HUMANISING TECHNOLOGY FOR INDUSTRIAL REVOLUTION 4.0: BIG DATA APPLICATION IN REAL ESTATE

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ABSTRACT

Big data has been a very popular concept in recent years due to the rapid development in internet technology. The real estate sector has also been impacted from this new occurrence as the sector deals with knowledge, data and information; as such the management of data is very important. This is because real estate is heavily involved in decision-making processes such as determination of value, investment decision-making, taxes, building management, maintenance management and portfolio management. Traditionally in real estate, the human factor plays a major role in job functions. Nevertheless the capacity of human ability and knowledge is limited. Humans are able to produce complex decisions rather than an algorithm, but have limited ability to process high volumes of data known as big data (BD). The real estate sector has become more complex in recent days compared to a decade ago. It requires accurate data analysis in order to be credible in the decision-making process. Data in real estate derives from many resources such as purchase transaction records, material information, life-cycle assets and costings, utility consumption, expenses, and portfolio returns. The data comes with an element of risk, which depends on the aims and objectives of the job function. In the internet era, data has evolved to include more information from areas such as social media, digital pictures and videos, cell phone signals, among others. In the data management revolution under the Industrial Revolution 4.0 (IR 4.0), BD in real estate can be defined as data which has the characteristics of high volume, high velocity, high veracity and high value which transforms to be intelligence information. Nevertheless, the emergence of BD is believed will not be taking the role of humans in the future. How can humans play a major part in the innovation of data management in Malaysia? This paper will further discuss the role of humans in technology and the emergence of the BD concept in Malaysia to comprehend the requirements of IR 4.0.

Keywords: *Humanising, IR 4.0, Big Data, Real Estate, Technology, Malaysia*

1. INTRODUCTION

The real estate sector in Malaysia has contributed significantly to Malaysian economic growth. Total investment in the real estate sector in Malaysia has recorded approximately RM140 million worth of transactions, in 2017 compared to only RM38 Million in 2001 (see Figure 1). This has shown the significance of the property sector in Malaysia. In order to keep the momentum of performance of this growth, the real estate sector in Malaysia needs to evolve in line with the transformation in industry demands of IR 4.0. At the global level, real estate products have shifted from having traditional physical valuation methods and property management procedures, towards flexible, mobile, innovative and sophisticated products. For instance, residential property has shifted from just physical development into smart cities which heavily implemented technology. The digitalisation concept in real estate will bring new economic models and new democratic ways in the working lifestyle. Technology has also had an impact on the industry by replacing some job functions in real estate, face-to-face interactions as well as changing the workplace environment. For instance, property managers have found that they are losing working hours in terms of showing vacant apartments. This has been replaced by using technology tools such as videos and virtual reality. Other examples include the use of valuation systems to replace traditional methods such as Artificial Neural Network (ANN), Zillow, House Canary and Mass Appraisal. The use of these systems replaces human dependency in determining valuations. Inspections, which are synonymous with the valuer's job function, have already been replaced by drones and Geographical Information System (GIS).

