Real Estate Industry in the Era of Technology 5.0

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Abstract

Purpose: This paper aims to suggest ways to apply the leading technologies of Industry 5.0 to the housing welfare field, tasks for this, and policy implications. **Research design, data, and methodology:** The analysis method of this study is a literature study. The analysis steps are as follows. Technology trends and characteristics of Industry 5.0 were investigated and analyzed. The following is a method of applying technology 5.0 in the industrial field. Finally, the application areas of each technology and the challenges to be solved in the process were presented. **Results:** The results of the analysis are 1) the accessibility and diffusion of technology. This means that all citizens have equal access to and use of the latest technology. To this end, the appropriate use of technology and the development of a user-centered interface are needed. 2) Data protection and privacy. Residential welfare-related technologies may face risks such as personal information leakage and hacking in the process of collecting and analyzing residents' data. 3) Stability, economic feasibility, and sustainability of the technology. **Conclusions:** The policy implications include: 1) Enhancing technology education and promotion to improve tech accessibility for groups like the low-income, rural areas, and the elderly, 2) Strengthening security policies and regulations to safeguard resident data and mitigate hacking risks, 3) Standardization of technology, 4) Investment and support in R&D.

Keywords: Industry 5.0, Housing Welfare, Human-centricity, Sustainability, Resilience

JEL Classification Code: E44, F31, F37, G15

1. Introduction

1.1. Background of the Study

The real estate industry, one of the most traditional sectors, has long been resistant to change. Historically, property transactions, management, and development have been deeply entrenched in manual processes, personal relationships, and conventional brick-and-mortar methodologies. However, the dawn of the digital era and its subsequent technological iterations have gradually begun to influence this industry.

As we move into the era of Technology 5.0, the convergence of multiple technological domains such as AI, IoT, augmented reality, blockchain, and more promises a revolutionary impact on various industries, and real estate is no exception.

The Technology 5.0 era is often described as the harmonious integration of advanced technology into human lives. Unlike its predecessor, Industry 4.0, which focused primarily on machine communication and automation, Technology 5.0 emphasizes human-centric technology. It's about making machines understand human emotions, needs, and actions and respond to them appropriately. In the context of real estate, this could manifest in myriad ways – from smart homes that adjust settings based on the inhabitant's mood to virtual property tours that can be personalized based on the viewer's preferences.

Furthermore, the last two decades have seen significant urbanization trends globally. With cities becoming densely populated, there's a pressing need for innovative real estate solutions that can efficiently utilize space, provide sustainable living options, and cater to the evolving demands of modern urban dwellers.

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Technology 5.0, with its emphasis on sustainability, personalization, and efficiency, can offer valuable tools in this quest.

However, for all its potential, the integration of advanced technology in real estate poses challenges. There are concerns about data privacy, the high costs of technological adoption, potential job displacements, and the readiness of both consumers and professionals in the industry to adapt to these rapid changes.

This study aims to delve deep into the strategies that the real estate industry can adopt to harness the power of Technology 5.0. By understanding its implications, both positive and negative, we can chart a path forward that not only ensures the industry's growth but also addresses the broader societal needs and challenges of our times.

1.2. Purpose of study

The overarching aim of this research is to explore the transformational effects of the technological revolution on the real estate industry and to identify innovative strategies that will facilitate sustainable growth and competitiveness in this new era. Specifically, the study seeks to:

Understand the Impact: Ascertain the depth and breadth of technological influences on real estate transactions, property management, and development trends.

Identify Challenges: Recognize the challenges and hurdles faced by the real estate sector due to rapid technological advancements, including issues of adaptation, regulation, and potential market disruptions.

Uncover Opportunities: Highlight the emerging opportunities presented by technological innovations such as virtual property tours, smart building technologies, data analytics, blockchain in property transactions, and more.

Formulate Strategies: Propose actionable strategies and best practices that real estate stakeholders can adopt to harness the full potential of the technological revolution, ensuring they remain relevant and effective in serving evolving consumer needs.

Recommend Policy Changes: Suggest potential policy adjustments or new regulations that can support the integration of innovative technologies in the real estate sector while ensuring consumer protection and industry integrity.

By achieving these objectives, the study aims to provide a comprehensive roadmap for real estate professionals, policymakers, and investors, guiding them through the complexities of the tech revolution era

and enabling them to make informed decisions for the future of the industry.

2. Literature Review

2.1. Technology development process

Initial Stages (Pre-Technology 1.0 Era): This period predates the formal classification of technological eras. It was marked by manual labor and rudimentary tools, laying the groundwork for future technological advancements. Technology 1.0 (Industrial Revolution Era): This era saw the advent of mechanization and steam power, leading to the first Industrial Revolution. It marked a significant shift from agrarian societies to industrialized ones, dramatically changing the way people worked and lived. Technology 2.0 (Electrification and Assembly Line Era): Characterized by the introduction of electricity and mass production techniques, including the assembly line. This era brought about more efficient production methods and began to shape modern manufacturing and urbanization. Technology 3.0 (Computer and Automation Era): The emergence of computers and automation technology marked this era. It was a period of significant digitalization, leading to increased productivity and the beginning of the information age. Technology 4.0 (Digital Revolution Era): Known as the era of the Digital Revolution or Industry 4.0, it is characterized by the fusion of digital technology into all areas of business and life. It includes advancements like the Internet of Things (IoT), big data, and artificial intelligence (AI), transforming industries and daily life. Technology 5.0 (Human-Centric and Societal Well-being Era): The current era, focused on integrating technological advancements with human needs and societal well-being. It emphasizes creating a balance between technological development and human-centric values, aiming to solve societal issues and improve the quality of life through technology.

