Just smart?
A Preliminary Study on the correlation of Smart City Infrastructure and Gentrification

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Abstract
This study uses Kaohsiung City as an example to explore whether smart city infrastructure leads to gentrification. Smart cities aim to improve quality of life and competitiveness, but they may attract high-income groups and force low-income residents to relocate. The study categorizes types of smart city infrastructure and employs Hedonic Price Method to analyze the relationship between the benefits of smart infrastructure and gentrification indicators, aiming to understand the impact of smart cities on spatial equity and propose policy recommendations for achieving inclusive and sustainable development.

Keyword: smart city; gentrification; sustainability

Introduction

In recent years, global urbanization has been on the rise, and urban issues are often inextricably linked to economic, social, environmental and governance issues. Smart cities are seen as one of the solutions that can address these issues (Micozzi and Yigitcanlar, 2022). However, as smart city policy advances and develops, there is no international consensus on its definition, which varies according to the target audience and influences policy making, except for the consensus on information and communication technology (ICT) as a core component of the infrastructure (Micozzi and Yigitcanlar, 2022). There is also no international consensus on how to define a smart city and what conditions a smart city should fulfill, but smart cities can be broken down as a combination of human capital, social capital and ICT infrastructure(Chang and Smith, 2023).

While past smart city research has focused less on quality of life and resident-centered issues, issues and challenges are beginning to emerge as smart cities are used as a means of solving all aspects of development. Infrastructure provision should be oriented towards improving the quality of life of the residents and moving towards sustainable development(Chang and Smith, 2023). Smart city infrastructure development emphasizes the need to balance the efficiency of urban infrastructure with the quality of urban life, and to identify priority areas for development, understand smart city needs, and integrate economic, social, environmental, and spatial domains(Grochulska-Salak and Wężyk, 2021).

With urban development, gentrification has begun to occur in a variety of contexts and areas. Gentrification, first used by Ruth Glass in 1964, describes a process of socio-economic change in urban areas caused by multiple factors (Johnson-Schlee, 2024), which is intuitively manifested by the loss of local residents' homes and the rise in real estate prices, with the middle and upper classes replacing the local residents in the community(Johnson-Schlee, 2024). The state of gentrification can be correlated with the amount of investment and infrastructure upgrading (Lees, Slater and Wyly, 2013).

Therefore, the construction of smart city infrastructures changes the local infrastructure pattern, improves the overall efficiency, and increases the local investment. Currently, there are fewer academic and practical studies on whether the upgrading of smart city infrastructures results in local gentrification. In this study, we will select a region as a site to discuss the changes in the various facets of a smart city as a result of the local government's policy and resource inputs.

In recent years, there has been growing discussion about the impact of investments in various smart city facilities on residents' quality of life and well-being. To provide better infrastructure, smart cities are increasingly intervening in data collection and utilization, integrating data into spatial applications. However, the collection of data that is private, widespread, and long-term has posed challenges to the autonomy of individuals and groups, blurring the boundaries between public and private domains, and gradually leading to the emergence of digital gentrification(Gstrein, 2024). In fact, when smart city projects are officially launched, signs of this phenomenon have already begun to emerge. The acceptance of smart infrastructure, from the overall residential area to the

individual level, should be incorporated into smart city governance.

The types of smart city infrastructures will cover four forms, namely technical and road infrastructure, social and service infrastructure, communication and data management infrastructure, and ecosystem infrastructure (Grochulska-Salak and Wężyk, 2021). It can be generalized into hard and soft infrastructure, where hard infrastructure refers to all types of buildings, equipment, space, facilities, etc., and soft infrastructure refers to education, applications, cloud systems, local norms, etc. Because most of the enhancements to the gentrification infrastructure are hard facilities, and that it is difficult to assess the impact of soft facilities on the price of housing and the local community when they are applied to the physical space, the study will focus on the hard infrastructure.

The study will focus on the following issues:

(a) Does smart city infrastructure cause changes in local housing prices?

(b) Is there a gentrification effect of the smart city infrastructure?

