, Pitchbook and Angelist; accelerators such as 500 StartUps, Y Combinator, PiLabs and MetaProp NYC. CB Insights reported that since 2012, PropTech start-ups had raised

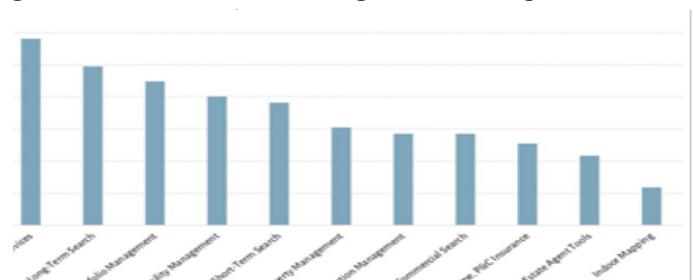


Figure 2: PropTech Investors by Category (Source: Venture Scanner, 2019)

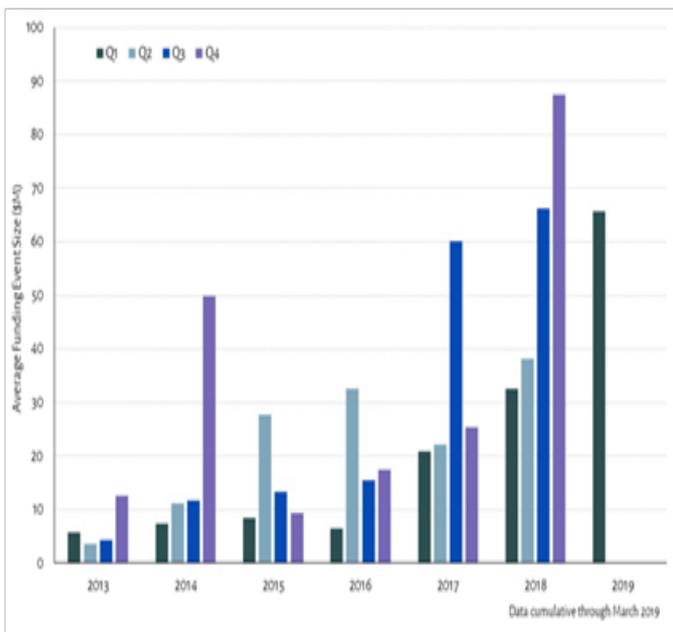


Figure 3: PropTech Average Funding Size (Source: Venture Scanner, 2019)

Figure 2 and 3 shows PropTech investors by categories of real estate services and average funding size between 2013 and 2019, respectively. This shows that the venture capitalist has a broadened definition of what is being considered as the real estate industry. For example, traditionally home sensor is not being considered as real estate but appropriately categorized as electronic. Nevertheless, this particular category – IoT Home, receive investors attention the most followed by home services. Looking at the funding size, the amount of liquidity that goes into PropTech start-ups in the increasing trend from 2013 up to the first quarter of 2019. This indicates two possibilities. First, start-ups with a good idea may not be able to materialize without any funding and proper guidance by the venture capitalist. Second, venture capitalist or accelerators may see that there is use potential behind PropTech idea that akin to what has fueled the dot.com bubble. As pointed by [2], by 2017 the evidence has shown that funding for PropTech has going mainstream that captured the interest of real estate professionals and traditional real estate firms. Example for such organization that have venture into funding PropTech start-ups includes Hines, LaSalle, Cushman, British Land, CBRE and others. PropTech second wave is mainly characterized by start-ups innovations and investment into it. This is made possible due to technological advancement that was first

introduced in the first wave PropTech. In other words, the first wave PropTech simply lay out the foundation and the second wave PropTech use the tools that have been provided to create innovations to solve the industry problems.

While the third wave PropTech may not arrive but the technology requires for it has been available recently. The next PropTech will be characterized by two technologies – blockchain and artificial intelligence [2]. Blockchain is the technology behind the cryptocurrency. Many may have heard about bitcoin but never been exposed to the technology that made it possible. [16] make a connection on blockchain to the crypto-economy. Taking the definition of crypto-economy by [17] as “economic system, which is not defined by geographic location, political structure, or legal system, but which uses cryptographic techniques to constrain behaviour in place of using trusted third parties”. Through the definition, the crypto economy is truly a cross border economy. Ideally, a cross border transaction could take place with minimal or no-constraint with a payment system that is accepted by all parties seamlessly at no transaction cost. The key concept of blockchain technology lies in the payment system that is recognized globally known as cryptocurrency.