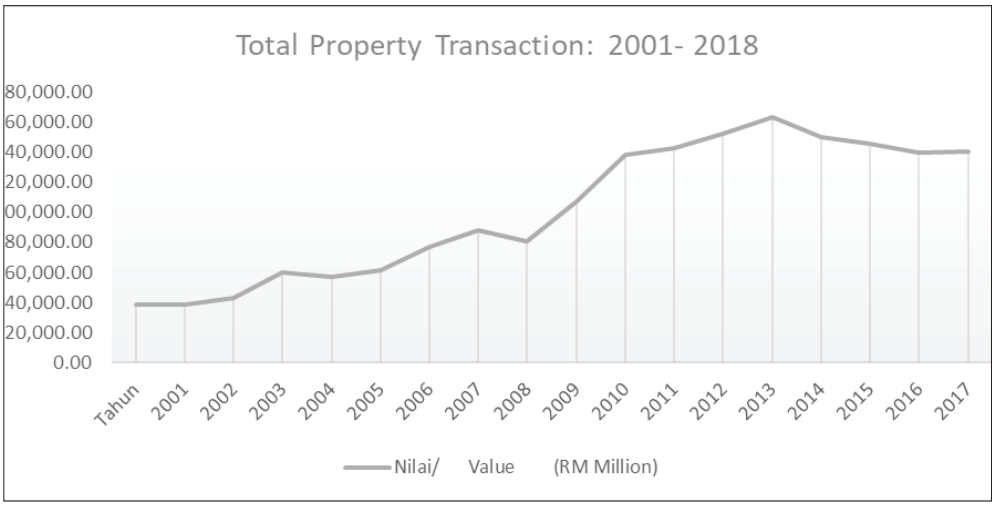

Figure 1: Total Property Transactions: 2001- 2018
Source: NAPIC 2019

The real estate sector at the global level has seen some innovation especially from the perspective of job functions, workspaces, job specifications and tools. It can be anticipated that in the future real estate will be dominated by technology applications such as artificial intelligence, BD and blockchain. It is believed that these technologies are relatively able to provide more relaxation time and therefore

people can focus on what the work-life balance really means. Therefore the real estate sector needs to add value due to the rapid change in technology by improving its products, business models, business strategies, innovation in property marketing, infrastructure upgrades and workplace conditions. This sector has seen several companies at the brink of collapse, especially in retail. Companies such as Mayer, Blockbuster, Toys R Us, Borders, Comet and Forever 21 have failed to respond to the changes in technology. These companies provide good examples of how disruptive technology can be, which leads to innovations being able to wipe out companies and retail property. On the contrary, companies such as Amazon, Facebook, Uber, Google, Netflix, Apple and Zalando are very quick to respond to the emergence of technology and manage to put aggressive plans into innovative business methods, business products and viability within the environment. These companies put less priority on property as a product but emphasise branding and culture. In addition, these companies are not focused in one region but established companies anywhere by manipulating technology workspace. With this development, the real estate world is at the turning point of transition with a profound and irreversible tilting of the real estate system in society and technology opportunities which can hardly be anticipated (Dijkastra, 2017).

Nonetheless the issue is whether technology is able to humanise people in the real estate sector. The introduction of the smart phone in 2007 has rapidly changed the way people do business, changed the way they interact, and has changed social and physical infrastructures. This includes the real estate sector which is currently in the process of redevelopment, modernisation and safeguarding (Jylha et al., 2019). According to Deloitte (2017), the real estate sector is going through a phase of deep change fuelled by a strong discontinuity from its cultural, social and demographic frameworks. Nevertheless according to the Global Proptech Survey (KPMG 2019), the real estate sector is at a moderate pace in terms of digitisation and automation, especially within job functions. According to the report only 58% of real estate companies are increasingly embracing digital technology while only 25% of respondents have a well-established data strategy that enables the capture and analysis of the right datasets (KPMG, 2019).

2. DISRUPTION IN REAL ESTATE

Disruption is a predictable pattern in all sectors where starts-ups use new technology to make it possible for something new and small to penetrate something existing and big in a short space of time (Vermeend & Smit, 2017). According to Veuger (2017), there are four phases involved in disruption, namely disruption, evolution, convergence and re-imagination of disruption. The research identified this phase of disruption and introduces a new product with a distinctive approach which is able to improve in state-of-the-art technology. This is followed by evolution where the proposition of value is based on the response of the respective industries. Convergence is an opportunity to broaden the customer base by attracting slow movers. The phase ends with the invention of the new product where newcomers in the market have a chance to take advantage of the market.

The new economy, led by technology, started many decades ago with the introduction of computers, which then evolved to the internet. The introduction of the smart phone has accelerated the new

economy concept to the digital economy. According to MDEC (2020), the digital economy refers to the actions taken by both the private and public sectors to adopt and utilise digital technologies to communicate with people, deliver goods and services and meet other core functions to raise productivity, revenue and income. It is estimated the global digital economy is now worth USD3 trillion.