Each stage of this evolutionary process demonstrates a significant leap in technological capabilities and societal impact, with Technology 5.0 representing a holistic approach that prioritizes human welfare and sustainable development alongside technological progress.

Table 1 summarizes the technological development process.

Table 1: The technological development process

Era	Description
Pre-Technology 1.0	Characterized by manual labor and rudimentary tools. It laid the foundation for future technological advancements.
Technology 1.0 (Industrial Revolution Era)	Marked by the advent of mechanization and steam power, leading to the first Industrial Revolution. Shift from agrarian societies to industrialized ones.
Technology 2.0 (Electrification and Assembly Line Era)	Introduction of electricity and mass production techniques, including the assembly line. Brought about efficient production methods and modern manufacturing.
Technology 3.0 (Computer and Automation Era)	Emergence of computers and automation technology. Period of significant digitalization, leading to the information age.
Technology 4.0 (Digital Revolution Era)	Fusion of digital technology into all areas of business and life, including the Internet of Things (IoT), big data, and artificial intelligence (AI).
Technology 5.0 (Human-Centric and Societal Well-being Era)	Focuses on integrating technological advancements with human needs and societal well-being. Prioritizes human welfare and sustainable development alongside technological progress.

Source: Author construction

2.2. Discussions about Technology 5.0

2.2.1. European Commission

The European Commission, an integral institution of the European Union, transitioned beyond the established framework of Industry 4.0 when they introduced the concept of Industry 5.0 in 2021. This innovative approach prioritizes a deeper connection to the human experience and emphasizes the significance of socio-environmental considerations. Central to this evolved vision are several key strategies presented in the European growth blueprint in 2019. Among these are the European Green Deal Policy, which aims for environmentally conscious growth; The European Commission has outlined "The Digital Strategy for Europe," imagining a future where Europe stands as a beacon of technological innovation and advancement. In tandem with this, there's a strong emphasis on a "Human-Centric Economy."

With a long-term perspective stretching to 2050, the overarching goal is to architect an industrial ecosystem that not only embraces sustainability but also significantly reduces the environmental impact, particularly concerning climate change. This commitment to sustainability dovetails with a robust ambition to fortify Europe's competitive stance in the global economy. To this end, the European Commission envisions a paradigm where research is directed towards the discovery and development of environmentally benign chemical compounds. Concurrently, there's an impetus to revolutionize traditional steel production methods, aligning them with the principles of carbon neutrality. Lastly, there is a concerted effort to cultivate a marketplace that values and promotes products resilient to climate variability, with a pronounced focus on recycling and circular economy principles. This holistic strategy illustrates Europe's commitment to intertwining economic growth with environmental stewardship.

2.2.2. Germany

The federal government of Germany has been at the forefront of championing the "Industry 4.0" movement, orchestrating a holistic approach that encompasses a partnership among private enterprises, public agencies, and academic institutions. One of the pivotal milestones in the journey towards the Fifth Industrial Revolution is encapsulated in the '2030 Vision for Industry 4.0,' a seminal document disseminated by the premier institution, Platform Industry 4.0, in 2019. This was followed by another impactful document, 'Sustainable Production: Actively Shaping the Ecological Transformation with Industry 4.0,' which saw the light of day in November 2020.

The '2030 Vision for Industry 4.0' delineates three foundational tenets that are poised to redefine the industrial paradigm: 'Autonomy', signifying a future where systems have self-directed functionalities; 'Interoperability', a principle that champions seamless integration across varied technological platforms; and 'Sustainability', an ethos that ensures that industrial growth is in harmony with environmental conservation. At the heart of this vision lies a pronounced emphasis on the human element - a dedication to enhance workplace conditions and ensure that the workforce is continually equipped with the evolving skill set required in a dynamic industrial landscape. Additionally, the document accentuates the imperative of cross-functional collaboration, both intra and inter-organizational, to seamlessly infuse sustainable manufacturing methodologies, mirroring the concurrent evolution of the industrial sector and societal expectations.

A fundamental principle underscored in the '2030 Vision for Industry 4.0' is the proactive stewardship of environmental shifts, predicated on the pillars of sustainable Industry 4.0. To elucidate, this encapsulates objectives such as the judicious use of resources, emphasizing a reduction in consumption while enhancing efficiency. It also heralds a transition from traditional mass production modalities to a more transparent, service-oriented approach. Moreover, the vision underscores the seamless integration within the framework of a circular economy, ensuring that the industrial sector operates in a closed-loop system that prioritizes recycling and minimal waste.

The journey we are embarking on provides a unique opportunity to glimpse the evolution of upcoming industry developments. This path is not just a path toward progress. This is a pivotal foundation for the imminent transition to Industry 5.0. As we navigate this path, we are witnessing the convergence of technological advancements and human ingenuity, which is leading to significant changes in the way industries operate and innovate. This transition is not just about technology upgrades. This is a holistic change in our approach to industrial processes, incorporating more sustainable, efficient and human-centric methods. The transition to Industry 5.0 marks a critical juncture where the synergy of human creativity and advanced technology is redefining the global industrial landscape.

