Describing Changes in the Built Environment of Shrinking Cities: Case Study of Incheon, South Korea

Jae Seung Lee, Ph.D.[1]; Sehyung Won[2]; and Saehoon Kim[3]

Abstract: In the early 2000s, nearly 30% of South Korean cities reportedly shrunk in terms of population, number of enterprises, and property disinvestment. Although many researchers have already documented socioeconomic changes linked with shrinking cities, little is known about how changes in a neighborhood's built environment influence the process of shrinking within a city's local context. Here, a neighborhood called Songhyun-dong in Incheon, which was previously one of the busiest mixed-use retail neighborhoods in Korea, was empirically documented through nontechnical analyses of urban-form data for the years of 1937, 1985, 1995, and 2013. It was discovered that urban planners' institutional response to urban shrinkage, such as development of extensive transport infrastructure and imposition of a rigid gridiron layout, failed to contribute to the recovery of the shrinking neighborhood. The resultant loss of securely-enclosed residential areas and adaptable market-space characteristics has amplified the downward spiral of the shrinking process. **DOI: 10.1061/(ASCE)UP.1943-5444.0000305.**

Introduction

A significant number of South Korean cities are suffering from shrinking population and job losses. According to recent survey by the Ministry of Land, Infrastructure and Transport (MOLIT) and the Korea Urban Renaissance Center (KURC), nearly 30% of the nation's cities across a range of sizes fell into the trap of shrinking between 2000 and 2005 (KURC 2010; MOLIT 2013). Over the past 20 years, small-sized cities like Naju, Taeback, and Samcheok experienced disproportionately great population losses. At the same time, part of metropolitan cities like Busan and Seoul also reported to present strong signs of shrinking (Fig. 1; Kim et al. 2010; Kim 2010a; Lee et al. 2010). Shrinking cities in Korea present a number of negative social indicators, e.g., a greater number of aged population living alone, a greater number of population below poverty level, higher rates of crimes and suicides, a higher percentage of severely deteriorated housing, and greater health risks associated with extreme heat events (Lee and Han 2014; Kim and Ryu 2015).

In response to these problems, the Korean central government established the KURC in 2006 to counteract the widespread shrinking-city phenomenon by devising a template of urban revitalization (Yoon and Lim 2007). The efforts led to the promulgation of the Special Act on Urban Revitalization in December 2013, which defined a shrinking city in the country according to the following three criteria: (1) the current population is less than 80% of that city's greatest population size over the last 30 years; (2) the number of enterprises is less than 95% of its greatest number of enterprises over the last 10 years, and; (3) more than half of a city's total buildings are older than 20 years (MOLIT 2013). Urban planning responses to shrinkage have not been unique to Korea. Nearby East Asian countries like Japan, for instance, saw more than 13% of the nation's total housing stock unoccupied or deserted in the late 2000s, motivating a national subsidization efforts for the repair and reuse of unoccupied buildings. However, too much expectation was placed on the chances of economic recovery through external capital investment, as shown in the continued shrinkage of marginal settlements in Japan (Lim and Lim 2012; Feldhoff 2013). In Hong Kong, about 4% of the city's privately-owned buildings were estimated to be older than 50 years, raising issues of revitalizing deteriorated buildings and historic structures through an innovative public–private partnership (Ho et al. 2012; Cheung and Chan 2014).

Previous studies documented a wide range of causes associated with shrinking cities worldwide (Herbert 1975; Bontje 2004; Ryan 2008; KURC 2010; Pallagst 2010). Among them, the decline of manufacturing-based industries and the resultant negative social impact was referred to as one of the most dominant forces driving the phenomenon (Bluestone and Harrison 1982; Ryan 2012). Similarly, shrinking cities in Korea present a typical downward spiral of socioeconomic indicators, such as (1) decreases in the number of industrial enterprises, (2) increases in property abandonment, (3) continued depopulation, (4) increases in local governments' debt, and (5) poverty spreading across a neighborhood. Yet, Kim (2010a) suggested that unlike the typical decline in many rust-belt cities in the United States and in Europe, the fall of manufacturing industries was not as influential in Korea. According to the research, manufacturing-based municipalities in Korea, such as Ulsan, Pohang, and Gumi, showed sustained growth since the 1970s. Additionally, it is known that shrinking cities do not necessarily occur through abandonment of economically unsuccessful areas. Large-scale property investment in the form of so-called

[1]Assistant Professor, School of Urban and Civil Engineering, Hongik Univ., 94 Wausan-ro, K520, Mapo-gu, Seoul 121-791, Republic of Korea. E-mail: jaeseung74@gmail.com

[2]Ph.D. Student, Dept. of Landscape Architecture with Urban Design concentration, Graduate School of Environmental Studies, Seoul National Univ.; Interdisciplinary Program in Landscape Architecture, 82-410, Graduate School of Environmental Studies, Seoul National Univ., 1 Gwanak-ro, Gwanak-gu, Seoul 151-742, Republic of Korea. E-mail: yan799@snu.ac.kr

[3]Assistant Professor of Urban Studies and Design, Dept. of Landscape Architecture with Urban Design Concentration, Graduate School of Environmental Studies, Seoul National Univ.; Interdisciplinary Program in Landscape Architecture, 82-410, Graduate School of Environmental Studies, Seoul National Univ., 1 Gwanak-ro, Gwanak-gu, Seoul 151-742, Republic of Korea (corresponding author). E-mail: skim5@snu.ac.kr

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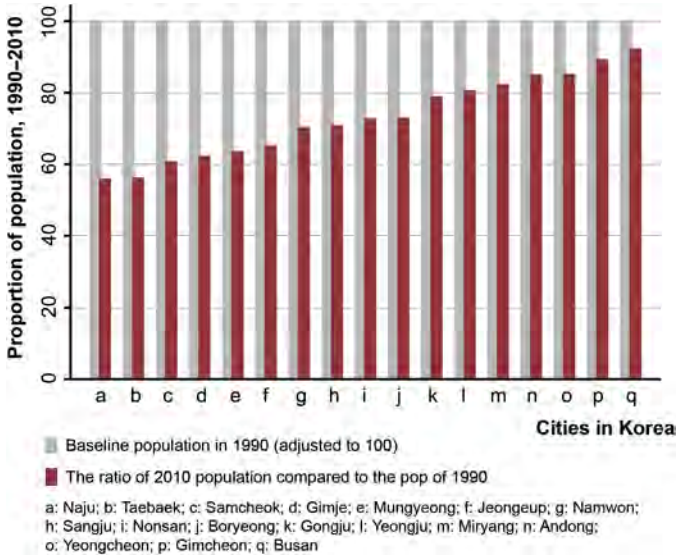

Fig. 1. Population decreases in Korean cities, 1990–2010 (data from Korean Statistical Information Service 2014 and Ministry of Public Administration and Security 2014)

urban renewal and highway construction in an economically-competitive area was widely documented to have destroyed fine-scaled grain of streets and the space of everyday lives (Ryan 2008).