The real estate sector has always been valued as an important commodity and pillar in nation economic growth. Nevertheless this sector has seen evolution which resulted from the impact from technology innovations. The IR 4.0 has shown the real estate sector that it is in need of innovation and parallels with consumer demand. The demand has brought disruption in real estate where property players need to anticipate trends in future consumer behaviour. For instance, the internet has reduced the demand for office space due to less demand in physical documents' storage space. This is due to the establishment of computing where all documents have been digitalised and saved in the cloud server. According to a report by Cushman and Wakefield (2018), office densification has shown that law firms signed leases that were 1/3 smaller space per employee than the previous lease. This indicates that the revolution in office space has had a significant impact on the demand in office property. The disruption in office property needs to be handled in order to ensure it will not have a spill-over effect on people, such as job losses and job functions replaced by computers. By not knowing the future demand or supply will make real estate value unpredictable and consequently creates volatility in the market. Retail property has had major disruptions with technology. Furthermore, according to Conway (2018), the number of real estate areas includes data analytics and platform applications that connect buyers and sellers, borrowers and lenders, customers and legal documents, customers and valuations. These areas are able to be replaced by an automation system which is driven by Artificial Intelligence (AI) application and can be replaced by algorithms rather than people-generated value.

The introduction of e-commerce has resulted in giant companies (as mentioned in the previous section) actively engaged with online retailers. Technology is able to provide options to consumers in terms of their shopping experience and products. Figure 2 illustrates a recent study by Zebra (2020) revealing that most of the global respondents (73%) preferred shopping lifestyle through mobile phone applications. More than half of the respondents were also more comfortable with online payments such as e-wallet, smart phone paying and cashless cards.

Figure 2: 2020 Study on Shopping Preferences
Source: Zebra, 2020

The evolution in office property is really concerning developers, governments and investors. According to a report by Yang et al. (2019), since 2010 flexible office space has been growing at an average rate of 23% per annum. A flexible office concept will allow companies to use space on a part-time basis with other facilities such as gymnasiums, conference rooms and cafés. In the US flexible office space has been offered by companies such as Regus, Spaces and WeWork. In Malaysia companies such as Komune, Uppercase, Worq, The Co and Nook are offering flexible working space in very strategic locations in Kuala Lumpur. These companies use emerging technology by offering an alternative workplace strategy. It can be anticipated in future that within the modern workplace, the ratio of space per full time employee is no longer based on square feet but will be based on the optimum space required and the function of the facilities. According to a recent study by JLL (2020), the modern workforce is also fluid due to alternative workplace strategies such as work-from-home arrangements, co-working and flexible working hours.

Disruption in the real estate sector has also occurred in the property management area. The task performed by humans, especially in buildings and operation management, has been taken over by smart home technologies, smart phone applications, remote security systems and robotics for cleaning and maintenance. This will have a significant impact on the number of available jobs in property management. Any disruption to drive the property management job function with job growth will have a significant impact for future employment. The disruptive in property management needs

to move away from pure operational management of the buildings to a more holistic approach, which requires knowledge that must be equipped among all stakeholders.

The disruption in real estate has not always had a negative impact on the real estate sector. It has also been able to create opportunities for industry players. For instance, the high demand in e-commerce will need the supply chain to be more effective in order to meet consumer demand. Supply chains need to be innovative: for example the process to deliver a product from raw needs to be sped up by using modern manufacturing technology to ensure the demand is able to meet the supply. The spill-over effect from innovation within the supply chain is increasing demand for distribution centres in major cities. In the US, Amazon has turned abandoned malls into distribution centres which are normally located in prime and easy access areas. Innovation in office property also indirectly makes office property players become more flexible in standard lease agreements. A flexible working space will require landlords to commit to long-term leases with tenants and they will also need to understand the agreements in terms of benefits and regulations. It is believed that office property will have a more significant impact from the disruption of real estate. According to a report by CBRE (2019), the office property vacancy rate in the Klang Valley area has steadily increased since 2015 with worrying over-supply conditions in 2019 (estimates) (see Figure 3). Although there is no evidence this over-supply condition is due to the disruption from technology, nevertheless for the Malaysian office property market, innovation in office property is highly necessary with the current condition. Office property players have to contemplate current trends in office property. At the global level, there has been a significant increase in growth of co-working spaces since 2015. Table 1 shows data on year-over-year growth of the number of co-working spaces and members worldwide. Without any innovative mechanism to overcome oversupply in the office market, it will lead to a high unemployment rate. According to Manyika et al. (2017), a weakness of the application of the IR 4.0 may occur in 2030 due to there being as many as 400 million to 800 million people worldwide having to find new jobs. As technology will disrupt the real estate sector in terms of space demand, change must focus on the innovation of space management.