2.2.3. Japan

In 2016, Japan's governmental visionaries promulgated the 'Society 5.0' strategy, a testament to their forward-thinking prowess. Envisioned as a harmonious fusion of robust economic trajectories and the resolution of pressing societal quandaries, this strategy accentuates the symbiotic melding of the ethereal digital world (cyberspace) with our tangible lived experiences (physical space). Upon examining this approach, the European Commission, in their discourse on 'Industry 5.0,' acknowledged the depth and sophistication of the 'Society 5.0' construct, elevating it as an emblematic beacon of innovation and progressive ideation.

Central to Japan's socio-developmental narrative is the entwinement of societal well-being with environmental stewardship. A salient feature of this narrative is Japan's unwavering commitment to place humanity at the core of its endeavors, championing a paradigm where both individual introspection and collective mobilization converge to sculpt the contours of societal evolution. Among the mosaic of attributes that define Japan's approach, its renowned resilience has garnered international accolades. The nation's remarkable alacrity in navigating the tumultuous aftermath of adversities, particularly disasters, is emblematic of its potent collaborative ethos. This ethos is marked by a dynamic interplay and synergistic alignment among its diverse industrial landscapes, entrepreneurial ventures, and the overarching governance structures. Such an intricate tapestry of collaboration has not only fortified Japan's recuperative prowess in post-calamity scenarios but also positioned it as a global paragon in resilience and recovery strategies, a sentiment echoed in the scholarly contributions of Narvaez Rojas et al. (2021).

2.2.4. USA

In the face of the evolving tides of Industry 5.0, the United States is strategically positioning itself, curating and enacting a myriad of initiatives. Paramount among these is the growing emphasis on environmental sustainability and energy conservation — areas that have taken center stage in contemporary policy discourse. As a testament to this, the innovative technological strides, accompanied by transformative policy shifts, underscore the nation's commitment to addressing these pressing global challenges.

A significant marker of international collaboration in this trajectory is the 2021 alliance between Germany's esteemed Platform Industry 4.0 and the United States' Clean Energy Smart Manufacturing Innovation Institute (CESMI). This collaboration serves as a beacon of their collective commitment. The confluence of their expertise revolves around the central theme of 'sustainable manufacturing vis-à-vis environmental and climatic imperatives'. This synergy can be aptly construed as an industrial counter-narrative to the escalating climate exigency, signaling a proactive, solution-oriented approach.

Within its borders, the US fosters a vibrant ecosystem that resonates with the principles underpinning Industry 5.0. A diverse consortium of research entities, esteemed academic establishments, and forward-thinking corporate entities spearhead research and development initiatives. The outcomes of these endeavors are manifesting as groundbreaking advancements across an array of domains, encompassing green technology, artificial intelligence, robotics, and the ever-expanding universe of the Internet of Things (IoT).

To encapsulate, the strategic orientations and proactive measures adopted by the United States in navigating the contours of Industry 5.0 illuminate its vision. This vision is emblematic of a commitment to sculpting an innovative industrial paradigm for the 21st century, while concurrently charting a course towards a future that epitomizes sustainability and resilience.

2.3. Prior Studies

2.3.1. Studies Related to Technology 5.0

esearch into Industry 5.0 has been a burgeoning area of academic interest, delving into its multifaceted

dimensions that range from theoretical underpinnings to tangible applications in fields like sustainability and supply chain management.

Initial academic pursuits have been rooted in the foundational concepts and theoretical paradigms that distinguish Industry 4.0 and 5.0. In this realm, works by scholars such as Souza et al. (2022), and Sindhwani et al. (2022) have provided seminal insights, offering a deeper understanding of the evolving nature and implications of these industrial revolutions.

Shifting the lens to the tangible manifestations of Industry 5.0, research has probed into the technological advancements and their consequential economic ramifications. Within this context, Waheed et al. (2022) and Voulgaridis et al. (2022) have contributed to a growing body of knowledge, dissecting the intricate interplay between technological innovations and the broader economic ecosystem in the age of Industry 5.0.

Furthermore, the nexus between Industry 5.0 and sustainability, as well as its integration into supply chain processes, has garnered significant attention. In this segment of research, Dwivedi et al. (2023) have explored the sustainable imperatives and potentialities within Industry 5.0. Similarly, Pacheco & Moktadir (2023) has delved into the intricate mechanisms through which Industry 5.0 interfaces with, and influences, contemporary supply chain dynamics.

In summation, the academic landscape surrounding Industry 5.0 is rich and diverse, encapsulating both its theoretical foundations and its practical implications across various sectors and thematic areas.

2.3.2. Study Related to the Real Estate Industry

Impacts of Technology on Real Estate: DeLisle (2000) delves into the broader real estate market dynamics and how technological advancements play a pivotal role in shaping its future. Starr et al. (2021) explores the rise of PropTech, emphasizing the transformational influence of new-age industrial technologies on the real estate sector. Seagraves (2023) critically assesses the role of AI in real estate, questioning its potential benefits and pitfalls. provides an empirical perspective by evaluating how technological innovations drive the performance metrics of real estate enterprises in Nairobi.

Review & Analysis of Smart Real Estate Technologies: Ullah et al. (2018) offer a comprehensive review, outlining the driving factors and challenges associated with disruptive digital technologies in the real estate realm. Sanquist et al. (2018) discuss the transformative journey of corporate real estate in the wake of the Fourth Industrial Revolution. Roulac (2019) presents a retrospective view, analyzing how historical industrial revolutions have left their mark on real estate dynamics.

