Prospects for Proptech Utilization in Urban Regeneration Projects

Author Jiyoung Kim[a] , Jumong Na[b]

[a]*Graduate Student, Chonnam National University, Gwangju, S.Korea*

[b]*Professor, Chonnam National University, Gwangju, S.Korea*

Prospects for Proptech Utilization in Urban Regeneration Projects

regenrationThis study is mainly focusing on the proptech related to urban regeneration. It explored the concept and types of proptech. It conducted a case study on 8 representative proptech companies related to urban regeneration. The dividing standards are ‘Construction technology’, ‘Commercial and smart city’, ‘Residential and smart home’, and ‘Sharing economy’. For each criterion, domestic(S.Korea) and Global companies are selected. Through the examples of each company, this study suggested the direction in which proptech companies are used in urban regeneration. Proptech companies collect big data on urban space, enable efficient use of urban space and resources based on this, realize urban regeneration in the long run, and support decision-making in future urban planning. In this way, the value of proptech in the field of urban regeneration was revealed and its utilization was derived. It is differentiated in that it linked proptech with the urban regeneration field and considered how proptech is used in this field through analysis of business areas of companies.

Keywords: Proptech, Urban regeneration, The fourth industrial revolution, Contech, Smart city, Smart home, Sharing economy, Case study

1. Introduction

Since the fourth industrial revolution emerged, our society has faced enormous changes in various fields. The fourth industrial revolution technologies were discussed for the first time at the World Economic Forum in Davos, Switzerland in 2016. The key technologies are blockchain, big data, artificial intelligence, VR and AR, drones, autonomous driving, and so on. These technologies are mixed in various fields and lead the rapid changes in society (Keum, 2020)

The fields of property and urban planning have also been affected by the fourth industrial revolution. Their main notion is 'Proptech'. Proptech is a compound word of 'Property' and 'Technology'. It could be defined as the new kinds of property services combined with the traditional property services offered in the offline marketplace and innovative technologies, such as big data, AI, etc. Many proptech companies currently operate – Online property matching services, asset management solutions, online property mediation and settlement systems, cloud funding, automatic property valuation by AI, property sales marketing, smart housing, and so on (Lee, 2020; Moon 2020)

The usage of the fourth industrial revolution technologies in the urban planning field is becoming important. Globally, many problems such as population bias, traffic jams, the shortage or oversupply of housing, and environmental pollution exist in cities. As a solution to these urban problems, the government has built new towns and carried out urban redevelopment. In 2008, the South Korean government unveiled the 'Ubiquitous city' which combines ICT and construction technologies and established related laws to find a way out of the urban problems. This is the time to find systemic and effective urban regeneration planning. (Park et al., 2017).

The purpose of this study is to classify the proptech companies related to urban regeneration and find the practical usage of proptech for urban regeneration toward the future formation of cities by reviewing the literature. This study has a clear distinction from previous papers in the aspect of focusing not only on individual properties at the micro level but also on urban areas as a whole for prediction and planning at the macro level.

In this study, Chapter 2 deals with the previous research, and chapter 3 indicate the methodology. In Chapter 4, we conduct an in-depth analysis of the representative proptech

companies in terms of urban regeneration. Lastly, in Chapter 5 we will thoroughly deal with the value of proptech in the field of urban regeneration.

2. Literature Review

2.1. The definition and classification of Proptech

Studies on the definition and types of proptech were reviewed as follows. Baum divided the proptech field into three categories: smart real estate (contech, smart building, etc.), sharing economy, and real estate fintech from a technical point of view.(Braesemann & Baum, 2020) Jones Lang LaSalle(JLL), which provides global commercial real estate services, classifies Asia Pacific proptech start–ups as a value chain and presents it as follows. In addition, as a result of analysis by investment size, it explains that brokerage and leasing, project development, and investment and financing are the largest in order. (Pasific, 2018)