Figure 3: Major Performance Indicators of Office Property in Klang Valley, Malaysia
Source: CBRE 2019

Table 1: Annual Supply and Demand of Office Property in the Klang Valley Area

	2015	2016	growth %	2017	growth %	2018	growth %
Number of co-working spaces	8900	12,100	35.96	15,500	28.10	18,900	21.94
Number of members	54,500	89,000	63.30	127,000	42.70	169,000	33.07

Source: Deskmag (2017)

There are other perspectives where the rise of technology will bring about disruption in the real estate sector. The real estate sector has to overcome the current process of supporting high quality data input. The basic element for high quality data is infrastructure to support the latest technology such as the introduction of 5G. Failure to support the rapid changes in technology could significantly make disruption in real estate become worst. In Malaysia although the internet penetration is high among Asian countries, nevertheless internet speed is among the slowest. With the growth of technology, especially in real estate related areas such as banking, commerce and services, the use of smart phone applications in business transactions is emerging; therefore internet speed is crucial to support these developments. According to a report by Khan (2018) on the readiness of future network cyber infrastructure in Malaysia, Malaysia requires a quantitative change in old telecommunication management plans which are well beyond the deployment of the 5G spectrum. This is required to meet the demand for responsiveness, emergence of massive data intelligence based applications which requires highly capable and reliable cyber infrastructure. Although Malaysia is quite slow in adapting innovation in real estate, the real estate sector is constantly moving and the readiness to adapt with advanced technology needs to be observed, in particular with infrastructure and facilities.

3. HUMANISING TECHNOLOGY

Humanising technology is highly related with how people live and work in a new way. To integrate the concept of humanising technology in real estate is to handle the demand and requirements for space and how it is used. The smart solution to harmonise between humans and technology in the real estate sector needs to be reconciled in order to minimise the impact of technology on humans. At the moment, the real estate sector still finds the best way to humanise technology. The disruption of technology on the real estate sector will make supply chains work more efficiently and integrated, which consequently will make less space, less cost and less time. Furthermore, the redevelopment, modernisation and safeguarding of the existing real estate sector are the current topics which are receiving broad scale attention and interest (Jylha et al. 2019). The integration of technology into the property sector is known as PropTech (Property Technology). The field is undergoing a transformation that will affect all related activities from the management of properties to the search for new houses and goes all the way to complete domestic digitisation (Battissti et. al. 2019). Nevertheless the benefit from technology to the real estate sector has not yet reached its maximum potential, as what has happened in other areas such as medical and engineering. According to Battissti et al., (2019) although

demographic and cultural changes will increasingly lead to an evolution of the organisational and operational models of real estate companies, the nature of these developments will still reflect more traditional, longstanding structural, strategic and operational features of the industry. Real estate has to continuously be an industry based on personal relationships. However, as this sector has been long established, the data that feeds the information becomes more significant in the decision-making process, especially for investors. As for governments, the data is very useful in making policies that aim to stimulate industry development. Furthermore, the co-modification of real estate which started as stand-alone assets, through Real Estate Investment Trusts (REITs), securitisation and increased interest from public and private funds, has raised the bar in terms of expectations, transparency and technological literacy (Winson-Geideman, 2018). In valuations, tax assessments and appraisals are in demand to handle many cases which require mass appraisals; paving the way for the Automated Valuation Model (AVM). Nevertheless in Malaysia, the use of AVM is still in the low percentage. Surveys among valuation firms in Malaysia on their automation level within the company has shown that 88% of companies are still at the semi-automation phase with letters, files, file cabinets and papers still widely used in the valuation job function (see Figure 4).