Data Science and Real Estate in the Fourth Industrial Revolution delve deep into the integration of data science methodologies tailored for real estate stakeholders, set against the backdrop of the Fourth Industrial Revolution.

Acceptance & Adaptation of Technology in Real Estate assess the receptivity of the Nordic real estate industry to technological tools, highlighting the challenges and opportunities in a digital age.

Prior Studies centered on the real estate domain have predominantly been focused on the paradigms of the Fourth Industrial Revolution, commonly referred to as Technology 4.0, and the realm of property technology, colloquially termed as proptech. These antecedent research endeavors sought to understand and demystify the intricate amalgamation of real estate practices with emerging technologies of their respective epochs.

However, a discernible lacuna exists in the academic corpus when it comes to the extrapolation of these technological intersections into the era of Technology 5.0. As we are on the precipice of this nascent technological epoch, the scholarly community is yet to extensively traverse this uncharted terrain. Consequently, what sets this research endeavor apart from its predecessors is its pioneering nature. This study embarks on a scholarly voyage to delineate and devise a blueprint for the evolution and strategic advancement of the real estate sector in the context of the Technology 5.0 era, an era which is still in its embryonic stages of conceptualization and realization within the broader academic and industrial discourse.

3. Analysis Framework

In the complex panorama of technological evolution, we stand at a transformative juncture, transitioning from the well-trodden paths of Industry 4.0 to the nascent, yet potentially seismic, terrains of Industry 5.0. This metamorphosis, characterized by an intricate array of refined technological innovations, encapsulates not just the zenith of human technological prowess, but also beckons a panoply of implications for myriad sectors, with the real estate arena occupying a pivotal nexus in this discourse. The confluence of sophisticated technologies and the intricate dynamics of the real estate industry invites a profound exploration, one that dives deep into the interstices of integration, adaptation, and eventual transformation.

In the wake of such technological zeitgeist, our academic endeavor is sculpted to meticulously dissect, analyze, and subsequently propose a cogent development blueprint for the real estate sector as it grapples with, and seeks to harness, the multifarious offerings of Industry 5.0. This ambitious undertaking is chiseled through a multi-pronged, exhaustive research methodology, delineated as follows.

3.1. Bibliographic Survey

An exhaustive bibliographic survey will be undertaken to collate and scrutinize scholarly articles, research papers, and pertinent studies focusing on the Korean real estate milieu. In undertaking this research initiative, we aim to meticulously establish a comprehensive theoretical foundation. By doing so, we will be able to identify the current breadth of knowledge in the field, and simultaneously bring to the fore any existing gaps or specific areas that might require more profound and detailed investigation in future inquiries.

3.2. Case Stratification

A meticulous case stratification protocol will be adhered to. Cases will be stratified based on a matrix of predetermined parameters ensuring they epitomize varied sub-sectors within the real estate domain. Additionally, the salience of each case, gauged by its innovative prowess, consequential impact, and pertinence to the overarching research paradigms, will be pivotal during this phase.

3.3. Differential Analysis

During this pivotal stage of our investigation, this research undertakes a meticulous and comprehensive exploration of the carefully observed patterns, evolutionary paths, and custom-crafted strategies that serve as the foundational bedrock, fostering the prosperity and rising prominence of each individual case presented. In this study, we analyze the nuances of how each sector adeptly integrates rapidly evolving technologies.

3.4. Integrated Exegesis

Post analysis, an integrated exegesis will be formulated. This will amalgamate insights unearthed during the differential analysis, distilling cardinal takeaways. Further, this synthesis will be juxtaposed with the theoretical constructs and perspectives gleaned from the bibliographic survey, ensuring a panoramic and nuanced comprehension of the subject matter.

By adhering to this rigorous academic methodology, the research seeks to offer a profound understanding of the confluence of evolved technological paradigms and the dynamism of the Korean real estate industry.

3.5. Classification Criteria of the Real Estate Industry

In the context of this research, the established criteria employed for categorizing various facets of the real estate industry are delineated below. In this research, the real estate industry has been segmented into the following categories:

Real estate brokerage platform, Commercial district analysis, Real estate Valuation, Real estate management, Real estate investment.

Table 2: Classification Criteria of the Real Estate Industry

Classification	Detailed Description
Real estate brokerage platform	• Digital-based platform offering property listings • Intermediary services between buyers and sellers • Features automated price recommendations, virtual property tours, and digital contracts
Commercial district analysis	• Analysis and trend identification of commercial areas • Evaluation of rental rates, store operation rates, and competitiveness of the area • Assessment of future development potential and investment value
Real estate Valuation	• Evaluation and analysis of real estate value • Factors considered: location, size, age, facilities, and features • Methods used include comparative market analysis, income approach, and replacement cost approach
Real estate management	• Operations and management of real estate • Tenant management, maintenance and repairs, and managing operational costs of buildings • Maximizing revenue through efficient asset management
Real estate investment	• Real estate investment strategies and portfolio building • Risk management and return on investment analysis • Consideration of various investment options: residential properties, commercial properties, REITs, etc.

Source: By the Author

4. Case Study

4.1. Real Estate Brokerage Platform

Over the past decade, the Korean real estate market has experienced a significant transformation, primarily driven by technological advancements and changing consumer preferences. A major development in this sector has been the rise of digital real estate brokerage platforms.

Historically, real estate transactions in Korea were predominantly facilitated by offline brokers. However, with increased internet penetration and the prevalence of smartphones, there has been a growing shift towards online platforms.