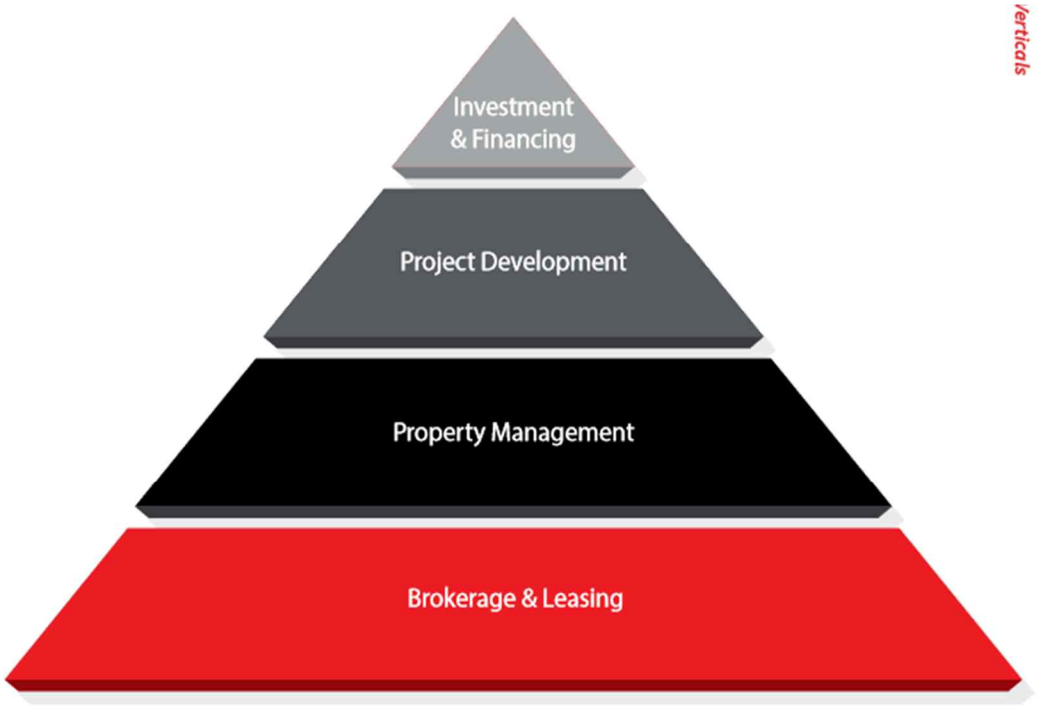

Figure 1. The classification of proptech in Asia pacific by JLL

CB insight divided the property technologies into ‘contech’, ‘commercial proptech’, and ‘residential proptech’. Table 1 shows the specific classification of proptech by it. (CB insights, 2016, 2017)

In Heo et al.(2019), according to the division of JLL and CBinsight, proptech technology was divided into contech, smart building and commercial proptech, smart home and residential proptech, and sharing economy proptech in consideration of value-chain, market size, and business type, and case analysis was performed as Figure 2.

Table 1. The classification of proptech by CB insights

Contech	Collaboration software, Marketplaces, Frontier tech/robotics (Drones, AR&VR, Construction Robots), Design Technologies, Inventory/supply chain management Data/Analytics, financial management, risk management(Monitoring and safety, Compliance/Security), design technologies,	
Commercial and	Brokerage and purchases	Listing/Search Services, Marketplaces, Virtual Viewing, Tech-enabled Brokerage, O2O Services, property information

residential Proptech	Management & Operation	Leasing-Management software, Data/Valuation/Analytics, Property and building management
	Funding	Mortgage Tech, investment, and crowdfunding

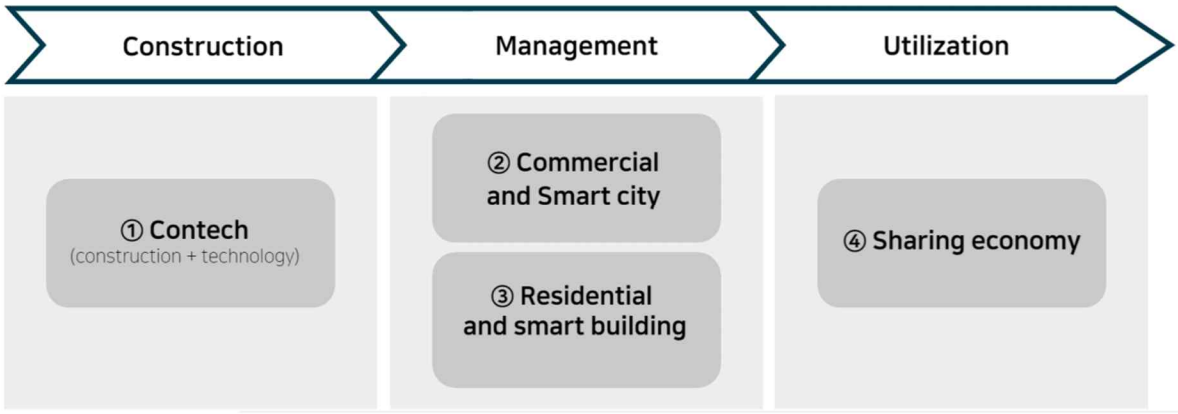

Figure 2. The classification of proptech by CB insights

2.2. The application of proptech

Prior studies analyzing the application cases of proptech companies are as follows. Jungyoon Lee et al.(2021) looked at the information provided by users based on the case of major companies in the real estate platform field among proptech companies and then sought ways to use the data provided by users. Through this, it presented implications for alleviating information asymmetry in the real estate market and strengthening the capacity of the real estate industry. Sungmin Lee(2021) analyzed the success factors of representative global proptech companies by classifying proptech companies by field, stage, and type, and suggested the development direction of the domestic proptech industry. . In particular, it was proposed that real estate micro investment methods such as crowdfunding should be applied even in areas of high social value such as urban regeneration. Suseok Choi(2019) focused on real estate fintech among proptech. Real estate fintech is a field where real estate investment and financing

fields are integrated, and it is mainly divided into P2P finance and cryptocurrency fields, analyzing the cases of major companies and suggesting development plans. Bae and Jung(2020) analyzed platform services focusing on accommodation and real estate through case studies of the real estate platform Biz Model. In particular, global platform companies Airbnb and Zillow, and domestic companies Yanolja, Zigbang, and Alsquare were compared.