Prior to the introduction of blockchain technology, the digital payment system was conceptualized through digital cash using a central server to overcome the double-spending problem [18]. However, the concept faces issues of compatibility, anonymity and double-spending prevention that has compromised the idea. The introduction of Bitcoin is a result of improvement based on [18], which is the decentralised nature of the payment system that is possible in the blockchain technology. This technology ensures the elimination of the double-spend problem through public-key cryptography. In this public-key cryptography, each agent is assigned a private key and public key shared with other agents in the system. The coins can be transferred to other parties by the digital signature of hash. The transaction is secure such a way public key generated addresses cryptographically stored in the blockchain. Each coin is assigned with address and the transaction in the crypto-economy is a transaction of coin from one address to another.

An important feature of the blockchain is the public key are not associated with the real-world identity. Although all transactions are traceable, it enables-

the transaction to occur without disclosing the agent's identity. The transaction is considered final once it has been recorded in the blockchain and simultaneously verifiable by many sources [19]. It is important to note that Bitcoin was a first decentralised public ledger, and the success of Bitcoin is due to the blockchain innovation. In this sense, blockchain is a platform for the public ledger that is recorded by parties involved in a transaction through the Internet. This, in turn, results in removing the need for a trusted third party or agent to guarantee a transaction. Thus could make a transaction process simple and reduce transaction cost. [20] assert that the application of blockchain ranging from cryptocurrency, financial services, risk management, internet of things, public and social services. This indicates the vast potential of blockchain technology in eliminating the third party in any transaction process that is usually part of the process in the real estate industry.

Another technology that will become the core foundation for the third wave PropTech is artificial intelligence (AI). AI is a technology known for its association in a computer science discipline and has become a significant technology in supporting social life and economic activities. AI refers to the ability of a computer system to perform the intelligent function of the human brain. [21] pointed, recent advances in AI are contributed by the significant improvement in the processing capability of computer and the production of data at a global scale by sensing devices, social media and web application also contributed to the rise of AI. These massive amounts of data can then be manipulated using various machine and deep learning techniques to conduct analytical analysis. The essence of AI is that it allows for automated decision making based on a given input(s). [22] noted that most AI system that is currently being developed is a form of an expert system that relies on a database of knowledge to make a decision.

AI has many real-world applications in various disciplines such as medical, engineering, finance and many others. In the real estate industry many studies that observe the AI application focus on the automated determination of property value. The main reason for such emergence is due to a critic on the subjectivity nature of manual valuation process. Since the real estate industry is a data-intensive industry, it seems that the AI has its specific potential in the industry and may some days disrupt some of the

profession.

As humans are more connected than ever, and this has ultimately changed the nature of work and lifestyle. A new business process is now created that demands flexibility. Numerous studies investigate the impact of technology has on various sectors in the real estate industry. Based on the prior discussion, is it really PropTech has a disruptive potential to the industry or is just a tool to complement the business process to make the industry much more flexible and efficient. This is the main question that the industry player needs to answer to determine the potential of PropTech start-ups to disrupt the industry.

As pointed earlier, PropTech is characterized by start-ups that use present technology to create innovation to solve an industry problem. Nevertheless, most of the studies look into the effect of technology on the industry. For example, [23] study the impact that ICT has on the commercial property based on what it is believed as "death of real estate" and "productivity means job loss" within the context of the office property market as a result of technological change. His study emphasises that real estate "has not and will not disappear" and concludes that the ICT will continue to create a shift and impose transformation but subtly and will likely to change the needs and preferences of the industrial players caused by change in the occupant needs.

In another study by [13] investigate the interaction between industry structure and ICT on the residential sector of the real estate industry. Based on structuration theory, the research shows that the pervasive use of ICT in the business process has concurrently altered the industry structure through reducing estate agents control over information while reinforcing the present contract-based structures. Another important point that affects professionals in the US real estate industry is the pervasiveness of the Internet has resulted to the eroding position of the real estate professionals due to their exclusive excess to the Multiple Listing Service (MLS). The listing of such information on the web provides access to everyone thus reducing the need for agent service and interpretation. However, the finding also shows that agents do have control on other valuable resources and their role can now focus on the process or transaction supporter.