4.1.1. Case

Certainly, here is a more detailed analysis of the changes in Korean real estate brokerage platforms, with a focus on Zigbang, Dabang, and Hogangnono, as summarized in <Table 3>:

Zigbang started as a platform for basic real estate brokerage tasks, connecting buyers and sellers and providing information on actual transaction prices. Technological Advancements: Over time, Zigbang has leveraged advanced IT technologies. It introduced features like virtual property tours through 3D and augmented reality (AR) technologies. These innovations have improved the user experience by allowing potential buyers to virtually explore properties. Data Analytics: Zigbang uses data analytics to offer personalized property recommendations to users. Machine learning algorithms analyze user preferences and browsing history to suggest properties that match their criteria. Mobile Accessibility: Zigbang has maintained a strong mobile presence, with user-friendly mobile apps that provide convenient access to property listings and services.

Dabang: Initial Functionality: Dabang, similar to Zigbang, began as a platform for basic real estate transactions, including rental listings and actual transaction price data. Technological Advancements: Dabang has adopted modern technologies to enhance its services. It introduced a chatbot feature that enables users to get quick responses to inquiries. This AI-driven chatbot improves communication and customer service. Market Trends: Dabang has also incorporated market trend analysis into its platform. Users can access data on property trends, price fluctuations, and demand in specific areas, helping them make more informed decisions. Integration: Dabang has explored partnerships and integrations with other services. For example, it may offer financial calculators to help users estimate mortgage payments or connect users with insurance providers for property coverage.

Hogangnono: Initial Functionality: Hogangnono, like its counterparts, started as a platform for real estate transactions, focusing on connecting buyers and sellers. Technological Advancements: Hogangnono has been at the forefront of innovation by incorporating emerging technologies like blockchain. It uses blockchain to enhance the security and transparency of property transactions and record-keeping. Market Data: Hogangnono provides comprehensive market data, including historical transaction records, price trends, and neighborhood information. This data-driven approach helps users understand market conditions better. Community Building: Hogangnono has also emphasized community building within its platform. Users can join forums, discussions, and share experiences related to real estate transactions. This social aspect enhances user engagement and trust.

Development Plans in the Technology 5.0 Era: In the Technology 5.0 era, these real estate brokerage apps are likely to continue evolving. They may explore emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), and big data analytics to offer even more personalized and efficient services. Integration with smart home devices and virtual reality (VR) for immersive property tours could become standard features. Enhanced data security and privacy measures, especially considering the sensitive nature of real estate transactions, will be a priority. Collaboration with financial institutions and mortgage providers to streamline the financing aspect of real estate transactions could be explored. Continued adaptation to changing consumer preferences and market dynamics, especially in response to shifts caused by economic factors or regulatory changes.

In the advent of Technology 5.0, real estate brokerage apps are anticipated to fundamentally reshape the property market. They will harness state-of-the-art technologies like artificial intelligence, augmented reality, and blockchain, providing users with a seamless, personalized, and more secure real estate experience. AI will enable smarter, data-driven decisions by analyzing market trends and property valuations, while augmented reality will offer immersive virtual property tours, allowing users to explore homes from anywhere in the world.

Blockchain technology will revolutionize property transactions, ensuring transparency and security, and simplifying the buying, selling, and renting processes. Additionally, these apps will play a crucial role in advocating for sustainable real estate practices, aligning with global environmental goals. They will likely include features that highlight energy-efficient properties or adhere to green building standards.

Table 3: Real estate brokerage apps.

APPs	AS IS	TO BE
Zig-bang	• simple brokerage app • Fee discount	• Home OS • Beyond a simple brokerage app: Leading the way in smart home technology • Prop-Tech company leading the residential lifestyle revolution
Da-bang	• Brokerage of one-room and other small-sized housing • Primarily used by young adults, including those living alone	• Enhancing the user interface (UI) and user experience (UX) • Considering AI integration for analyzing user preferences • Tailored real estate information based on user needs and preference
Hogangnono	• Providing actual transaction price for apartments	• Providing various real estate information desired by consumer

Source: Author construction

4.1.2. Key Features

User Interface (UI): The platform offers a user-friendly interface, allowing users to easily search for properties based on various filters such as location, price, size, and type.

Virtual Tours: Leveraging AR and VR technologies, users can take virtual tours of properties, reducing the need for physical visits. Automated Price Recommendations: With the help of AI and big data, the platform suggests pricing recommendations for sellers, based on current market trends.

Review System: Users can leave reviews for properties and brokers, ensuring transparency and building trust.

Impact on the Market: The rise of such platforms has increased the transparency and efficiency of real estate transactions in Korea. It has also fostered competition, pushing traditional brokers to adopt technological solutions and offer more value-added services to clients.

4.1.3. Challenges and the Way Forward

While these platforms have gained significant traction, they also face challenges such as regulatory hurdles, competition from traditional brokers, and the need to constantly innovate to meet changing consumer demands.

In conclusion, the rise of real estate brokerage platforms in Korea marks a significant turning point in the industry, highlighting the profound impact of technological innovation and shifting consumer behaviors. These platforms, emerging as pivotal players in the real estate sector, are not merely digitizing traditional processes; they are redefining the way individuals interact with real estate markets.

4.2. Commercial District Analysis APP

4.2.1. Case

In this case study, we compare and analyze changes in domestic commercial analysis service platforms. Through this, the commercial analysis app seeks to present development plans appropriate for the Technology 5.0 era. The following <Table 4> summarizes recent changes in apps related to commercial analysis.