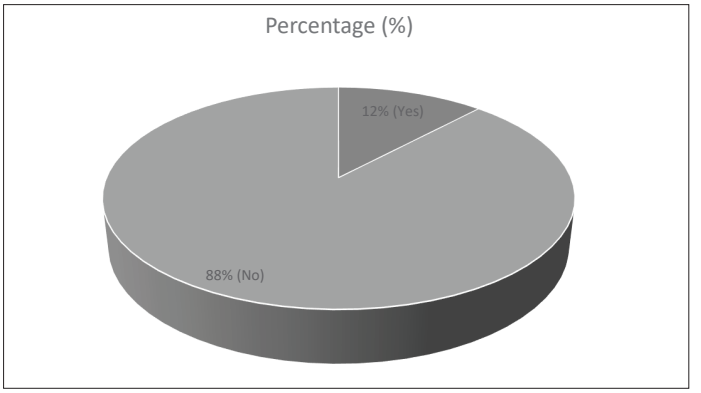

Figure 4: Automation Level Among Valuation Firms in Malaysia

Nevertheless this could provide benefit to the real estate industry in Malaysia to create a more humanising element from evolution in technology. The Malaysian real estate sector is not ready to adapt to the technology that has been designed from overseas, especially from developed countries. Technology has emerged from a very different environment, situation and affordability context than it finds itself in today. Technology has been enforced by IR 4.0 at the global level because it was perceived that all countries need to embrace technology, otherwise the industry will become defunct. However in the face of paradigm shift in terms of evolution in technology, many property players retreated due to several limitations such as knowledge, skills and practice. It has been said that technology will diminish many jobs in the future. There is convincing evidence that the combination of humans and technology has not been a total success. The potential of technology to increase productivity and quality of work is itself still in doubt. What can be seen with the rapid development of technology into the real estate sector is the neglect of basic human issues in the design and system. For instance AVM increases the output of valuation reports; nevertheless the system reduces the skills required by the lower group of employees, whilst increases the skills of the higher group

to control subordinates in the organisation. This will create the lower group in the organisation there are left without necessary skills. The lack of behavioural research before creating the technology or system will have a negative sentiment among people. Furthermore the design of technology is more technology-driven rather than cost-driven. The system has been created due to capability rather than job function needs. To make the system more humanistic it is necessary to recognise the negative implications on human needs and behaviour, as well as the cost and benefits. It needs to involve more stakeholders to understand the requirements for the system in the organisation by taking into account lower groups of employees.

With the evolution of technology in software and hardware, it seems to diminish the ability and function of humans in real estate job functions. Technology has created new boundaries between people rather than erasing the previous ones. The internet has transformed Malaysia to be more digital; where all government agencies and private companies set up their own websites and repository systems. Nevertheless the excitement of designing a website relies on technology itself, not humans. The majority of websites are still confusing, with designs and applications not being user-friendly. No doubt that the internet has bought radical revolution to technology which has impacted on people's way of life. It started with websites; and popular applications of technology have transformed to more sophisticated technology such AI, Blockchain, BD and Virtual Reality (VR). These technologies have the power to relieve people from traditional labour works to carry out tasks with greater speed, scale and accuracy which are beyond human capability. These sophisticated technologies will bring opportunities that need to be embraced and leveraged for the benefit of humans. The technology is already here and humans cannot simply turn their backs on the power and potential of these technologies.