From an urban-design perspective, urban shrinkage presents interesting cases about change in the adaptable capability of a city. Moudon (1986, p. 178), among others, defined adaptability as the resilient capacity of the built environment to accommodate a variety of emerging social and economic requirements over time without major revision of a city's physical space. In a city with decreasing competitiveness, social preference for urban space may change abruptly. The space become marginalized, sometimes become deserted for a long period of time, without rejuvenated demand for new activities. Facing such disruptive urban change, paternalistic urban planners and policy-makers may propose urban revitalization policies that are highly dependent on external investment. This policy often tends towards familiar, previously-tested planning actions: infrastructural improvement and relaxing redevelopment regulations, both of which in the past proved to be successful in attracting would-be property investors. However, the policy prescription may substantially decrease the adaptability of the built environment by disabling the creative reuse of community-owned assets over time—or digging a dipper hole with shovels that might have been effective in the past years but not anymore.

A preliminary literature review suggested that only a small number of studies have investigated changes in the adaptability of the built environment in shrinking cities. This paper attempts to fill in the research gap with evidence gathered from a Korean city. The authors first reviewed the empirical foundations of the formation of shrinking cities in Korea. For the purpose of literature review, the authors collected case studies published by KURC or peer-reviewed articles that documented the actual change in a city's built-environment characteristics. This is not because theoretical explanation is unimportant, but rather because the main concern was to integrate previous findings attainable from observation of urban forms. Given the large number of studies, however, the selected literature may reflect a sampling of the most reliable, representative research findings within the Korean context. Then, an urban district in Songhyun-dong, Incheon was empirically investigated. This research analyzed the long-term urban-form change of the study area and explained the relationship between the potential causes of shrinking and changes in the pattern of streets and blocks.

Literature Review

Empirical studies focusing on Korea's shrinking cities started fairly recently. In the fields of urban planning and design, some of the earlier studies emerged around the 1990s, if not before, and they largely focused on Seoul (Jeon 1996; Lee 1996; Kim 1998). Lee (1996) identified a pattern of asymmetric decline between population size and the number of jobs in various districts of Seoul. After reviewing multiple socioeconomic indicators between 1972 and 1990, a prominent loss of population in areas that did not exhibit similar signs of job loss was found in the study. The result was explained by two forces: overly restrictive regulation of inner-city residential redevelopment and speculative property investment in the periphery of Seoul. The two forces worked in the same direction: housing affordability in an inner-city area diminished while opportunistic movement of upper-middle-income households to larger, newer housing units in the periphery of Seoul was catalyzed due to the expected increase in housing values. Compared to the great mobility of residential demand, the locational change of business districts to new places was far slower, leading to the asymmetric distribution between residential populations and jobs.

However, the explanation does not seem to cover the full spectrum of shrinking cities in Korea. A recent important study by Kim (2010a) found that the loss of jobs, industries, and residential population proceeded concurrently in many cities, including small-sized cities like Jeongeup, Nonsan, and Samcheok, and urban districts located in the metropolitan cities like Seoul, Busan, Daejeon, and Incheon. The study was largely built on the so-called vicious-circle model of shrinking cities. Contrary to the explanation that a few asymmetric forces determined the pattern of shrinkage, the model attempts to explain the formation of a downward spiral of multiple socioeconomic forces, such as (1) structural change in a city's industries, especially agriculture and service-oriented industries; (2) movement of localized jobs to distant provinces away from large cities and into foreign countries like China; (3) state-subsidized development of new housing, transportation infrastructure, and administrative centers outside inner-city areas; and (4) further deterioration of a poorly-planned neighborhood with narrow streets, inaccessible parcels, or overly-dense settlements. Previous studies also illustrated the presence of one or more of the forces influencing the shrinkage of Korean cities (Kang et al. 2000; Yim et al. 2008; KURC 2010; Cha and Park 2010).

Within the framework of the vicious-circle model, further attempts were made to identify a few triggering factors for the initiation of the shrinkage cycle. Some researchers suggested that the relocation of the state's administrative function prompted rapid shrinking across many cities in Korea. A study of pre-relocation and post-relocation Jeonbuk Provincial Government Office in the city of Jeonju, for instance, revealed that there was a decrease in the number of pedestrians by 28.9% and retail sales by 40% near the relocated site (Kwon et al. 2006). Similarly, the relocation of a university campus, city hall, court, medical institution, broadcasting center, or police station—often planned and implemented by the public authority—was associated with the shrinking of many cities, including Daejeon and Gunsan (Kang et al. 2000; Kim 2003; KURC 2010). The shrinkage seemed more prominent in underserviced, physically-deteriorated neighborhoods, as shown in an area clustered with vacant homes in Cheongju or a site with

declining bed-and-breakfast establishments in Wonju (Yim et al. 2008; Kim 2010c; KURC 2011). But the identification of triggering factors requires more scientific investigation because administrative relocation is often compounded with a set of urban decentralization policies involving various purposes.