The landscape of commercial analysis apps in Korea is marked by the prominence of three key platforms: Oasis Business, Share Kim & BC Card, and FINDA. These platforms have carved out a niche in the market by offering essential tools and data for commercial analysis, catering to a diverse range of business needs.

Initially, these apps began by offering straightforward commercial analysis services, focusing on basic data aggregation and interpretation. However, as the pace of technological advancement accelerated, the operators of these apps recognized the need to evolve and adapt to stay relevant and useful to their consumers.

This evolution has been characterized by the integration of various IT technologies. For instance, the use of artificial intelligence and machine learning algorithms in these apps has enabled more sophisticated data analysis, allowing businesses to gain deeper insights into market trends, consumer behavior, and financial forecasting. This level of analysis was not possible with the initial versions of these apps.

Furthermore, the incorporation of big data analytics has allowed these platforms to handle vast amounts of information, turning raw data into actionable insights. This capability is particularly crucial in today's data-driven business environment, where the ability to quickly analyze.

Table 4: Commercial district analysis APP

APPs	AS IS	TO BE
Oasis Business	• Big Data & AI technology company that evaluates the value of commercial districts and commercial real estate based on Human experience Data	• Presents a plan to solve information asymmetry issues using big data and AI technology in the commercial real estate field. • Operates various services such as Right Money, ITTANG and ACSS • Provide customer service in cooperation with construction companies
Share Kim & BC Card	• A specialized platform for providing short-term rentals	• Partnership with BC Card • Providing customized information to consumers
FINDA	• Providing loan brokerage and management services	• Acquired Open Up, a big data-based commercial analysis startup • Providing key information to small business owners and self-employed people • Provides trends in delivery sales volume and proportion rankings by detailed industry

Source: Author construction

4.2.2. Key Features

Local Data Collection and Analysis: This app gathers and analyzes data from various commercial areas, providing users with valuable insights into various business types, including stores, restaurants, cafes, and more.

Real-time Updates: The data for commercial areas is continuously updated in real-time, ensuring users have access to the latest information, including new stores and promotions.

Map-based Visualization: Users can easily visualize commercial areas on a map, making it convenient to locate stores and services in a given area. Personalized Recommendations: The app offers personalized recommendations based on user preferences and purchase history.

Review and Rating System: Users can write reviews and rate stores and services, allowing them to share information with other users.

4.2.3. Challenges and the Way Forward

Ensuring Data Accuracy and Reliability: Maintaining the accuracy and reliability of commercial area data is crucial, minimizing fake information and outdated data to provide trustworthy information. Privacy and Security: Protecting user data and ensuring privacy compliance are essential considerations, adhering to privacy regulations and maintaining data security.

Diverse Business Models: Diversifying revenue models is necessary for ongoing support and development of the app, including options such as advertising, subscriptions, and licensing.

AI and ML Enhancements: Improving artificial intelligence and machine learning capabilities is essential for more accurate recommendations and analyses. Building Local Communities: Facilitating interactions between local businesses and users by building and maintaining local communities is important for the app's success.

A commercial district analysis app in South Korea should provide users with convenient information and experiences while addressing challenges related to data accuracy, security, and privacy.

4.3. Real Estate Valuation Platform

4.3.1. Case

In this case study, we compare and analyze changes in Korean Real Estate Valuation platform platforms. Through this Real Estate Valuation platform seek to present development plans in the Technology 5.0 era. The following <Table 5> summarizes recent changes in Real Estate Valuation platforms.

4.3.2. Key Features

Property Data Integration: The platform should aggregate data from multiple sources, including property records, recent sales, market trends, and comparable property information.

Advanced Analytics: Utilize statistical models, machine learning algorithms, and AI-driven insights to analyze property data and generate valuations.

User-Friendly Interface: Provide an intuitive and user-friendly interface that allows real estate professionals, appraisers, and users to input property details and receive valuations easily.

Table 5: Real estate brokerage apps.

APPs	AS IS	TO BE
DISCO	• Information on actual transaction prices of land and buildings • Auction information	• Plan to connect real estate information and users more closely on a regional basis • Developed into a portal service that provides real estate information on a regional basis
XAI LAND	• Evaluate and predict the future value of real estate through our self-developed automatic real estate valuation model (AVM)	• Providing comprehensive real estate services including purchase, sale, development, and lease
KAKAO BANK	• Online bank	• Providing market prices for townhouses and multi-family housing, where market prices are difficult to determine, through AVM • Mortgage loan sales

Source: Author construction

Customization: Allow users to customize valuation parameters and factors, taking into account specific property characteristics and market conditions.

Property History: Offer historical property data and trends to help users understand how property values have changed over time.

Market Comparisons: Provide comparisons with similar properties in the same area to give users a context for their property's value.

Reports and Documentation: Generate detailed valuation reports with explanations and supporting data that can be used for real estate transactions, appraisals, and investment decisions.

4.3.3. Challenges and the Way Forward

Data Accuracy: Ensuring the accuracy of property data is a constant challenge. Platforms must have robust data quality checks and validation processes.

Regulatory Compliance: Adhering to real estate valuation regulations and standards in different regions and jurisdictions can be complex and must be continuously monitored and updated.

Data Privacy: Safeguarding sensitive property and user data is crucial. Compliance with data privacy laws and regulations, such as GDPR or HIPAA, where applicable, is essential.