Study area

Kaohsiung City is in the southern region of Taiwan, with a large hinterland with an international commercial port and an international airport, is the political, cultural and industrial core of the south, and is one of the six Special Municipality in Taiwan, with 38 administrative districts, and is also the promotion area of the Asia New Bay Area 2.0 Intelligent Technology and Innovation Park.

The urban development policy has brought great changes to Kaohsiung's space and industries. Since the 1960s, Kaohsiung has been a major industrial center for Taiwan's heavy industry and light industry for processing and exporting, with rapid industrial development. 1980s, the major industries gradually dominated the city, shifting to low energy consumption, low pollution, and high value-addedness; in 1990s, Industrial Park and science park were established, and the townships possessed very high industrial intensity, with the industrialization level reaching its peak; it was not until 2000 that the type of industries changed and industries upgraded, with tertiary service industries gradually replacing some of the industrial industries. Since 2000, the industrial type has changed and the industry has upgraded, and the tertiary service industry has gradually replaced part of the industrial industry, and later joined the WTO(WU, 2011); since 2015, the smart city policy has been gradually implemented; in 2020, the Kaohsiung Smart City Promotion Committee was established, which is a team that combines industry, government, and academia, and combines the use of wisdom to drive the sustainable development of the city and the transformation of industries; and in 2021, the national program Asia's New Bay will be launched. Promote the 5GAIoT New Innovation Park Project in Asia's New Bay Area, a national-level project (Information Industry Council, 2021).