Although studies that directly linked urban forms with the process of shrinking were few in number, it was argued that abandoned or underused properties in Korean cities were often heterogeneously mixed with high-valued, well-maintained properties (Kwon et al. 2006; Kim et al. 2010). A recent study was conducted estimating the probability of parcel-level redevelopment in Seoul's historic districts. Using the logistic regression model, the research showed that buildings that were relatively newer, larger, and previously converted to a different use were more likely to be redeveloped when other influential factors were controlled for (Kwon et al. 2014). The results indicated that parcels with greater adaptability in catering to new uses and larger space requirements were more susceptible to urban change. On the other hand, parcels with less-adaptable conditions remained obsolete and undervalued for an extended period of time. The previous studies suggested that several triggering factors—ranging from the migration of administrative functions to diminished adaptability of urban forms—may have been influential in urban shrinkage, along with the presence of a vicious cycle of multiple conditions in Korean cities.

Study Area and Research Methods

Rise and Fall of Songhyun-dong, Incheon

Incheon's inner-city area presents a particularly notable pattern of shrinkage. The city is often envisioned as the vibrant gateway to the country, especially after the opening of the Incheon International Airport in 2001 and the establishment of the Songdo International Business District. However, this state-of-the-art property development took place in tandem with the large-scale decline of inner-city areas like Jung-gu and Dong-gu. These two neighborhoods' economies are heavily dependent on service and retail industries. For instance, about 22.8% of Incheon's business service providers and 12.2% of the city's retail traders are agglomerated in these neighborhoods (Incheon Metropolitan City 2013b). However, over the last 20 years, these areas have lost a disproportionately large number of residents, retail businesses, service jobs, and prestigious schools (Fig. 2).

Songhyen-dong, a neighborhood in Dong-gu, was originally located in a low-lying marshland periodically flooded with tidal streams. During the Japanese colonial period, the area's locational premium—such as its proximity to downtown Incheon and to the northern port area—as well as the placement of the nation's first railway line linking the site with Seoul captured the attention of Japanese entrepreneurs like Ikeda Suketada. Under his entrepreneurship, the reclamation of marshland was undertaken in 1925 (Incheon Metropolitan City Museum 2013). By the mid-1930s, the area saw the opening of two major market places: Songhyunli Daily Commodity Market and Baedali Market (Fig. 3).

The original land-owner of the site for Songhyunli Market was a Japanese developer who purchased the reclaimed land from Ikeda. But the developer decided to donate the land to the city of Incheon in return for development benefits in other areas, as the negotiation process for the relocation and compensation of former land occupiers were delayed (Incheon Metropolitan City Museum 2013). The publicly-owned land became occupied by popular bazaar with clothing shops, tailors' workshops, street vendors, and vegetable sellers. The rise of retail activities inspired the relocation

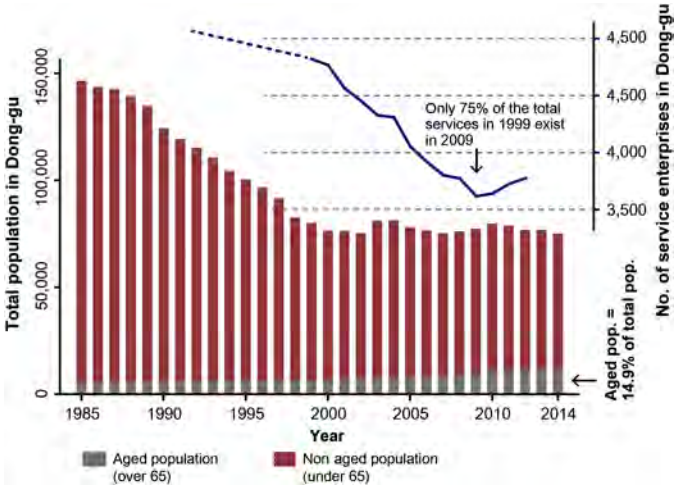

Fig. 2. Changes in total population, aged population over 65, and the number of service enterprises in Dong-gu, 1985–2014 (data from Incheon Statistical Yearbook 2014; Statistical Data of Dong-gu 2015)

of residential populations who built informal wooden houses and makeshift tents. During and after the independence of Korea from Japan (1945) and the Korean War (1950–1953), commercial activities in the area continued to spread out. In 1946, for instance, the merchant association was formalized and a large number of war refugees, young peddlers, and displaced North Korean workers opened their own shops either on the street or in the legal shop houses. First-of-its-kind infrastructure maintenance by the Korean government was conducted in 1953, such as road repair and development of an underground sewerage system (Incheon Metropolitan City Museum 2013). Beginning in 1962, the nation's first five-year economic development plan emphasized the growth of export-oriented industries, including textile and clothing industries, under the military regime of Chung-hee Park. As the neighborhood emerged as one of the busiest retail markets for traditional clothes, school uniforms, underwear, and Western-style shoes, squatters began to settle down in the area permanently. After an initial round of disorganized, ramshackle building activities throughout the 1950s and 1960s, more formalized market structures began to be constructed along the railway line, especially near the Dong-Incheon Station. For instance, eight-block stretch of markets with residential uses in the upper-floor areas were constructed with a reinforced concrete structure by the merchant association. The markets accommodated clothing and marriage-supply retailers and evolved into the formation of Songhyun Jayu Sijang in 1965 and Jungang Sijang in 1972 (Moon 2006; Incheon Metropolitan City Museum 2013).

But the early retailers and service providers began to lose their market share in the 1980s. With the greater inflow of low-priced foreign clothes due to the Import Liberalization Policy (*sooyip jayoowha*) and the emergence of corporate store chains, traditional clothing sellers and textile retailers rapidly lost their competitiveness. With the decline of retail businesses, the fine-grained, highly-diverse street flavor that used to draw shoppers in and out of the city disappeared over the years. The bona fide planning disaster, however, took place when the local government of Incheon decided to intervene in the remaking of the neighborhood. Facing the abrupt disappearance of retailers and shoppers, the city's urban planners instituted top-down planning prescriptions, expecting that greater accessibility and economic development is positively