Market Volatility: Real estate markets can be subject to rapid changes and economic fluctuations, making it challenging to provide accurate valuations in uncertain times.

Technology Advancements: Staying up-to-date with the latest advancements in technology, such as AI and machine learning, is essential to improve valuation accuracy and efficiency.

User Trust: Gaining and maintaining the trust of real estate professionals, investors, and users is critical for the platform's success. Transparent methodologies and accurate results are key.

Data Security: Protecting sensitive property and user data from cyber threats and breaches is an ongoing concern.

A real estate valuation platform plays a crucial role in property transactions, investment decisions, and property management. Meeting these challenges while providing accurate and reliable valuations is essential for its success in the real estate industry.

4.4. Real Estate Management

4.4.1. Case

In this case study, we compare and analyze changes in Korean real estate management platforms. Through this, real estate management apps seek to present development plans in the Technology 5.0 era. The following <Table 6> summarizes recent changes in real estate management apps.

When it comes to platforms in the property management applications space, three names stand out clearly: Trustay, Home Button, and The Good House. Each has unique features to meet the dynamic demands of the real estate market.

These apps initially performed simple home management tasks and provided actual transaction price information. Since then, as technology has advanced at a rapid pace, the operators of these apps have evolved to meet the needs of consumers by utilizing various IT technologies.

4.4.2. Key Features

Property Maintenance: Regular maintenance and upkeep of properties to ensure they remain in good condition, which can include repairs, landscaping, and general upkeep.

Tenant Management: Handling tenant relations, including leasing, rent collection, addressing tenant concerns, and ensuring lease agreements are upheld.

Financial Management: Managing property finances, including budgeting, rent collection, accounting, and reporting to property owners or investors.

Marketing and Tenant Acquisition: Attracting and screening prospective tenants, advertising vacant units, and conducting tenant background checks.

Table 6: Real estate management apps.

APPs	AS IS	TO BE
Trustay	• long stay • short term rental	• Real estate asset management and value enhancement • Advancement in convenience and utility
Home button	• The easiest rental management service • Digital conversion of document-type lease agreements	• Simple payment market for housing rent • Evolving into a big data platform that provides rights analysis through data calculated based on a profitable rental real estate asset management platform
The Good House	• Self-managed housing management company • Providing master lease service for officetel rental management	• Focus on developing various services and new processes to relieve customer anxiety and inconvenience

Source: Author construction

Legal Compliance: Ensuring compliance with local, state, and federal laws and regulations related to property management and tenant rights.

Tenant Services: Providing services to tenants, such as emergency maintenance response, property security, and amenities management.

Risk Management: Identifying and mitigating risks associated with property ownership, including insurance coverage and safety measures.

Property Improvement and Renovation: Overseeing property improvement projects and renovations to enhance property value and attract tenants.

4.4.3. Challenges and the Way Forward

Tenant Issues: Dealing with problematic tenants, eviction procedures, and tenant turnover can be challenging and time-consuming.

Maintenance Costs: Balancing the cost of property maintenance and repairs with the need to keep properties in good condition can be a financial challenge.

Market Fluctuations: Real estate markets can experience fluctuations in property values and rental rates, impacting property income and investment returns.

Regulatory Changes: Keeping up with changing local and federal regulations that affect property management and landlord-tenant relationships.

Tenant Satisfaction: Ensuring tenant satisfaction to reduce turnover and maintain a steady income stream.

Financial Management: Managing property finances, including budgeting and accounting, requires attention to detail and accuracy.

Emergency Situations: Handling emergencies such as natural disasters, accidents, or property damage can be stressful and require quick response.

Property Security: Ensuring the safety and security of both tenants and the property itself is an ongoing concern.

Sustainability and Environmental Compliance: Meeting environmental standards and sustainability goals may become increasingly important in property management.

Real estate management is a multifaceted field that requires expertise in property operations, tenant relations, financial management, and legal compliance. Successfully addressing these challenges while maximizing property value and income is essential for effective real estate management.

4.5. Real Estate Investment

4.5.1. Case

In this case study, we compare and analyze changes in domestic real estate investment platforms. Through this, the real estate investment app seeks to present development plans appropriate for the Technology 5.0 era. The following <Table 7> summarizes recent changes in real estate investment apps.

In Korea, when discussing leading platforms in the real estate-to-application space, three names stand out clearly. KASA, REALBUY and FUMBLE each have unique features to meet the dynamic demands of the real estate market.

These apps initially performed simple investment tasks and provided actual trading price information. Since then, as technology has advanced at a rapid pace, the operators of these apps have evolved to meet the needs of consumers by utilizing various IT technologies.

4.5.2. Key Features

Asset Types: Real estate investments can include residential properties (e.g., houses, apartments), commercial properties (e.g., office buildings, retail spaces), industrial properties (e.g., warehouses), and even vacant land.

Income Generation: Rental income from tenants is a primary source of revenue for real estate investors. It provides a steady cash flow when properties are leased.

Appreciation: Real estate values can appreciate over

Table 7: Real estate investment apps

APPs	AS IS	TO BE
KASA	• Korea's first real estate digital beneficiary certificate (DABS) trading platform • Increasing access for individuals to invest in commercial real estate	• Reorganization process after being acquired by Daishin Financial Group • Public offering resumed starting with Daishin Securities account opening
REALBUY	• Big data-based real asset investment platform created by investment experts • Investment advisory business that analyzes and recommends quality investment products	• Provides landmark investment opportunities for individual investors
FUMBLE	• Among the innovative technologies that allow anyone to easily invest in high-quality large assets, the company is carrying out a token security (STO) business that combines blockchain technology and traditional investment and financial systems	• Goal of equal real estate investment opportunities • Sculpture investment in 7 places this year

Source: Author construction

time, potentially leading to capital gains when selling properties.