For the housing industry, technology should be based on the human experience rather than processes or policy. This can result in serious issues for affordable housing. With the vast amounts of data available to all housing stakeholders, several problems should be able to be resolved, such as construction materials, demand and supply equilibrium, land matters and financing. It is important for the housing industry stakeholders to humanise technology rather than using technology to compound a process or policy. Furthermore, digital does not only bring technology in terms of software and hardware but also makes it capable of making things as easy as possible from the human perspective. In strata management, it is critical to deliver services by using technology platforms to be more personal and provide a human experience for tenants. Technology for strata management such as remote security systems, remote maintenance systems and mobile apps for management and administration must be armed with insights and expectations from the customers. The technology must be involved with accelerating the pace of solution management, testing early and learning quickly from customer feedback.

Nevertheless Malaysia is still making a great effort to meet the demand of the IR 4.0; therefore there are certain aspects in technology that needs to be revised. Humanising technology in real estate should look into the fundamentals of human needs, namely knowledge and personal ability, human relationships and safety. The real estate market in Malaysia is moving towards a mature market. As a

result it contains lots of data that needs to be transformed into knowledge. Previous industrial phases have emphasised more on knowledge, which created a knowledge-based economy. The knowledge-based economy has created rapid development of databases. The integration of Information and Communication Technology (ICT) and databases has transformed the computer system compatibility and interface to be more intelligent. To humanise the intelligent revolution in the technology, humans must control the technology by upgrading their own knowledge.

In principle, knowledge can create shared values in technology by taking different states of nature into technology. This is done by humanising and democratising technology and design, and also design of information-sharing systems for lower-level job classes. Furthermore, technology is supposed to prioritise people and at the same time offer communities better services. For instance, technology is able to facilitate a fairer taxation system, ensuring the rights of the community in a new digitalised society, equality in the privacy of personal data and technology without any differences. In addition, technology must be sustainable. For instance technology would be expected to solve the climate change issue especially in achieving Sustainable Development Goals (SDG) by the United Nations (UN). The use of technology must be economically and socially sustainable, synchronised with social cohesion, preserving cultural diversity, improving human quality of life, empowerment and democratic values.

Nevertheless what will happen to the millions of people who are affected by jobs that are replaced by these sophisticated technologies? Neglecting the needs of people in technology development will make people agonise. In the digital transformation which is based on the internet, these technologies are the disruptive elements in technology which lead to the disappearance of jobs. However these technologies are also revenue opportunities and create new jobs. For instance the use of smart phone applications has created new services such as Uber, Grab, Food Panda and home businesses. Other areas in the real estate sector will also see a substantial increase in unemployment numbers, such as office property. Office automation will remove some of the traditional jobs such as key punchers, data entry clerks and secretaries. What needs to occur now is that the personnel in these areas update their knowledge which requires almost similar skills but in the medium of technology. As soon as these groups of personnel are almost non-existent they will gain more knowledge, therefore gaining power and access to better jobs. Furthermore, the government must not be fully blamed for high unemployment due to office automation; blame also needs to be cushioned at the micro-level in organisations from the aspect of quality of work. Early involvement from employees can minimise the effect from office automation, which requires skills to recognise and motivate to adapt to technology in a working culture. Consequently the aim to humanise technology in the sector is able to be achieved.

4. BIG DATA APPLICATION IN REAL ESTATE

In the previous section, discussion has touched on the element of disruption of technology to the real estate sector and how the industry is able to cope with the uprising of technology. Historically, the sector presents as an early adopter and the industry as a whole has tended to be conservative, characterised by a very gradual evolution (Battisti, 2019). Changes in the sector have been seen as rapid at the global level, which means that the Malaysian real estate sector will eventually not be

able to avoid the evolution of technology. The need for markets to evolve will force property players to equip themselves with knowledge which could be embedded in the sector. Nevertheless the real estate operational model will still reflect the fundamentals that are based on traditional, longstanding structural, strategic and operational facets. Therefore it is necessary for the industry to implement technology that is capable of supporting the job function process in handling large amounts of data. This is due to the real estate industry always having to be faced with risk. Risk management is a methodological system, proactively using adequate processes, methods and tools (Sienou et al., 2006).