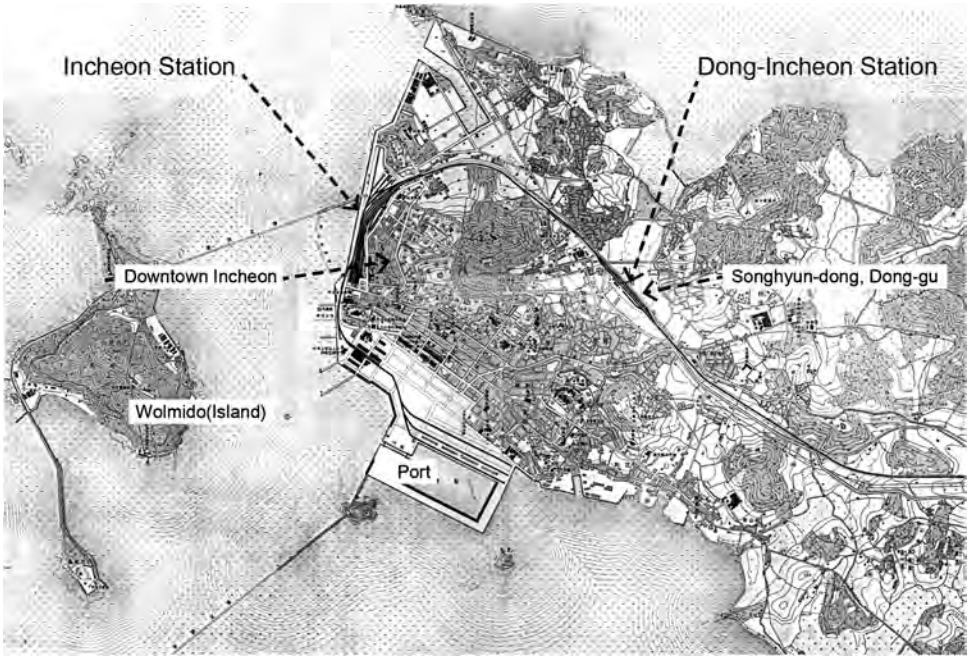

Fig. 3. Map of Incheon in the 1910s (modified from Incheon Metropolitan City 2013a)

associated (Ozbay et al. 2003). A gridiron layout was developed on top of existing urban blocks as an attempt to quickly improve the dense, poorly-built urban environment. Additionally, in the late 1990s, the area was chosen as one of 33 urban renewal sites in Incheon. The local government started to accumulate urban-renewal funds by collecting 10% of city-wide urban planning taxes since 1994 (Hankyoreh Shinmun 1997). Using the funds, the classic formula of urban renewal—demolition, compensation, and privately-driven urban redevelopment—was applied to the district under the auspices of the local government. The expected redevelopment outcome, however, has yet to take place as of today. Neighborhood shrinking has continued and retail businesses have collapsed. More recently, entire marketplaces along the stretch of Jungang Avenue have become abandoned, with some exceptions, and related service shops and entertainment destinations also lost their customers. A cinema building called Aekwonkeukjang, located in the middle of the district, was closed in the 2000s and labeled a "disaster-prone facility" in 2007 due to the possibility of structural collapse.

Research Methods

Here, an approximately 0.5-m^2 area located to the north of the Dong-Incheon station in Songhyen-dong, Incheon was investigated. The area included all of the blocks within a 500-m distance from the station. The boundary is defined by the Songhyun Neighborhood Park, where the first water-supply system in the city was located in 1908, and a highway development site called Sanupdoro. To the north of the study area is Sumuntong-gil, which used to be a waterway connecting the neighborhood to the sea but was covered up in the early 1990s. The study area encompasses 14 linear blocks, including Jungang Sijang and Songhyun Jayu Sijang; about 68% of the area is designated a retail-commercial use and the rest is residential use. The built environment is relatively old and increasingly, though not completely, obsolete with more than 70% of its buildings older than 25 years (Incheon Metropolitan City 2013b). Approximately 45% of its streets are less than 4 m in width, meaning that about half of the streets in the study area are not in accordance with the minimum street standards specified in the Architecture Law of Korea (Figs. 4 and 5).

In order to illustrate change in the built environment, time-series spatial data of buildings, streets, and blocks were created for the years of 1937, 1985, 1995, and 2013. The majority of information employed in this study was collated from historic maps, aerial photos, and a recent GIS database acquired from the Incheon Metropolitan City. Fine-scaled spatial information such as street patterns, buildings, and vegetated open spaces were clearly visible from the acquired aerial photographs (Incheon Metropolitan City 2013a). The 1937 master plan of Incheon's inner-city area drawn by Japanese urban planners was collected from the Kyujanggak Institute for Korean Studies at Seoul National University. The plan showed the locations of basic transportation infrastructure, street sections, built areas, schools, and planned railway lines. Before analysis, all datasets were spatially modified to fit into the acquired GIS data and were georeferenced in *ArcGIS* to the Inchon_Geo coordinate system. To complement any mismatched spatial information, multiple field trips were made to the study area between February and October 2013. Additionally, consultations with local experts at Incheon National University and Inha University were made for the purpose of ground truthing. Using the digitized data, this research analyzed change in multiple urban-form indicators in the study area, such as the percentage of street area (%), the average width of streets (m), the degree of block elongation = (block length along a major road/block depth), and street frontage (m) for each year (Table 1). Additionally, visual representation comparing before-and-after street patterns was made during 1937–1985 and 1985–2013, respectively. Compared to previous studies like Ryan (2008), which focused on comparing street frontage change within a neighborhood over a certain time span, this study diversified the dimensions of the built environment because the inclusive pattern of buildings, parcels, and streets seemed to be strongly associated with the shrinking process of the study area.