Leverage: Real estate can be purchased with borrowed money (mortgages), allowing investors to control larger assets with relatively small upfront investments.

Tax Benefits: Real estate investors can benefit from tax advantages such as deductions for mortgage interest, property taxes, and depreciation.

Portfolio Diversification: Real estate investments can be used to diversify an investment portfolio, reducing risk compared to a single asset class.

4.5.3. Challenges and the Way Forward

Market Risk: Real estate markets can be cyclical, and property values can fluctuate due to economic conditions, interest rates, and local factors.

Property Management: Managing rental properties can be time-consuming and may involve dealing with tenant issues, maintenance, and property upkeep.

Liquidity: Real estate investments are not as liquid as stocks or bonds. Selling a property can take time and may involve transaction costs.

Financing Risks: Borrowing to finance real estate carries the risk of mortgage defaults and interest rate fluctuations.

Property Expenses: Property ownership entails various costs, including property taxes, insurance, maintenance, and repairs.

Regulatory Changes: Changes in local, state, or federal regulations can affect property values and rental income.

Tenant Vacancy: Vacant periods between tenants can lead to reduced income and increased costs.

Market Research: Investors must conduct thorough market research to identify locations with growth potential and rental demand.

Property Condition: The condition of a property at purchase and its ongoing maintenance can significantly impact its performance as an investment.

Competitive Market: In desirable real estate markets, there can be intense competition, which may lead to higher purchase prices.

Risk of Over-Leverage: Taking on too much debt to acquire properties can lead to financial stress if rental income does not cover expenses and debt service.

Successful real estate investment requires careful planning, risk assessment, and a clear understanding of both the opportunities and challenges associated with the specific property and market in which an investor operates. Diversification, due diligence, and a long-term investment horizon are often essential strategies for real estate investors.

5. Conclusions

The analysis results of the development plan for the real estate industry in the Technology 5.0 era are as follows.

Real Estate Brokerage Platforms in Korea: These platforms have gained significant traction but face challenges, including regulatory hurdles, competition from traditional brokers, and the need for constant innovation to meet changing consumer demands. They exemplify the evolving nature of the real estate industry, driven by technology and changing consumer behavior. The future promises further advancements as these platforms continue to innovate and reshape the Korean real estate landscape.

Challenges for Commercial District Analysis App: Ensuring Data Accuracy and Reliability: Maintaining accurate and reliable commercial area data is crucial,

minimizing fake information and outdated data. Privacy and Security: Protecting user data and ensuring privacy compliance are essential, adhering to privacy regulations and maintaining data security. Diverse Business Models: Diversifying revenue models, including advertising, subscriptions, and licensing, is necessary for ongoing support and development. AI and ML Enhancements: Improving AI and machine learning capabilities is essential for accurate recommendations and analyses. Building Local Communities: Facilitating interactions between local businesses and users by building and maintaining local communities is important for success.

Real Estate Valuation Platforms: Challenges include regulatory compliance, data privacy, market volatility, technology advancements, user trust, data security, and staying up-to-date with industry changes. Meeting these challenges while providing accurate and reliable valuations is crucial for success in the real estate industry.

Real Estate Management Platforms: Challenges in real estate management encompass tenant issues, maintenance costs, market fluctuations, regulatory changes, tenant satisfaction, financial management, emergency situations, property security, and sustainability compliance. Effective real estate management requires addressing these challenges while maximizing property value and income.

Real Estate Investment Platforms: Challenges in real estate investment include market risk, property management, liquidity, financing risks, property expenses, regulatory changes, tenant vacancy, market research, property condition, competitive markets, and risk of over-leverage. Successful real estate investment requires careful planning, risk assessment, diversification, due diligence, and a long-term investment approach.

Policy implications based on the research results are as follows.

Support for Technology and Innovation: Policies should promote and support technological innovation in the real estate sector. Governments and businesses should encourage the development of real estate technology and digital solutions, and allocate funding to innovative services.

Data Accuracy and Personal Data Protection: Real estate information platforms and apps must maintain data accuracy and prioritize personal data protection. Governments should strengthen regulations to verify data accuracy and protect user privacy.

Development of Diverse Revenue Models: Real estate-related platforms and apps need to develop diverse revenue models. This includes securing revenue streams through advertising, subscriptions, and licensing, and building sustainable business models.

Application of AI and Machine Learning: Policies and research support are needed to apply artificial intelligence and machine learning technologies to enhance real estate valuation and analysis.

Formation of Local Communities: Location-based real estate information platforms should foster interactions between local businesses and users by building and maintaining communities. This contributes to the local economy and enhances user satisfaction.

Real Estate Regulation and Education: Improvements in regulations and policies affecting the real estate market are crucial. Providing relevant education to investors and consumers to increase transparency in the real estate market is essential.

Enhancing Sustainability: Policymakers should promote sustainability in the real estate industry, encouraging compliance with environmental standards and regulations. This includes supporting energy efficiency and eco-friendly building practices and facilitating sustainable real estate investments.

These policy implications aim to support innovation and development in the real estate market, preparing for the future in areas such as real estate platforms, investment, management, and valuation.

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