2.3. Usage of proptech in urban regeneration

Cases in which proptech is used in the field of urban regeneration can mainly be used for property value evaluation using big data and artificial intelligence. This function is used to review the target area and feasibility of the urban regeneration project. Hyeyeon Lim (2020) selected 3 companies – Envelop City (New york, USA), Ratio City (Toronto, Canada), Spacewalk (S.Korea) – as the companies that calculate the value after real estate development project to evaluate development feasibility through planning and design by utilizing big data of laws related to urban planning in the real estate area. While traditional real estate valuation companies evaluate the value at the present time, these companies calculate the value after development. In particular, in the case of Spacewalk, AI analyses complex building regulations on behalf of humans and derives optimal development plans for parcels of less than 660 ㎡.

(Cho, 2018b) revealed a case in which Spacewalk is used in ta street housing maintenance project among urban regeneration projects supported by the government policy. The ‘Street Housing Maintenance Project Site Search Service’ provided by this company is a service that helps find the optimal site to maximize the effect of the Street Housing Maintenance Project.

In addition, through the ‘Street Housing Maintenance Project Feasibility Review Software’, the feasibility review of the project can be conducted in a short time. Lastly, Through the ‘Land Book Safety service’, it is possible to consider the housing deterioration degree of new development of nearby real estate and support to easily find buildings with potential collapse risks.(Cho, 2018a)

The previous research analyzed the definition and type of proptech and indicated the direction of development through case analysis. In line with this trend, this study also analyzes domestic and international cases of proptech related to urban regeneration according to the type classified through the review of prior research, and through this, we will find the utilization of proptech technology for urban regeneration.

3. Methodology

The analysis focuses on 1) case studies of proptech companies related to urban regeneration, and 2) finding the utilization and development of proptech for the urban regeneration field. Proptech has appeared in the market in earnest since 2010, and in 2018, it began to attract attention as it emerged as a major issue in the global real estate market (Heo et al., 2019). In particular, there are not many studies related to proptech in Korea, and most papers on proptech were published in 2020 (Lee et al., 2021). Therefore, data within the last 10 years were used. The main data are from the papers, articles, and promotion information of each proptech company. Related papers and articles are found with keywords ‘proptech’,

‘urban planning’, ‘urban regeneration’, ‘smart city’, ‘real estates’, and ‘sharing economy’. The information about each specific case is from their website, promotion documents, and articles. In the case of presentation papers, the data are from related global forums and conferences. Investigating proptech companies which are coming deeply into our society as the new concept closely could give enough insights for the utilization of proptech companies in the future urban regeneration.

4. Case studies of proptech companies

According to the classification of Heo et al.(2019), global and domestic companies related to urban regeneration were selected. The selection method centered on companies searched with urban regeneration and urban planning keywords. In the case of Contech, Angel Swing, a domestic company that provides construction site virtualization solutions through drones, was selected. As a global company, Holobuilder, a cloud-based construction management platform, was selected. For the commercial proptech part, Glow Seoul which provides urban regeneration space solutions, and Sidewalk Labs which was a smart city project in Toronto were chosen. For the residential proptech company, Zigbang in S.Korea that provides online real estate trading platforms and residential management services, and Skyroom in the United Kingdom, which aims to solve housing problems through the use of idle land in rooftop space were selected. Finally, in the field of sharing economy, Korea's Homes Company, which is working on the Covillage project, a self-sufficient rental housing village, and WeWork, a global shared office platform were selected as the representative.

Table 2. Proptech companies for case study

Group	Domestic	Global
Contech (Construction technology)	ANGELSWING	HOLO BUILDER
Commercial & Smart city	SPACEWALK	SIDEWALK LABS
Residential & Smart home	zigbang	SKYROOM
Sharing economy	HOMES	wework

4.1. Contech

4.1.1. Engel Swing

Angelswing is a contech startup that develops and provides drone data solutions that help smart construction management through the virtualization of construction sites. Angelswing's drone data solution provides a cloud and web-based software platform by realizing a wide construction site on the monitor with drone shooting and analysis technology. This makes construction site management more convenient and efficient. Angelswing's drone mapping technology goes beyond the concept of simply utilizing space and extracts spatial data by comparing photos taken with drones and their actual appearance. The data generated in this way becomes the basic data for establishing the overall regeneration project plan and is also used to improve the urban environment in underdeveloped areas. In redevelopment areas, it is also used to calculate land compensation.

In fact, through the virtualization work that implements the construction site on the web, it can be confirmed changes that take place in the flow of time from the past to the present. It

also enables faster and safer coverage on the web with just an online click to the site. Drone data is useful in many ways. For example, it has compatibility with existing CAD software, can be converted into usable spatial information anyone can use, and is possible to automatically process and calibration when it is uploaded on the web. Recently, a business agreement was signed with Engel Swing and Seoul National University's Smart City Engineering Department for smart city research and public institution development cooperation.