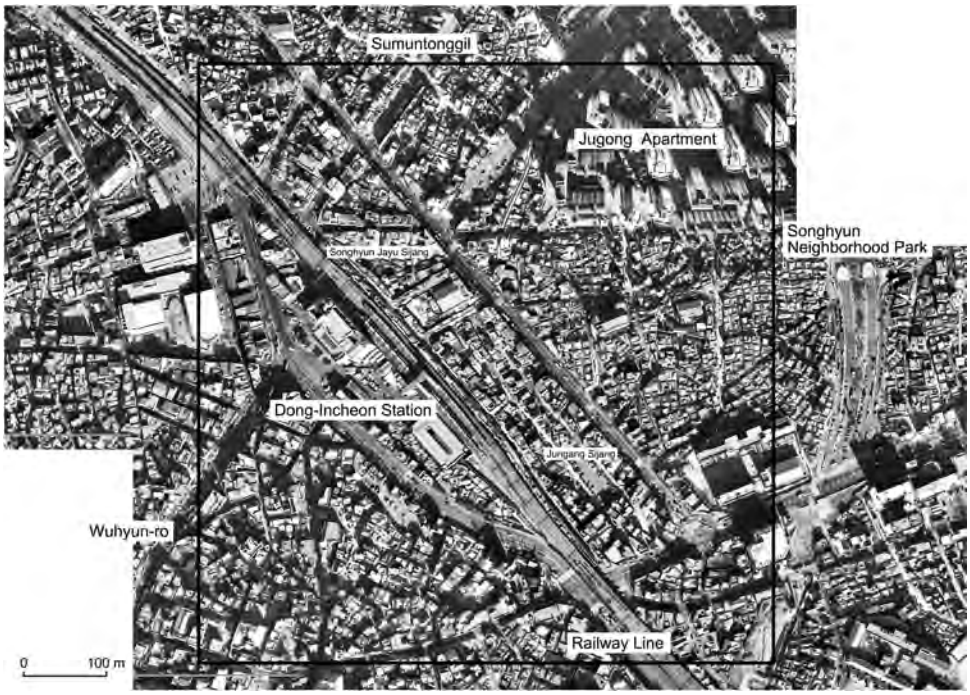

Fig. 4. Aerial photo of the study area (modified from Incheon Metropolitan City 2013a)

Fig. 5. Picture of the study area located to the north of Dong-Incheon station in Songhyun-dong, Incheon (image by authors)

Results: Overly Extensive Gridirons and Underutilized Public Space

Increases in the Street Area from 23.3% in 1985 to 32.2% in 2013

The Songhyun-dong neighborhood became fundamentally restructured with the overlay of a gridiron pattern. The results indicated that the surface area of streets—including walkways, roads, and parking lots in the study area—continued to expand over time. A particularly significant increase took place over the last 30 years (Fig. 6). Between 1937 and 1985, for instance, the percentage of street area changed modestly from about 21 to 23.3%. But the percentage increased dramatically afterwards, to 27.3% in 1995 and to 32.2% in 2013 (Fig. 7). This percentage is overly high, about triple the city of Incheon's average (11.8%) and is even higher than a

Table 1. Measures of Urban Form Change in the Study Area

Measurement	Units	Data sources
Percentage of street area	%	Aerial photographs (1985, 1995, and 2013)
Average width of streets	m	The Japanese master plan (1937)
Degree of block elongation	ratio	Incheon GIS database (2013)
Street frontage of individual parcels	m	Historical maps of Incheon (1910–2000)

similar-sized area of the central business district in Gangnam-gu, Seoul (15.3%). If areas covered by railway lines are included in the calculation, the ratio is at about 45% (Incheon Metropolitan City 2013b).

Street area is typically increased by two ways: widening existing streets and developing new ones. In the study area, the effect of street widening was minor, except for a few streets like Changjeonwae-ro to the south of Dong-Incheon Station. The inconsequential effect of street widening was supported by the fact that the average width of streets changed marginally over the past 30 years, from 3.75 m in 1985 to 3.77 m in 2013. The second factor—new street development through the arrangement of an elongated gridiron layout—served as a dominant force of urban-form change in the area. By 1985, streets like Songlim-ro and Whadojin-ro dramatically transformed the southeastern part of the neighborhood into rectangular-shaped perimeter blocks. By 1995, the gridiron extended to the middle of the neighborhood and transformed the site completely into a patchwork of elongated grids. In the map of 2013, 11 elongated blocks were fully realized by overlapping—but not entirely erasing the remnants of—the existing street pattern (Fig. 8).

The overly-extensive gridiron development was an outcome of the urban planners' institutional decisions and the local government's infrastructure financing. In the study area, most of the buildings constructed before the 1970s were simple masonry or wooden structures built in situ; many parcels were informally subdivided after individual buildings were constructed; streets were often too narrow, and hazard-mitigation facilities like fire hydrants were sparsely distributed. As many clothing retailers kept piles of fabric in public corridors, the area was highly vulnerable to fire hazards,