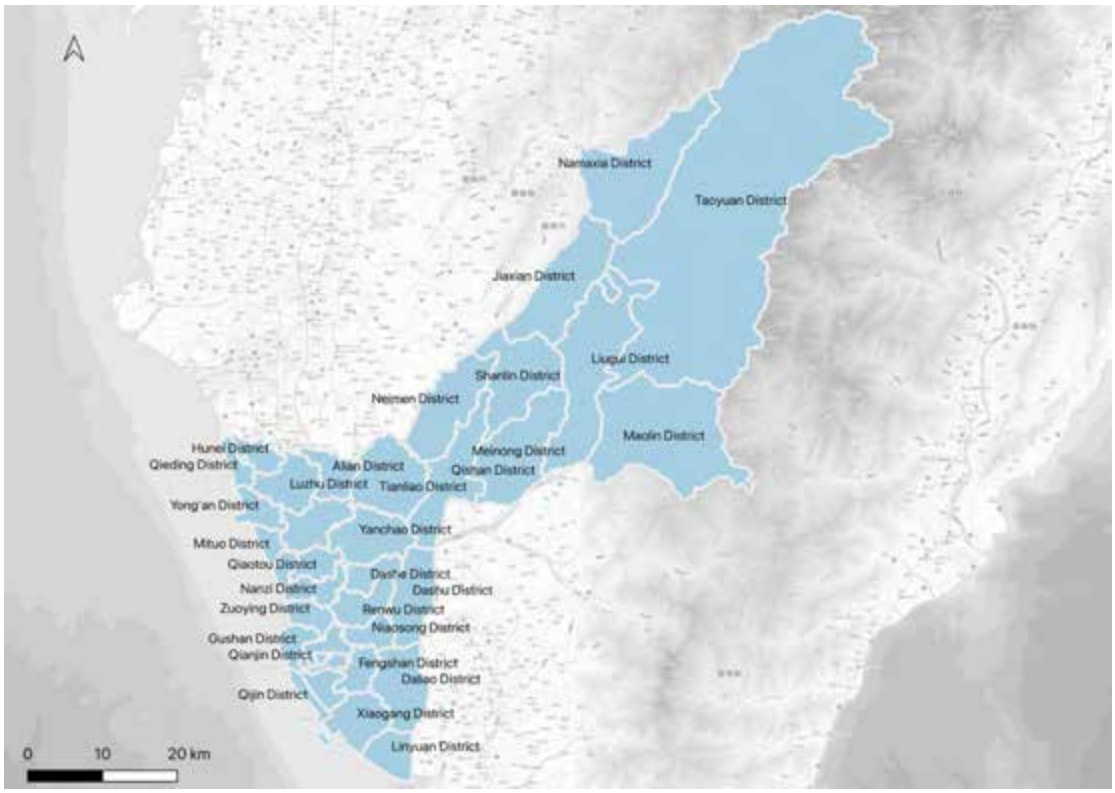

Figure 1 Kaohsiung City

Materials and methods

In this study, the hedonic property value method is used to understand which projects are the main influencing factors. Therefore, it is necessary to first select case areas, collect their smart city infrastructure construction plans or policies, compile infrastructure projects, and then conduct project screening. After eliminating soft infrastructure projects, the remaining hard infrastructure projects will be subject to the next round of screening, and then the facilities that are too small in scale or have a timeliness will be eliminated. Next, the representative year of the case area was selected, and the average price of housing in the area was used as the information of housing price in the area by collecting the price of housing in the area according to the year. After the data collection and processing, the information is analyzed by the hedonic property value method. Figure 2 the filtering process and the analyzing process shows the filtering process and the analyzing process.

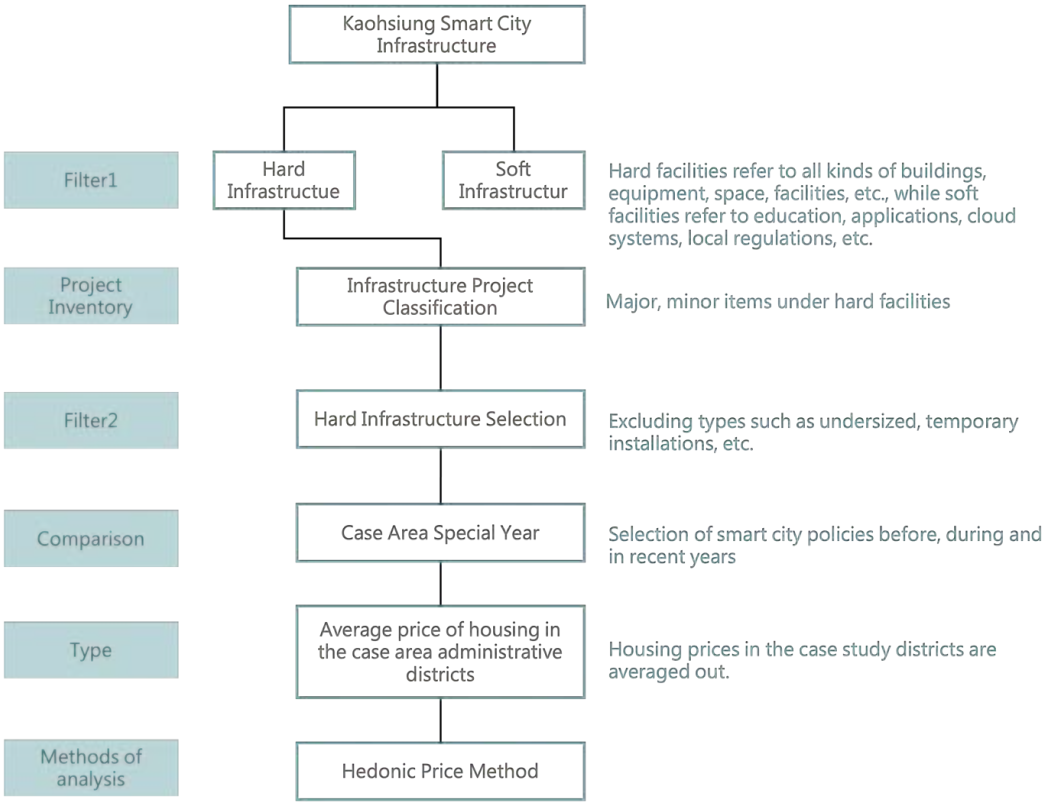

Figure 2 the filtering process and the analyzing process

Since 2015, smart city-related programs have been gradually implemented in Kaohsiung, and the types of smart city infrastructure are categorized according to nine major categories in the Kaohsiung Smart City Promotion Platform Project Achievement Zone: smart Mobility, smart living, smart healthcare, smart governance, smart security, smart tourism, smart education, smart energy, and smart agriculture. After counting the projects that have been implemented and will be implemented soon, the development of smart mobility, smart security, smart healthcare, and smart governance is the main focus, and the preliminary statistics of the main projects include software level and hardware level, and the 2025 Smart City Exhibition promotes the newest policies with healthcare, transportation, and life as the main axes (Kaohsiung Smart City Promotion Platform, 2025).Table 1 Unifying the Kaohsiung Smart City Infrastructure Buildings Table 1Categories, projects, and program listings (Kaohsiung Smart City, 2025).