Since 2016, Angelswing has participated in urban regeneration projects focusing on redevelopment and environmental improvement in underdeveloped areas. Angel Swing's drone mapping technology was used in Samseong-dong(Seoul Gwanak-gu), Guryong Village(Seoul Gangnam-gu), and Siheung-dong(Seoul Geumcheon-gu) regeneration projects. Overseas, it was also applied to the Nepal Gokarneshwar shanty town urban development project. Angelswing's drone mapping technology goes beyond the concept of simply photographing space, allowing more precise spatial data to be extracted by comparing photos taken with drones and actual images. The data generated in this way becomes the basic data for establishing an overall regeneration project plan and is also used to improve the urban environment in underdeveloped areas. Moreover, in redevelopment areas, it is also used to calculate land compensation. Angelswing is currently using its solution in collaboration with the World Bank to monitor Cambodia's garbage dump. It examines how the volume and area of the garbage mountain change over time, and helps to analyse how the surrounding environment is affected by the garbage mountain. (Noh, 2020)

4.1.2. Holobuilder

HoloBuilder is an XR platform company specializing in cloud-based construction and management. HoloBuilder is a software that can view the construction site 360 degrees based

on AR (augmented reality) and predicts the progress of the building, and is already being used by many construction companies. The 360-degree data implemented based on AR technology includes overall information such as the size, spacing, number, and wiring of reinforcing bars required for construction. In addition, by using the cloud, Holobuilder offers 360-degree reality capture from the development and planning stages to maintenance, and key information related to materials such as size, spacing, several reinforcing bars, and facility information such as electricity are also included. It is also possible to track construction progress through hourly observation and to be compatible with the 2D and 3D modelling software such as AutoCAD and SketchUp. 55% of Engineering News-Record (ENR) [1] TOP 100 general construction companies are already using it, and they said that HoloBuilder's technology facilitates large-scale construction site management and reduces photo-related work time by more than half.

In June 2021, FARO, a 3D measurement, and imaging solution company, took HoloBuilder over. HoloBuilder's technology platform, which initially focused on construction management, provides general construction companies with a solution that can efficiently monitor construction progress and manage it virtually using 360-degree cameras of off-the-shelf products. HoloBuilder's SaaS platform adds easy and fast reality capture photo documentation and remote access capabilities to Faro's high-accuracy 3D point cloud-based laser scanning to help build a comprehensive digital twin solution within the existing ecosystem. The comprehensive solution provides overall scan and image management capabilities for the digital twin market, including robotic assembly 3D simulation, construction management,

[1] Engineering News-Record(ENR) is the weekly magazine which is specialized on the consturction and engineering field and it compiles and publishes rankings of the largest construction and engineering firms annually, measured by gross revenues

facility operation and management, and pre-accident planning. (Ha, 2021) HoloBuilder and Faro are working on process automation and workflow optimization at construction sites with the vision of digitizing the physical world.

4.2. Commercial and Smart city

4.2.1. Spacewalk

Spacewalk provides a service to review the business feasibility of small-scale land development of less than 660㎡ through artificial intelligence architectural design technology. The representative services are 'Land Book' and 'LBDevloper'. Firstly, Land Book offers a development method that can maximize profitability in limited land by deriving estimated land price, AI architectural design, and estimated profit after development through AI and big data technology. When constructing a new building, users could check the development value of land with the information like 3D images, floor plans, business feasibility, etc. and can get the suggestions of properties that are suitable for demanders analyzing numerous properties in the market with Land Book technology.

The AI valuation provided by Land Book calculates the maximum size of the building that can be built on the land after analysing the topographic conditions of the land and related building regulation based on real estate big data. This result leads to the processo of estimating the profitability of new construction based on the surrounding sales price and rental data. Users can easily utilize scattered and complex land-related information, and the estimated price through the Land Book serves as a reference standard when selling or purchasing land. In

addition, the land explorer, which can select and view the land through condition setting, is used when the user searches for the desired land.(Lim, 2020)

Secondly, Spacewalk provides ‘LBDeveloper Solution’ that can quickly review the business feasibility of a street housing maintenance business in about an hour. It also offers features such as search for candidate sites, automatic identification of business destinations, deduction of AI design plans, derivation of feasibility review results, and output of CAD(Computer Aided Design) and Korean reports. Using the various data mentioned above, it is possible to find an area with high business effect as a target by analysing the housing deterioration, the trend of rent and sales, and the analysis of related laws such as floor area ratio. Moreover, the city structure is visualized based on the policies and laws regulated in the space so that the optimized design can be visually compared. (Cho, 2018b) LBDeveloper is currently providing street housing maintance business solutions, and it will expand to various urban regeneration projects such as small-scale reconstruction projects.