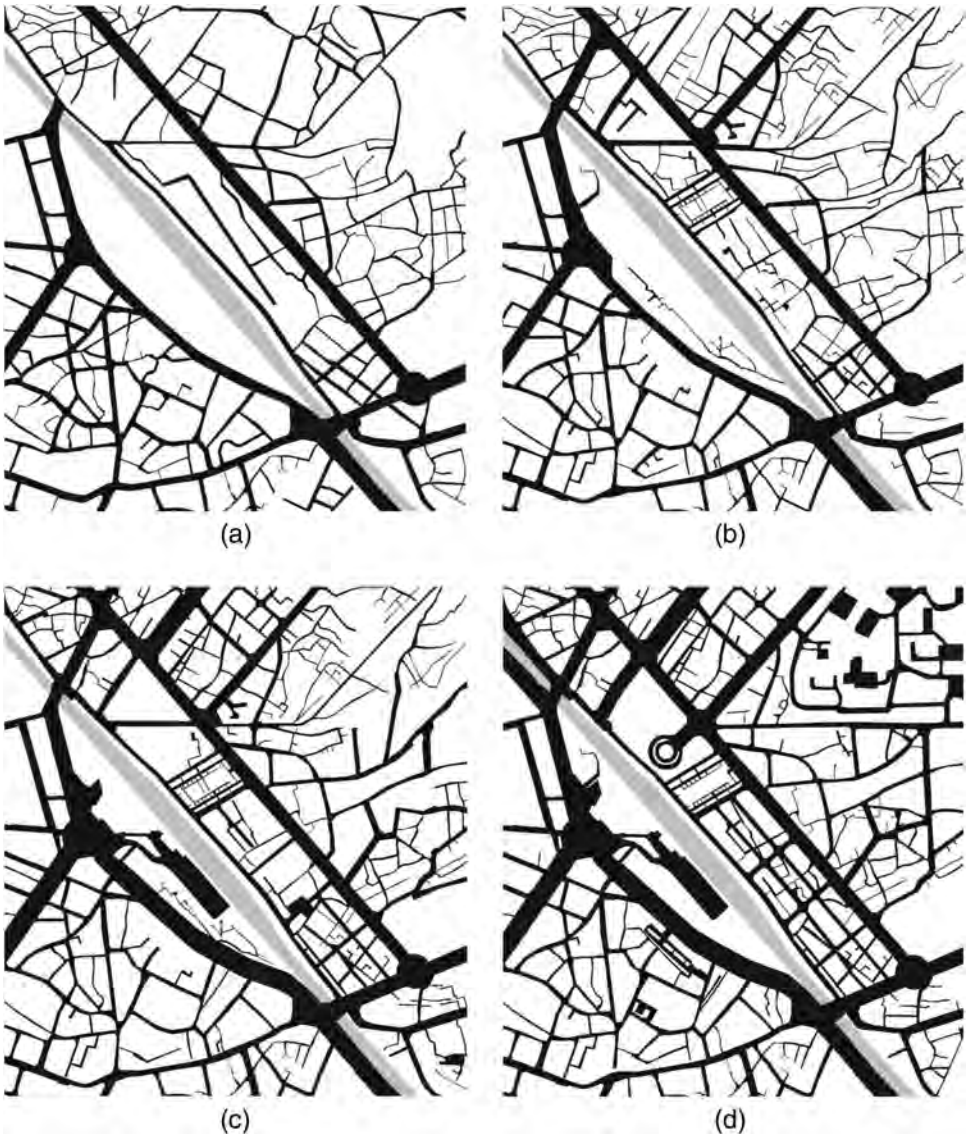

Fig. 6. Change in street pattern by years: (a) 1937; (b) 1985; (c) 1995; (d) 2013

Fig. 7. Comparison of newly-developed streets (in black) between 1985 and 2013 and existing streets (in grey)

as shown in a series of fire outbreaks in 1970, 1971, 1973, 1974, and 1977; in 1970, four retail buildings collapsed during the construction of nearby Jungang Market, leading to the death of seven people and 25 injuries (Incheon Metropolitan City Museum 2013). Provision of new streets and parking lots was one of the most readily applicable actions, projecting a clear before-and-after image made by the planning intervention. After the initial adjustment of streets and sidwalks, the city's urban planners ambitiously espoused master plans incorporating extensive transport networks and wider streets in the 1980s (Kim 2004). The 1984 City Master Plan (dosigibongyehyck) and the 1988 Incheon Transport Planning Master Plan (gyotongjeongbigibongyehyck), for instance, advocated infrastructure development and design regulations for wider streets as important measures for promoting the long-term growth of the area. Over the years, the local government's Urban Planning

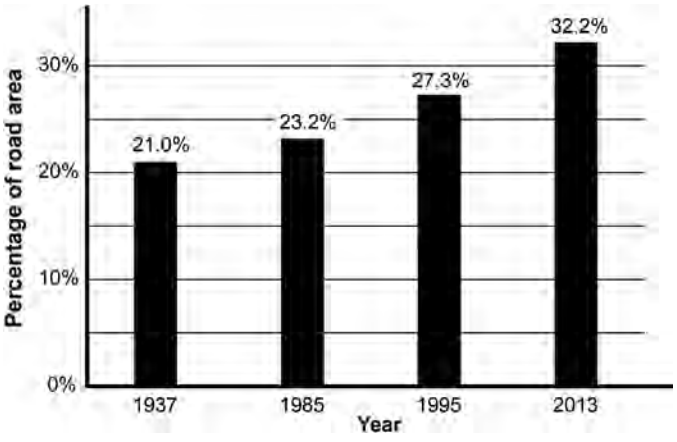

Fig. 8. Increases in the percentage of road area between 1937 and 2013

Department persistently executed a "delayed public investment plan (*mijiphaeng doro*)" by building more streets in the study area (Dong-gu District Office 2004).

Highly Uncertain Benefits of Extensive Gridiron Development

However, the paved-street area in the neighborhood seems to be more than adequate, if not completely inappropriate, to serve its mixed-use community. The gridiron development neither reduced overcrowding of shoppers in bottleneck areas during peak hours, nor significantly improved the live-work environment. Interviews with a group of retail owners selling school uniforms and traditional clothing suggested that a deep frustration was shared among the retailers regarding the manner in which government-driven street development was undertaken without fundamental revival of commercial activities. Indeed, the number of retail and service enterprises in the area including wholesale, retail, hotel, and financial establishments continued to decrease, from 4,822 in 1999 to 3,776 in 2012 (Incheon Metropolitan City 2013b). One of the retailers with 30-year experience was greatly embarrassed about continued government financing for wider streets, while no financial resource was available to him for the rehabilitation of his own properties and investment in product design. According to him, a sizable number of retailers were spending more money for daily commodities like food and drink than their earnings; some had to be financially supported for sustenance by their family members living away from them.

Additionally, the gridiron development little contributed, if not any, to the promotion of livable residential environment in the study area. With the extended gridiron layout penetrating the inner part of the housing quarters, a sense of tranquility and security faded away. Through-traffic was highly encouraged in front of two to three-story multifamily houses, without any traffic mitigation measures or pedestrian-friendly urban design consideration. Although piecemeal housing redevelopment was spurred along the new streets, the lack of low-traffic sidewalks and safely-enclosed open spaces disintegrated public space with the residents' intimate daily lives. This sentiment was reflected in the recent community-driven protest against the city's urban renewal visions and the opening plan for a new 50-m road—called Sanupdoro—linking two new towns developed in the periphery of the inner-city area. Heewhan Lee (Citizen and Alternative Institute 2013), director of the Citizen and Alternative Institution in Incheon, disapproved of the city's urban change over the last 10 years by saying that "... the entire city of Incheon degenerated into a drilling site ... a catastrophe." Street development was frequently coupled with housing renewal projects in Incheon. However, the city's new housing complex accommodated less than 20% of the original dwellers on average, due partly to a profound distrust developed during the clouded process of redevelopment (Citizen and Alternative Institute 2013).