Table 1 Kaohsiung City Smart City Infrastructure Project Statistics

Category	major projects	Number of Projects	Description of Projects
Smart Mobility	7	21	Kaohsiung Light Rail Transit (LRT), Kaohsiung Transportation Mobility Service Program (MeN-Go), etc.
smart living	10	11	Kaohsiung Net Zero House and Intelligent Building Promotion Program (regional design principles and standards), Smart Public Housing (Smart building system), etc.

smart healthcare	6	7	Physical Medicine Specialized Hospital 5G Intelligent Safe Care System (iSafe, iCure), etc.
smart governance	11	18	Smart Kaohsiung AI Lighthouse Project (city-level sovereign AI platform), 3D pipeline data integration application project, etc.
smart security	12	21	Smart Water Resources Monitoring and Networking Platform, Climate Change Adaptation Promotion Platform (Disaster Alert System, Climate Change Disaster Risk Mapping Platform, Adaptation Enforcement Program Reporting System), etc.
smart tourism	3	3	Kaohsiung Fun Card Intelligent Tour, Seeing Greater Kaohsiung (5G XR Smart Tour System), etc.
smart education	2	2	E-game U generation island learning paradise, Net Zero Academy
smart energy	5	6	Fishery and electricity symbiosis , etc.
smart agriculture	3	3	Kaohsiung Farmer's Newsletter, Kaohsiung Plant Doctor's Help, Livestock Manure and Urine Water Irrigation and Farming Reuse Adopting and selecting from (Kaohsiung Smart City Promotion Platform, 2025)
available at: Kaohsiung Smart City 2025			

STEP1

This study conducts the first classification of smart city infrastructure types in Kaohsiung City, Taiwan, distinguishing infrastructure types into soft and hard infrastructure categories. The selection is based on whether the infrastructure exists in a physical space. Considering the characteristics of hard and soft infrastructure, this study focuses on hard infrastructure to examine its impact on surrounding property prices. Infrastructure types, based on the aforementioned characteristics, can be categorized into hard domains, soft domains, and hybrid domains (Albino and and Dangelico, 2015. "Hard" domains include buildings, energy grids, natural resources, water management, waste management, mobility, and logistics, where ICT can play a decisive role in system functionality. "Soft" domains include education, culture, policy innovation, social inclusion, and government, where ICT applications are typically not decisive (Senatore and Sessa, 2023). Hybrid smart city implementation projects are composed of both soft and hard infrastructure, initially classified as hard infrastructure, with subsequent spatial impact assessments conducted.

After screening, preliminary selections were made based on hardware infrastructure, and projects with little relevance to housing or housing prices were excluded based on actual application scenarios. Smart city infrastructure that does not directly impact housing prices, such as facial recognition at daycare centers, physiological monitors in hospitals, and tunnel detection systems, were excluded. Only hardware infrastructure with housing price impacts were presented. The detailed list is shown in Table 2.

Table 2 Step 1: Kaohsiung Smart City Hard Infrastructure

category	Scope of influence	Facility projects	Description of the facility	Sources:
Smart Transportation	Within 800 meters of each station along the light rail line	Light rail transit system	There are no overhead lines on the whole line, 100% low floor of the carriage, vibration and noise suppression track system	(Yu and Hsu, 2025)