4.2.2. Sidewalk Labs

Sidewalk Labs is Google's parent company Alphabet's 2015 city-renovation-targeted subsidiary company. Sidewalk Labs participated as a partner in the smart city project as much as possible and had the plan to redevelop the area of 8,093,713 square meters that had been neglected for 50 years in Quayside and Portland, western Ontario, on the Canadian side.

According to the plan, the establishment of the smart city will have about 60 high technologies. It is a system that analyzes with -of-the-art technologies such as big data and

artificial intelligence (AI) that collects accumulated data from temperature, noise, and garbage disposal with numerous sensors installed all over the city. (Shin, 2020) As the largest smart city in the North America, its performance of it was highlighted due to Corona 19, expecting the world's expectations that associated effects such as city revitalization and job creation would be enormous, but this project eventually failed. The reason is privacy, leakage of personal information, and COVID-19. (Lim, 2021)

Meanwhile, Sidewalk Labs has created DELVE, a tool that uses artificial intelligence to come up with millions of urban development designs in just a few minutes. It creates various options based on criteria such as budget, location, and size, and then evaluates them so that developers can choose the optimal design. DELVE used machine learning technology. It is a way for artificial intelligence to learn using the basic values of data to improve the experience. DELVE's remarkable point is providing information on the "holistic" factors that determine the quality of life, such as walking environment and amenities, outdoor space, and light. For example, analyze the amount of sunlight received by each residential unit, not the entire building, and choose the appropriate materials. Property developer Quintain recently used DELVE to design a multipurpose rental construction(build-to-rent) plan for a 12-acre site in Wembley Park near London, and gained 24 designs for lighting, outdoor spaces, residential complexes, etc.

4.3. Residential and Smart building

4.3.1. Zigbang

Zigbang is an online real estate trading platform that ranks first in the residential proptech market in Korea. Previously, to buy a house, people had to rely entirely on the

information provided by offline real estate, but since the launch of Zigbang in 2012, it has ushered in the era of online real estate platforms. Consumers who had to visit a realtor without any information in the past could check the rooms that fit in their budget and conditions on their mobile in advance and make a more reasonable decision on these days.

Zigbang has changed the real estate market through the advancement of metaverse technologies such as 3D and virtual reality (VR). After launching the first VR home tour in 2017, the company is leading the market change with the introduction of a mobile model house in 2019 and a 3D apartment complex tour in 2021. In addition, by converting the floor plan of the apartment to 3D, consumers can check the interior without visiting the apartment, the view from the inside of the apartment, and the level of dimming that shows how much sunlight enters depending on the time of day.(Park, 2021)

When people search for the area in demand, Zigbang's apartment sales service visualizes information – the exact time point and sales price – at a glance in the form of a move-in schedule, planned sale, and imminent sale. If consumers click on the complex they want to get information on, they can find out the sale price, the square foot price, the average sale price in the last two years in the neighborhood, the market price of the tenant complex, the popularity ranking of apartments, and the regulated area.

Zigbang has been building and disclosing its data on which areas of the population in each region of the country are leaving and coming in through a service that visualizes population movement over time by analyzing resident information. Also, through the 'Put Out My House' service, people can easily put out property for sale through the website and app directly. When the property owner leaves the apartment for sale and contact information, the broker specializing in the apartment contacts them after confirmation. It makes them save the hassle of not having to search for the property one by one. (Kim, 2019) It has acquired Hogang

Nono which provides information services for apartment transactions, Universe, a share house operator, and Nemo which is a commercial real estate information platform. Moreover, it is leading the digitalization of homes by acquiring Samsung SDS Home IoT.

4.3.2. Skyroom

Skyroom analyzes geospatial data to find developable airspace for buildings in downtown London and is carrying forward a business model to build prefabricated houses. Skyroom contributes to solving the housing problem by enabling the construction of up to 630,000 new homes in London, 70% of the value of a housing price is the cost of land, by utilizing the idle airspace places of existing buildings. (Han, 2019)

Airspace development refers to the construction of a space for another use or a new house on top of an existing building. Skyroom can offer anywhere from two to ten additional floors using a proprietary podium system. Rooftop development helps landowners create additional value on existing properties. Rooftop development is more economical, environmentally friendly, and faster than development through conventional methods. Typically, roof development takes 12 to 24 months.

Rooftop development can reduce the demand for operating energy from existing buildings by increasing the efficiency of the building frame structure and can replace existing energy sources with renewable energy sources using sunlight or heat pumps. It is also efficient in creating an environment for biodiversity through rainwater storage systems, landscaping, and green roofs. In this respect, the sustainability of existing buildings can be increased. A more sustainable model of urban development that preserves existing buildings and prevents urban sprawl is realized through upward expansion rather than external expansion.

Skyroom uses HM Land Registry data, including UK House Price Index and homeowner information, as well as freehold and leasehold information to identify buildings suitable for rooftop development in the land owner's portfolio.