In this sense, the benefits of new street developments in the post-1980 years are seemingly hypothetical. More generally, when the number of parcels abutting a street is very small, then providing more streets with high pedestrian priority may connect a number of parcels with broader walking networks and vibrant social fabrics. For example, in the 1970s, the development of vehicular roads with paved sidewalks might have been important to the growth of mid-sized to large-sized retail businesses in the study area. However, the positive effects of gridiron development quickly declined over the 1980s, especially without fundamental improvement of the neighborhood's spatial permeability and greater social contacts among the visitors and the retailers. The formation of a gridiron layout further isolated the already-confined neighborhood with railway

lines and superblock housing masses because the border of the neighborhood was clearly delineated by wide boulevards that emphasize drivers' comfort at higher speeds. When an entire neighborhood remains rather inaccessible to pedestrians, the development of internally-connected streets alone cannot provide greater convenience to shoppers and merchants. Additionally, the hierarchy of a previously-dominant commercial corridor like Jungang-ro was weakened, as an increasing number of uniformly-designed thoroughfares intersected the corridor. The emptiness of new, wide streets became even more prominent as a large portion of the remaining community became aged (older than 65), which doubled from 3.8% in 1985 to 7.4% in 1997, and quadrupled to 14.6% in 2014. This largely left the streets underused and devoid of the cohesive, walkable environment that used to be enjoyed by toddlers and children in the past.

Diminished Adaptability of Parcel Patterns and Architecture

With the local government's head-long march toward larger streets, the organic street pattern had been substantially transformed since the 1980s. What makes this change rather unique compared to other large-scale urban renewal is its impact on the increases in street frontage. For instance, street frontage surged from 23,150 m in 1985 to 40,933 m in 1995, and again to 44,701 m in 2013 in the study area (Fig. 9). This increase was clearly visible to the east of Dong-Incheon Station, where fine-grained blocks were imposed with an elongated gridiron layout for 336 parcels within the block. But an increase in the street frontage could not establish a desirable geometrical order. For instance, traces of pregrid parcel patterns remained after the imposition of the gridiron pattern, leading to the pervasive presence of dead-end alleys, skewed parcels, triangular-shaped open spaces, and buildings encroaching on newly-created public space (Fig. 10). The indiscriminate increase in street frontage transformed the pattern of access across a number of parcels, generating multiple site-location problems that discouraged the adaptable reuse of underutilized buildings and sidewalks. For instance, many buildings that used to face an alley from a single side came to face streets from two or more sides. Then, the previous alley—often a narrow, organically-shaped linear space that used to define the edge of urban blocks—came to be located inside the newly created perimeter blocks. The alley gradually became obsolete as pedestrians quickly shifted toward the new street and the number of eyes upon the old alley decreased. As the social use of the alley declined, the space often turned into a dead-end with illegal construction where adjacent land-owners privatized parts of the alley.

More recently, a large-sized traffic rotary, called Bukgwangjang, was created to the north of Dong-Incheon Station by merging many privately-owned, small-sized parcels. Eminent domain was carried out to develop the infrastructure, not because social agreement was made about the demand for a new traffic rotary, but because land acquisition, clearance, and rotary development was part of a long-delayed infrastructure reinforcement scheme under the city master plan. However, a tabula rasa approach of replacing diverse social uses with transport infrastructure did not guarantee successful revitalization of the neighborhood. The site for a rotary was originally occupied by affordable dining places, locally-owned cafeterias, and fast-food stands sprinkled along the sidewalks. A menu of choices for eating and drinking and nearby retail shops in Jungang Sijang used to greatly complement with each other. In this sense, planning intervention to make the traffic rotary neglected the enduring significance of the previous urban pattern and its social uses, which survived throughout the long-term transformation of a neighborhood.

Another significant change in the urban form of the study area was the substantial elongation of the parcel forms. On average, the ratio of parcel elongation in the study area increased sharply, from about 1:1.74 in 1985 to 1:2.50 in 2013 (Fig. 11). As shown in the case of Bukgwangjang, the imposition of gridiron was made possible by merging multiple parcels, especially those aligned side-by-side, and turning them into long, narrow parcels. While parcel

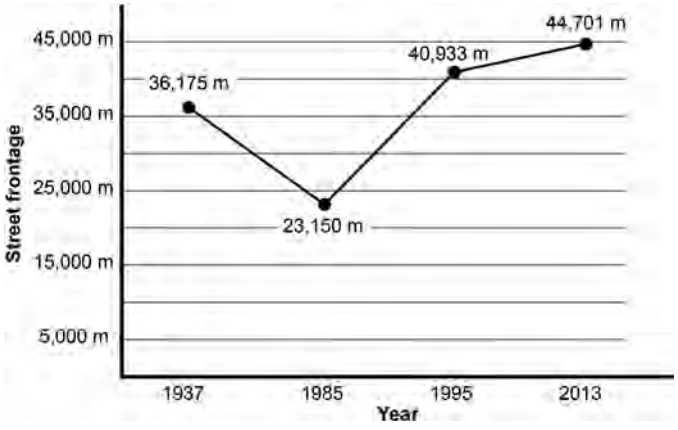

Fig. 9. Change in the length of street frontage between 1937 and 2013

Fig. 10. Dead-end alley with few visitors and a triangular-shaped parcel shaped by road development (image by authors)