Table 2 Step 1: Kaohsiung Smart City Hard Infrastructure

category	Scope of influence	Facility projects	Description of the facility	Sources:
Smart Transportation	Within 300 meters of a highway ramp	Important intersections around national highway ramps within the jurisdiction of the city	Taking national highway ramps and flat roads as the planned scope, 5G and AI image recognition were introduced, and real-time traffic flow detection modules and road network-based instrumentation and control strategies were established	The Impact of Transportation on the Real Estate Prices in Taipei City
Smart living	There is no clear scope	6-year 1.25GW plan	The roof is equipped with a solar photovoltaic system, a ground row and a water surface photoelectric system	-
Smart living	It is usually a single building	Intelligent building systems	Centralized setting of smart water meters, smart electricity meters and microcomputer gas meters, and centralized information management system	Exploring the Future Real Estate Market and Industry Development Trend from the Planning Concept of Smart City (Lai Zongyu|2018)
Smart living	It is usually a single building	Central monitoring system	Intelligent security and disaster prevention, waterproof and anti-theft systems, intelligent public facilities management, renewable energy equipment and monitoring systems	(Bagheri and Shaykh-Baygloo, 2021)
Smart governance	It is usually a single building	Carbon and water footprint monitoring and analysis of buildings	Smart water meters and smart meters are installed in buildings to collect water consumption and electricity consumption, and timely control the peak and off-peak power consumption and water consumption of buildings	(Bagheri and Shaykh-Baygloo, 2021)

Table 2 Step 1: Kaohsiung Smart City Hard Infrastructure

category	Scope of influence	Facility projects	Description of the facility	Sources:
Smart security	There is no clear scope	Charging disaster prevention mechanism	Promote the construction of a friendly charging environment for electric vehicles, promote a four-fold disaster prevention mechanism, including thermal imaging cameras, intelligent automatic notification systems, low-pressure water mist fire-fighting equipment, as well as special fire blankets and fire-fighting measures for electric vehicles, and a total of 738 charging piles have been set up in 121 public parking lots	-

STEP2

From the literature, understand whether the introduction of smart facilities has improved the performance of existing facilities, enhanced quality of life, and attracted highly educated individuals. Collect data on the types of facilities that have had an impact, focusing on changes in room availability between 2023 and 2024, and concentrate on the administrative districts where these facilities are located. Examine the annual changes in property prices registered in the real estate price registration system for these administrative districts. This study utilizes publicly available data from the Real Estate Transaction Case Actual Information System, focusing on residential buildings and facilities in the surrounding areas. After confirmation, the locations of smart city infrastructure are primarily concentrated in seven administrative districts: Qianjin District, Lingya District, Yantian District, Gushan District, Zuoying District, Sanmin District, and Fengshan District.

Result

This study aims to investigate the impact of smart city infrastructure types on housing prices. Taking Kaohsiung City as a case study area, the study takes an inventory of nine major categories and their projects, namely, smart mobility, smart living, smart healthcare, smart governance, smart security, smart tourism, smart education, smart energy, and smart agriculture, which have been promoted in recent years, in order to further explore the changes in the overall housing prices before, during, and after the promotion of the smart city. It is expected that by identifying the types of infrastructures with significant impacts and describing their spatial status, the results of this study can help to address the issues of spatial inequality and social inclusion in smart city infrastructures, and also serve as a reference for subsequent studies across different spatial scales or long-term changes.

Research Limitations

In terms of gentrification and smart cities, it can be seen that the formation factors of gentrification are quite diversified, and housing prices are only one of the forms of presentation, and there is a lack of discussion and exploration of local population migration in the study, so it may only serve as an illustration of the extent of the impact of smart city infrastructures on local housing prices. Secondly, the types of smart city infrastructures constructed do not have the same spatial scale of impact, and although the concept of smart cities has been around for a number of years, the actual time for improvement and construction has not been long, so it is not easy to see the obvious state of affairs in the short term. In addition, as the infrastructure of smart cities is widely oriented, this study only focuses on the hard infrastructure and does not include the soft infrastructure. Ultimately, because the case study area is an administrative district, different facilities, land types, and other influencing factors in each administrative district are neglected; and the average price of housing also leads to a lack of precision, and the price of housing varies with multiple factors such as the facilities of the lot, the land,

the building, and the quality of life. Therefore, as a preliminary study on the impacts of smart city infrastructure and gentrification, this research attempts to explore the relationship between the two.

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