4.4. Sharing economy

4.4.1. Homes Company

Homes Company is leading the corporate shared housing market focusing on single-person households. Homes Company starts with a corporate co-living (shared housing) model for the first time in Korea and moves forward as a lifestyle developer that encompasses development, operation, brokerage service, and rental management solution(application). A co-living house is a new type of dwelling type designed by introducing the concept of a sharing economy in which a co-space is shared while having an independent room. It operates 664 Homes Studios and 5 Homes Living Lounges in Yongsan, Gangnam, and Songpa, which are major downtown areas in Seoul and the occupancy rate is 97.6%.

Homes Company is promoting Co-Village(Homes Town) together with Gansam Architecture. Homes Town is a rural co-living rental housing village for the future of local cities. It is characterized by having a village form that develops by introducing and operating smart farm-based self-reliant and self-sufficient jobs and community living foundations on a large 77,000 ㎡ site in the suburbs. It is a town with the advantages of the city and countryside. The residential facility is a futuristic self-sufficient consisting of 540 households (population: 870) on a 35,000 ㎡ scale. Home IT and smart mobility will be utilized in each living space. (Jang, 2020)

Co-Village has the following goals: A sustainable platform with 315 self-sufficient jobs and lifestyles, a smart town leading the hyper-connected era, and a modular town that develops rapidly and flexibly changes and expands. Using modular (ODM) technology, it is possible to move in within one year after purchasing the site, and Co-Village, a village that can have mobility in the future, has high social values such as solving housing problems, appropriate jobs, health and welfare, and using renewable energy based on a post-urban basis. provide a living environment.

In addition to Homes Company, which is in charge of planning and operating the project, and Gansam Architecture, which is in charge of PM and town planning and architectural design, various companies and startups are participating in the project. Airbnb (accommodation type residential operation and marketing), Younggeul Farm (smart farm operation), Goqual (town and home IoT service), and Puma City (smart agriculture and job management) participated as a team in this project. (Son, 2021)

4.4.2. Wework

Wework is a global shared office company. Shared office refers to sharing office space with other companies. A business that provides shared office services purchases or leases real estate and then divides it into several units and releases them to other tenants. Building owners can reduce the risk of vacancy by hiring large tenants for the long term (5 to 10 years), and re-tenants can rent office space for a short term (monthly) as needed.

Wework was established in New York in 2010 and operates 765 branches in 38 countries around the world as of May 2022. Members of enterprise companies with more than

500 employees account for about 46%. Wework brought about a big change in real estate in that it lowered the barriers to entry into expensive buildings in good locations and made lease agreements more flexible.

Wework attracts a variety of people and companies, from single freelancers to startups and large corporations. In particular, for startup companies whose business size and sales are not yet fixed, a shared office with everything is more economically flexible than moving to expand business or wasting manpower and resources on unnecessary parts such as interiors. (Kang, 2018) Wework not only provides office space, but also additional facilities such as conference rooms, rest areas, and community spaces, and even purchases of various supplies such as coffee, toilet paper, and printing paper.

In addition, the Wework community team provides networking services so that people from various industries can gather and network. Events such as snack events, book salons, and humanities gatherings are created to make synergy among Wework members through communication and business collaboration.

5. Application for the urban regeneration of proptech

Urban regeneration aims to revitalize and solve the social, economic, and physical problems that already prosperous cities face in the process of decline. (Lee, 2012) In particular, today's urban regeneration is changing into a concept of an urban project that revitalizes the function of a city by improving the comprehensive environment of a city that has not fulfilled the essential role of a city or has been stagnant due to changes in the times(Byeongmin Lee, 2016). Recently, the proptech industry is growing rapidly through technology combination and business convergence to increase synergy effects. As can be seen in the previous eight

representative cases of proptech, it was found that proptech companies are used in various ways in areas related to urban regeneration. Based on these cases, the development directions proptech companies can be utilized in the urban regeneration field in the future are as follows.

5.1. Collecting the big data from the urban space

Proptech companies can play a leading role in collecting big data on urban space for urban regeneration. Big data in the smart era is generally defined as data with a very large capacity collected from various information sources and is mechanically collected and updated frequently. Unlike the existing analog age, in the smart age, spatiotemporal units are divided into ultra-fine units, and vast amounts of data are recorded and collected. (Ahn, 2019). Existing city information was centered on statistical data produced at a certain point in time that could be easily found by the National Statistical Office. However, to actively cope with rapidly changing trends in future urban space management, big data-based city information that is created in real-time, such as day or time, and that can consider cities, citizens, and technologies are needed(Nam et al., 2014)

In the case of proptech companies, they can take on this role because they have the expertise and business feasibility in each field. In the case of Angel Swing, it provides a service that virtualizes and maps construction sites through drones, and Holo Builder is operating a cloud-based construction management XR platform. In addition, SkyRoom analyzes geospatial data to manage idle space such as rooftops of buildings in the city, and Zigbang comprehensively provides detailed data on real estate resources such as apartments and studios. These technologies will be effective in obtaining real-time city data if they are spread over a wide area called urban space and used as a tool to collect overall big data of urban space. Such

big data collection of urban space can be used as useful information for policymakers for future urban regeneration and future urban planning.