BD has now become a new field that requires information and integration of information systems. The evolution of BD has attracted both academic and professional experts. This field represents the latest developments in the field of electronic business nowadays. BD is the industry's hottest keyword (Waller & Fawcett, 2013). In the business industry in Malaysia, it has also shown the need for the use of BD in business decision-making and improving efficiency. It is a quantitative information explosion generated by human behaviour on the internet and social media that has attracted the attention of companies, academics and the business press.

In today's society, data is more valuable as it keeps all the dimensions of company information and needs to be kept in good order. However, this data is meaningless without the ability to analyse and produce results. Successful companies make decisions based on the facts and information available. Every business needs to create a strategy and be clear about the information required to achieve goals set. Data has been growing since the development of technology and social media. The development of this data is a good evolution if each party makes use of the data that can profit a business. The Figure below shows data growth from 2008 to present (Forbes, 2020) at 40% compound annual rate; reaching as much as 45 zettabytes (ZB) in 2020. To highlight from Figure 5 below, poor data management can cost up to 35% of business operating revenue.

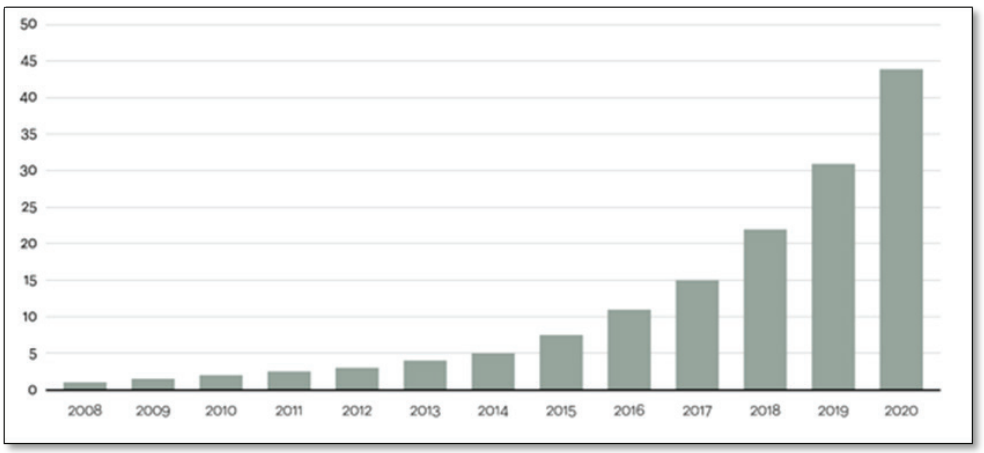

Figure 5: Growth of Data in Zettabytes (ZB)
Source: Forbes 2020

BD offers great potential to governments for areas such as cost savings, improved services and occupancy insights. The real estate information can be transformed into valuable recommendations for top officials, administrators and the public about how facilities are being used, how efficiently the assets operate, and to identify potential liabilities and opportunities in advance. Additionally, centralised information can bring clarity to a complex portfolio of multiple sites, building types and oversights. For many governments, seeing the whole picture is an enormous challenge because facilities may be centrally owned and managed or leased by individual agencies and departments. A centralised data management system can reveal insights that save money and suggest new ways to serve constituents, as well as inform traditional buy, sell, lease and occupancy decisions. The initiative will make it easier to allocate land to its highest and best use, creating new development opportunities (CBRE, 2019).