Another study by [24] looks at the impact of Internet usage on the real estate brokerage firm fi-

nancial performance. Their research is motivated by the erosion of the estate agent position as a result of MLS become publicly available that they hypothesise this will have a negative impact on the firm financial performance. The finding, however, shows that it is not the case. It shows that the use of the internet, in fact, improve the firm financial performance indicating the role of ICT is, in fact, to complement the business process rather than disrupting. This finding is further reinforced through a study by [25] that conclude in today business environment that uses ICT pervasively; real estate professional is still required to act as an intermediary between seller and buyer. The study suggests two key reasons for such findings, first relates to the time-consuming information search and the assistance provided by the agent on the considerably time-consuming transaction process.

In the investment sector of real estate industry, [26] coined the concept “automated landlord” to highlight the way digital technologies improve the investors’ capabilities as well as reshape the realities of what it means to be a renter. The study argued the ICT act as an enabler for investors in the housing market to aggregate the ownership of resources, extract income flow, and convey these flows to the market securely. These can be done through the management of tenant and properties that is increasingly governed by smartphones, digital platforms and apps, and the data and analytics gather and enable by these devices and infrastructures. In the end, the study concludes that full automation to take the investors role is unlikely to take place due to the peculiarities of the tenant and the properties. Some example given as for tenant some may insist to made payment physically rather than through an online system or would speak to human over the phone instead of the chatbot. While for properties, some instant and urgent maintenance require human intervention instead of automatically repaired.

On the retail sector or the industry, e-commerce does have a significant impact on the demand on retail space as well as value implications to the commercial property owner. [26] try to clarify the linkage between e-commerce and the demand for retail space in China real estate market. The finding suggests that between 2009 to 2013, there was a pattern of slowing growth in retail property sales and accelerating vacancy rate of the retail space is associated with the dramatic growth in e-commerce sales. However, the

study asserts that due to the respective advantage and disadvantage link to the online and offline shopping, physical retail stores will not be completely overshadowed by the online shopping portal.

A study by [27] examines the impact of technology and e-commerce has on traditional retail sales, commercial property values and percentage rents. The paper argued that e-commerce activity occurs at the physical retail location but recorded as online sales that result to the loss of on-site sales information, reducing tabulation of gross sale per square foot recorded in the property owners account and potential loss of percentage rents. The finding, based on those surveyed, most retail owners do not include the online sales provision in the lease contract, and this has value implications to the owners. The study also suggests that such provision must be included in the lease contract to capture some percentage of e-commerce sales.

In a much recent study by [28], suggest that although internet sales are in increasing pattern in the Netherlands, the same is also true for sales in the supermarket. Using a qualitative approach, the study interview real estate and e-commerce manager of eight Dutch supermarket chain. The study concludes that the effect of online sales on physical sales is rather minimal. Nevertheless, traditional supermarket chains continue their online strategy and this is evident through the launch of online initiatives. The purpose of pursuing such a strategy is mainly due to defensive motives in preventing potential loss in sales to the competitors.

IV. CONCLUSION

Three main themes have been explored in this paper on the impact of technology on the real estate industry. These are the possible impact of ICT and emerging digital technology, the indirect impact of ICT to real estate industry as a result of a change in other industry structure due to ICT that alter demand to real estate industry and finally the potential future technology that may change the structure of the industry such as blockchain and AI. As has been highlighted, PropTech comes in three waves and based on prior studies; it may not completely disrupt the real estate industry due to the natural characteristics of the industry. However, the innovation created by the PropTech start-ups may act as a complement to the

current business process. This may help to solve specific issues that have been associated with the industry and make the industry more efficient and productive.

The main purpose of this paper is to provide a brief overview of the impact of digital technology on the real estate industry based on prior research. A more comprehensive study is required across different real estate market on a global scale. Real estate market is generally influenced by the local market condition in which the property is located. Therefore, there will be no one size fits all when evaluating the impact that digital technology has on the global real estate industry. Due to different legal structure impose in various real estate market, the outcome may differ from one country to another.

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