It will be difficult for big data to be collected with common standards and shapes throughout the country. Therefore, a platform that can organically combine various data collected by region or spot is needed. Incentives should be prepared so that proptech companies can share the data collected by the company for the regeneration of a specific area in a way that can be shared.

5.2. The effective usage of urban space and resources

Proptech companies can discover new spatial values and enable efficient use of space and resources in the city. The use of big data enables efficient resource management and customized service provision in terms of urban planning and management, and the most useful use of big data is analyzed through 'prediction'. Proptech can collect and process data in real-time and provide vast amounts of data necessary for city planning. In addition, it analyzes data with various technologies to accurately identify problems and increase the predictability of urban planning. Through this, it is possible to find new ways to utilize limited urban space more efficiently when establishing urban planning (Ahn, 2021)

Spacewalk calculates the maximum value of a building that can be built on a target land by evaluating space with artificial intelligence through real estate big data. Proptech companies support the efficient use of urban space according to its function without wasting the space. It is because they offer the way to increase the value of land by utilizing complex data such as land topographical condition, related laws, pre-sale price and rent data, and floating population. As can be seen in the case of WeWork, a shared office platform company, Proptech allows

citizens and companies to live in the space without making minor decisions – choosing residential and workplace locations, large and small problems due to lease contracts, purchasing supplies in the space, and complying with lease periods. Companies who want to move their workplace could reduce the waste of unnecessary effort and resources. Therefore, in terms of efficient use of urban space, applying prop-tech innovation technology to urban regeneration projects will revitalize underdeveloped areas and enable efficient use of resources.

5.3. Suggestion for the systemic urban regeneration

Proptech can be a policy decision support tool for future city policymakers to derive more rational plans. Urban regeneration needs a comprehensive plan that includes not only physical elements such as land use, transportation, and urban facilities, but also social elements such as population, education, health, and economic elements such as industry and employment. Therefore, it is necessary to accurately diagnose and analyze the target area for planning and derive reasonable alternatives. Therefore it is important to secure sufficient data necessary for analysis and prediction. It can be used as a tool to support decision-making according to the big data collected around the city..

Although it failed for reasons such as privacy issues, the smart city project conducted by Skywalk Labs also showed the vision of future urban regeneration. If the city automatically collects big data – such as traffic information, garbage discharge information, environment (water and air quality) information, and energy consumption collection - from the time a city designed, and operates the public facilities organically and flexibly by data, it will be able to

dramatically solve the current urban problems such as parking problems, environmental pollution, and energy waste.

The urban development design tool 'DELVE' provided by Sidewalk Labs also collects data related to transportation, environment, economy, welfare, etc. necessary for decision-making with the goal of data-based urban planning, and based on this, the most efficient urban design. It can support more systematic decision-making for urban policy makers

6. Conclusion

This study explored the concept and types of proptech and conducted a case study on 8 representative proptech companies related to urban regeneration. Through this, implications for the development direction in which proptech can be utilized in the urban regeneration field were derived.

We looked at Angelswing, a contech company that provides construction site virtualization solutions through drones, and HoloBuilder, a cloud-based construction management platform. In addition, Spacewalk, which is utilized in urban regeneration projects proposing a business feasibility review to the development of small space, and Sidewalk Labs, which provide urban development design solutions along with the Smart City Project, were examined. As a residential proptech company, Korea's No. 1 proptech company, Zigbang, which provides total online real estate services, and Skyroom, which solves housing problems by developing idle land on the rooftop, were analyzed. Finally, we looked at Homes Homes Company, which is conducting a self-sufficient rental housing village project, and Wework, a global office platform that can share communities and workspaces.

Through the examples of each company, this study suggested the direction in which proptech companies are used in urban regeneration. Proptech companies collect big data on urban space, enable efficient use of urban space and resources based on this, realize urban regeneration in the long run, and support decision-making in urban regeneration. In this way, the value of proptech in the field of urban regeneration was revealed and its utilization was derived.

This study has a limitation in that the cases can be subjective and limited because the investigation was limited to eight domestic and foreign companies by type according to the proptech type according to the previous research. However, the below 3 points are differentiated from previous studies. 1) Linking proptech with the urban regeneration field, where there are not many research results yet 2) In-depth analysis of domestic and foreign leading proptech companies about urban regeneration 3) Consideration of how proptech is used in the urban regeneration field through analysis of business areas of companies.

References

Ahn, S.W. (2021). Proptech, innovate the city. City Information, 475, pp.3–3.

Ahn Y,S. (2019). Analsis of city space and bigdata in the smart city. City Information, 453, pp.39–42.

Bae, S.Y., & Jeong, G.D. (2020). The case study of Property platform Biz model – focusing on accomodation and property brokerage. Property and Urban Research, 13(1), pp. 105-129.