There are lots of complex datasets involved in real estate. Namely the data of rental, inventory, assets, people, operational, geographies, pricing, retail data, office data, locations, materials etc., therefore it is vital for property players to have a better platform to handle more complex and unstructured data. Those enormous sizes of data with variations and complexity brings new revenue models and vast spaces for the development of BD in property management (Du et al., 2014). There are areas of job functions in real estate that are able to elevate by utilising the concept of BD due to its high relationship with data management. There are areas that BD is able to enhance efficiency in property management activities such as:

i. Analytics in building automation systems
ii. Automation in property management job functions
iii. Machine learning in real estate marketplaces
iv. Price analyses for housing
v. Customer's preferences
vi. Office automation
vii. E-commerce for retail

Given the relative new concept of BD in real estate, the implementation must at least have a significant impact on the real estate job function, especially for government assets and facilities. The aim is to find the most reliable data to make data-driven decisions and more effectively meet the needs of the public. As stakeholders look to data and analytics to help achieve more efficient delivery of services and better program outcomes, investors will be a critical force behind developing enterprise strategy for delivering effective data and analytics' programs. Nevertheless, the challenges and barriers must be taken into account as it will be a large and time-consuming undertaking. This is where humans are able to play a vital role to ensure BD will use people in a major role instead of taking over the job function.

The approach of BD in real estate needs to recognise the role of the humans at its core function. BD applications will not just recognise the elements of the data but also the individual equipped with knowledge and skills. If the BD system fully recognises the value of the job function, both parties, namely technology and humans, need a greater focus. The use of BD in the industry needs

knowledgeable employees who are able to leverage the value of the data. For instance, in the housing industry, the function of the BD model is capable of analysing customer preferences, behaviours and outcomes, which are difficult to predict in reality. The human side of the BD technology is to understand how people perceive problems, use the information, suggest ideas and provide knowledge. As the real estate industry is always about people, to therefore understand how humans operate is essential. For instance, the social aspect in property management will shape property managers to handle the issues of property management in strata buildings. Data scientists may play a major role in BD systems. Nevertheless the role played by social scientists will remain important for the data to leverage more value, depending on the purpose. Consequently the combination of data scientists and social scientists will create customer insight teams, eventually humanising technology through BD applications to achieve results in the real estate industry.

5. CONCLUSION

This paper highlights the aspect of humanising of technology, and focuses on the real estate industry in Malaysia. The perspective of discussion emphasises the disruption of technology to real estate areas. It suggests humanising technology in order to keep a balance of the impact of technology on the industry and the opportunity of using the BD concept in real estate job functions. The movement of technology into the real estate industry is unable to be stopped, which places risk on the industry and makes it vulnerable. Therefore in order to get the full benefit from technology, industry players need to recognise the advantage that humans could identify from it. Specifically, by recognising the potential use of technology it is possible to redefine the process, also with advantages from the perspective of humanising the technology. In examining the practical implications of technology to the real estate industry, the viewpoint must be from different disciplines in real estate, namely valuations, property management, estate agencies, appraisals and asset management. In addition, the stakeholders involved in the real estate market, such as investors, sellers and buyers are all human. If technology is able to balance the need for the market and technology it will be able to make the market more secure. This is able to be achieved because technology offers important opportunities in assessing real estate risk in the decision-making process.

The effect of technology must rely on the involvement of people in order to remove their resistance to change. Effectiveness refers to the success of technology in terms of final implementation and operation. Technology is not supposed to be blamed if people are not able to find balance in terms of benefit from the perspective of humanising the technology. Disappointment in technology is not inherent in the technology itself. The disruption in the technology can be transformed into opportunities where the enhancement of the skills is a good justification for employees to demand salary upgrading. The automation strategies will bring new position known as system analyst where employees need to advance their skills into more analytical rather than clerical areas.

The term humanising in technology, which puts people and social as main elements, could also be known as socio-technology. The implementation of technology inevitably has a significant change to society and industry. A research effort is needed in the field of humanising technology to match

that in the hard science area, which only emphasises on product. The way decision-makers look into technology need a paradigm shift where more attention should be given to the element of humans in technology and organisations. Furthermore, employees need to begin to humanise their job functions to become more aware of the application of technology and stop being unresponsive to changes. The attitude to accept technology's behaviour and role can take part where eventually technology is able to become human being rather than human doings. Technology will not be able to replace humans, as humans can evolve with the technology. Humans need to upgrade their knowledge from the aspect of increasing digital culture. Machines and technology have been created to serve and assist humans and not the other way around.

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