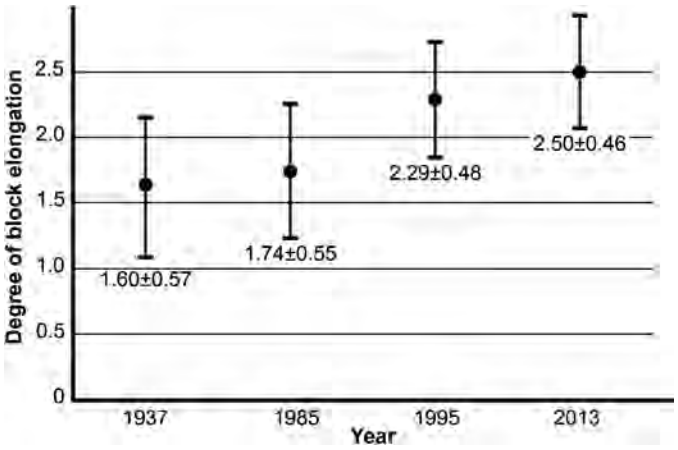

Fig. 11. Change in the average degree of parcel elongation between 1937 and 2013

elongation does not cause a problem per se, some very linear parcels received the kind of similarly linear building structure that was rarely built in the neighborhood, such as four-story horizontal buildings stretching over several gridiron blocks. But without a large number of consumers shopping for clothes and fabric in bulk, the overly-large, linear building floors with sparse vertical stairs were not adaptable to building-use change over time. Since each building module was separated by thick shear walls, even minor physical modification of the building was impossible. Also, vertical movement within the building was only possible through an internal stair sporadically located in the building module. Additionally, this type of building was poorly equipped with water, gas, and heating infrastructure. This in turn made the big-box-like building unable to accommodate new uses, except for temporary uses such as a warehouse, leaving the upper floors of the market totally abandoned for more than 10 years. Since the buildings are located near the mall entrance of the site from the railway station, the underused building structure—often illegally occupied by homeless people—projected a negative image of the overall neighborhood quality. Thus, the shrinking of the neighborhood likely stemmed not only from declining retail industries but also from the rigidity of buildings and parcel forms.

Chains of Shrinking Retails, Overly-Large Gridiron Development, and Decreased Adaptability

The study area presented two narratives of shrinking cities—one typical and the other atypical—within the Korean context. The first narrative is quite well-known: shrinking cities are affected by multi-scaled, interactive socioeconomic changes. With the rise of retail businesses during the 1950s and 1960s, the Songhyun-dong neighborhood attracted a significant number of tailors, workers, shopkeepers, and their families. After the early round of intensive in situ building construction, the local government began to intervene in the physical upgrading of the neighborhood. Meanwhile, the boom-and-bust economic cycle hit the neighborhood hard. With the rapid erosion of retail businesses and outward migration of middle-income households, Songhyun-dong lost both its commercial and residential appeal. This chain of events was associated with the shrinking process in the study area.

The second narrative illustrated in this study is as follows. The previously-thriving retail community of Songhyun-dong faced further declined precisely because the neighborhood was expected—and was physically modified later—to re-emerge as a major retail attraction in the city. An economic slump was perceived to be correctible through the provision of infrastructure by the urban planners, but the planning intervention served to amplify the decay of the neighborhood. The deployment of a gridiron layout and development of transport infrastructure were part of familiar planning prescriptions aimed at revitalizing the neighborhood. However, the expected renaissance of the neighborhood did not follow. To the contrary, the adaptability and cohesive environment of the neighborhood decreased substantially due to the fragmentation of remaining open spaces, deformed parcel patterns, and the development of an overly-large, inadaptable building structure. Again, the local government reverted to old, paternalistic planning responses: further development of a traffic rotary and a large-scale urban renewal plan were part of the urban revitalization package. The active inertia of excessive, government-subsidized infrastructural deployment without greater demand for retail space further depressed potential private investment in the properties. Continued planning intervention likely altered the attitude of shop owners and retailers in the decaying neighborhood. They became increasingly dependent on the external investment associated with revitalization, rather than utilizing their own assets and experiences. This perception was reflected in a recent survey: more than 90% of the communities in the study area wanted government-driven urban renewal, and once the renewal plan starts, they are willing to sell their properties and leave the neighborhood permanently (Incheon Metropolitan City 2013b). More recently, the city finally withdrew the renewal plan and the prevailing form of development has shifted from wholesale redevelopment to piece-by-piece rehabilitation by individual land-owners. However, this new approach is not likely, in the near future, to invigorate a neighborhood that has already lost its cachet.

Conclusions

This study suggested that changes in the built environment of Songhyun-dong are closely associated with its shrinking process. In the face of declining retail businesses, the public authority was reluctant to give up their high expectation of the former retail hub. This perception prompted the urban planners to develop an extensive gridiron layout that far exceeded the actual amount of spatial demand in the neighborhood. The overly-large gridiron and extended street frontage further fragmented the parcels and stifled the incremental adaptation of major retail buildings to new uses. The waste of paved street space, unnecessary through traffic, and the rigidity of building structures also undermined the neighborhood's chances of accommodating a variety of new entrepreneurs.

Some lessons can be drawn from the study. First, urban design and infrastructure planning in a shrinking neighborhood should be carefully customized to the different phases of urban change. It seems that transformative methods of designing the built environment—ranging from gridiron development to promoting a new type of retail market along a major commercial corridor—may lead to varying degrees of revitalization effects according to the phases of shrinkage and the degree of remaining human capital. Although meeting the future demand of consumers and new households with diverse preferences might be a planning goal worth pursuing, right-sizing the menu of choices for revitalization in a shrinking neighborhood could be the first step that public investment is not wasted. Second, maintaining the long-term adaptability of the built environment—including parcel pattern, street edge, and land uses—is highly important. Leaving some room for near-future urban change, such as privately-driven infill development, temporary use of available open spaces, and adaptive reuse of residential

properties for commercial activities, will significantly delay the cycle of obsolescence in an urban area. The characteristics of an adaptable urban environment may serve as a lifeline for the survival of deteriorating communities that might be incrementally replaced by small-scaled social ventures or informal manufacturers/artists.

This study is largely explorative and may suffer from limited scope where analyses are attained from a case in Incheon. Thus, the research outcome may not be generalizable to other cities. More systematic, consistent data collection on the causal chains of public policies, occupants' perceptions, and parcel-level development patterns is required to verify this study. Additionally, this research does not include numerous potentially influential socioeconomic factors affecting the long-term transformation of a neighborhood, such as the ownership structure of retail properties and involvement of private developers. Future research area may examine whether this type of neighborhood can actually be revitalized through careful redesigning of the built environment alongside the involvement of multiple agencies that work with the community members.

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