CB insights. (2016. May 10). Office Space: 53 Tech Startups Reshaping Commercial Real Estate. CB Insights Research. https://www.cbinsights.com/research/commercial-real-estate-tech-market-map-company-list/

CB insights. (2017. July 11). Building Blocks: 100+ Startups Transforming Construction Tech. CB Insights Research. https://www.cbinsights.com/research/construction-tech-startup-market-map/

CB insights. (2016. May 4). Home, Sweet Home: 96 Tech Startups Reshaping Residential Real Estate. CB Insights Research. https://www.cbinsights.com/research/residential-real-estate-tech-market-map-company-list/

Cho, S.H. (2018a). Spacewalk and Landbook. Korean architects, 595(2018), pp.22–27.

Cho, S.H. (2018b). Property Valuation Model. KIBIM Magazine, 8(3), pp.26–29.

Choi, S.S, (2019). The current status and tasks of the industry of Property Fintech. Gukto, pp.32–37.

Ha, J.S. (2021, June 17), Faro merged Holobuilder... and expands the products in digital twin. Guktoilbo. http://www.ikld.kr/news/articleView.html?idxno=236154

Han, S.H. (2021, February 26). Property+cutting edge technology = proptech...it can find the way to solve the urban housing shortage and design the maintenance of old houses. Chosunilbo. https://www.chosun.com/site/data/html_dir/2019/02/25/2019022502806.html

Heo, Y.K. & Kim, S.H. (2019). Proptech Company, the future of real estate industry. CERIK. Construction Issue Focus. pp.1-38.

Jang, H.S. (2020, June 26). ′Homes Company′ who leads the shared house market, focuses on making the innovative residential service model. FNTIMES. https://www.fntimes.com/html/view.php?ud=2020062614492185615e6e69892f_18.

Kang, J.N. (2018, April 25). Wework experiment the the 21century′s version of ′Dure′ with the moto ′Be together′. Shin Dong-a, Shared Economy Report, 704, pp.382-391

Keum, S.S. (2020). The Fourth Industrial Revolution and the Direction of Development in the Real Estate Industry. Property Management, 22, pp.37-54.

Kim, S.O. (2019, October 5). PropTech Pioneer Dabang and Zigbang Expands Its Step After Entering the Sale Market. inews24. https://www.inews24.com/view/1212832.

Nam, G.W., Shin, G.W., Kim, D.J., Shin, D.B., Ahn, J.W., Kim, S.B., Choi, S.H., & Jang, D.I. (2014). Big data and Smart city. City information, pp.3-25.

Noh, G.S. (2020, September 25) ′Doneuimun′ AI reconstruction and Drone measurement, Proptech evoluate the urban regeneration. Munhwa Daily. https://www.munhwa.com/news/view.html?no=2020092501031203021001.

Lim, H.Y. (2020). Proptech and Valuation: The Case of Landbook. The dessertation of Korea Appraisal Society, 19(1), pp.53-71.

Lim, S.J. (2021, April 23). Lessons from Google′s biggest smart city project failure in North America. Chosun Biz. https://biz.chosun.com/site/data/html_dir/2021/02/04/2021020403041.html .

Lee, B.M. (2016). Regional development and urban regeneration based on the culture heritage – focusing on <Festival of ferry tale in Seoul>. The Economic Geographical Society of Korea, 19(1), pp.51–67.

Lee, S.Y. (2020). Proptech Classifications and Development Prospects. Journal of Korean Social Trend and Perspective, 110, pp.191–224.

Lee, J.Y., Oh, G.J. & Ahn, J.J. (2021). Study on the Development Direction of Domestic Proptech Company: Focusing on the Real Estate Platform Information Provision Function. Knowledge Management Research, 22(2), pp.55–76.

Lee, S.Y., Oh, E.J. & Lee, H.Y. (2012). A study on the regeneration policy for regions in recession. Korea Research Institute for Local Administration. Research Report, 466, pp.1−258.

Pasific, J. A. 2018. The Growing Influence of Proptech. Jones Lang LaSalle. TechinAsia

Park, W.N. (2019, September 23) ″Contech Startups″ who will open the smart construction era is coming. Venturesquare. https://www.venturesquare.net/791424.

Park, H.H. (2021, June 7). National property application, Zig bang became the 12th unicorn. Seoul Economy. https://www.sedaily.com/NewsView/22NJME44R4/GD0101.

Shin, D.Y. (2020, May 7) Google gave up the Toronto smart city project due to Covid 19. Korea Herald Business. http://heraldk.com/2020/05/07/%EA%B5%AC%EA%B8%80-%EC%BD%94%EB%A1%9C%EB%82%9819%EB%A1%9C-%ED%86%A0%EB%A1%A0%ED%86%A0-%EC%8A%A4%EB%A7%88%ED%8A%B8-%EC%8B%9C%ED%8B%B0-%EA%B0%9C%EB%B0%9C-%ED%8F%AC%EA%B8%B0/.

Son, D.W. (2021, August 11) With jobs and living infrastructure... a self-sufficient shared village in Gangwon. Maeil Economy. https://n.news.naver.com/mnews/article/009/0004837025?sid=101