Enhancing Sustainable Urban Regeneration through Smart Technologies: An Assessment of Local Urban Regeneration Strategic Plans in Korea

Hyun Woo Kim 1, Dakota Aaron McCarty 1 and Jaekyung Lee 2,*

1 Department of Urban Policy & Administration, Incheon National University, Incheon 22012, Korea; kimhw@inu.ac.kr (H.W.K.); dakota.mccarty@inu.ac.kr (D.A.M.)
2 Department of Urban Design and Planning, Hongik University, Seoul 04066, Korea
* Correspondence: jklee1@hongik.ac.kr; Tel.: +82-2-320-1673

Received: 9 July 2020; Accepted: 20 August 2020; Published: 25 August 2020

Abstract: This study develops multiple evaluation indexes in the context of sustainable urban regeneration through introducing smart technologies/infrastructures and assesses 63 local urban regeneration strategic plans by using the content analysis method. A total of 107 indexes are developed based on the four aspects (economy, society and culture, environment, and livability) of sustainability. From our findings, the average plan quality score of 54 local governments’ plans is 17.5 out of 50, with the metropolitan governments’ plans averaging 16.8, which indicates that the plans currently sampled do not sufficiently reflect the basic concepts of sustainable and smart urban regeneration. The contents of most of the plans generally focus on specific sectors, such as society, culture, and housing, whereas smart technology-related information and policies are relatively deficient. Among the five plan components (factual bases, goals/objectives, policies/strategies, implementation, coordination) reviewed, the implementation component receives the highest score, while indicators related to action strategies are mentioned least often. In particular, the results reveal that indexes relating to the energy and transportation sectors are not frequently mentioned; as such, each municipality is recommended to work to increase awareness of smart technologies and policies.

For urban regeneration projects to be sustainable, multi-faceted policies must be implemented by various stakeholders with a long-term perspective. The results of this study can be used as a base for local planners and decision-makers when adopting and supplementing existing regeneration plans, and can contribute to promoting more sustainable urban regeneration through actively adopting various smart technologies initiatives.

Keywords: urban regeneration; content analysis; plan evaluation; sustainability; Korea

1. Introduction

Many cities in Korea (e.g., Najoo, Samchuk, Sangju, Taebac, etc.) as well as in North America and Europe (e.g., Pittsburgh, St. Louis, Manchester, etc.) are currently experiencing urban shrinkage due to population decline, aging, deindustrialization, and industrial changes [1–3]. This necessitates an urban paradigm shift from previous redevelopment and maintenance projects, which focused on quantitative expansions [4]. Unlike the previous paradigm, which primarily pursued physical and economic improvements, the urban regeneration that has emerged as an alternative seeks to revitalize aging city centers by considering the overall aspects of the city, including environment and society. In Korea, after the 2013 enactment of the “Special Act on the Promotion of and Support for Urban Regeneration Act” (“Urban Regeneration Act”), 46 urban regeneration projects were put in motion in the subsequent year. However, since the number of projects was limited and the municipalities...
focused more on establishing plans than on implementing projects, the national government could not demonstrate any visible changes or improved performance in the relatively deprived residential areas [5]. To complement and promote city center revitalization, the current administration has included the Urban Regeneration New Deal (URND) project as one of the top 100 national tasks. The URND ultimately aims at improving residential welfare, restoring urban competitiveness, and creating new jobs by strengthening endogenous capacities through the revitalization of old residential and declining cities, led by each local government [6]. The specific objectives of URND are as follows: (1) Job creation; (2) welfare system enhancement; (3) cultural restoration and regional identity securement; (4) pleasant and safe environmental conservation/management; (5) citizen capacity and participation encouragement [7]. To achieve these goals, the substantial sum of 10 trillion won (about $8.17 billion) in public financial resources has been invested annually by the central government since 2017 and is planned to continue until 2021. As of 2019, 283 new urban renewal projects are in progress or planning stages. However, some have questioned whether cities can be successfully revitalized by abandoning previous redevelopment approaches and adopting the URND measures. Kang and Choi [5] assert that although the URND can be stably implemented according to the current government’s roadmap, a high possibility of failure in public value remains due to gentrification and the overheating of real-estate speculation, which may limit the sustainability of such efforts. Hwang et al. [6] also note that one significant problem with the URND is that residents’ opinions cannot be sufficiently reflected in existing regeneration activation plans due to formal administrative procedures. Several developed countries have achieved successful urban regeneration based on long-term goals and specific policies through the implementation of comprehensive planning [8–10]. Although tremendous resources are being invested in urban renewal, the lack of planning efforts may hinder the sustainable development in the long term.

While there are several urban regeneration projects happening in the aging city centers, there are also a number of new town developments under construction at the outskirts of the cities which are adopting a multitude of modern technologies and infrastructure plans and initiatives. If the urban regeneration projects in the city centers continuously maintain the existing physical, social, and land-use policies and dismiss implementation of smart technologies, the development gaps between city centers and the new towns may be very difficult to close, even many years later. Thus, current regeneration plans and projects need to mirror the movements of the recent fourth industrial revolution to better maintain their effects through the establishment of modern smart urban infrastructure [11]. While the Korean government recently announced 25 projects specifically aimed to develop more smart-oriented urban regeneration by 2022, other urban renewal sites that have been selected for the URND are also highly recommended to actively adopt various smart infrastructure and smart techniques in order to promote citizen quality of life and enhance regional competitiveness. Smart infrastructures operate with various uses of sensor and Internet of Things (IoT) embedded technologies to allow real-time data acquisition, analysis, and communication; thus, they can be applied and adopted into diverse fields of urban planning (e.g., energy, water, streets, and buildings) [12]. Localities therefore need to recognize the importance of smart technologies and facilitate greater linkage policies with their general urban regeneration strategies.

With the perception that a sustainable urban environment can be greater achieved through the integration of smart technologies within the urban regeneration plans, this study assesses local urban regeneration strategic plans, the highest-level regeneration plans in each municipality, to examine the degree to which each of the local plans have sufficiently incorporated the key concepts of sustainable urban regeneration with active adoption of smart technologies. In addition, plan performance scores are compared to identify the strengths and weaknesses in the eight different sectors (e.g., commercial, industry, society, culture, space, energy, transportation, and residence), which are classified within four factors (economy, society, environment and livability) of sustainability to better provide policy suggestions for further plan/policy improvement. Because the central government provides a standardized guideline to each municipality while establishing the urban regeneration strategic
plan, local and municipal governments’ plans were also compared to further explore how different levels of government have addressed urban regeneration on their existing plans.

The study first reviews previous studies, projects, and guidelines to conceptualize the definition of “sustainable urban regeneration with smart technologies”, searches other plan assessment studies related to urban renewal, and examines the process for plan evaluation components. Research methods, including steps for selecting the adequate evaluation indicators, reliability analysis, study area, and data analysis, are then introduced. The assessment results are elaborated, followed by a discussion. Detailed policy suggestions are ultimately made for each of the five plan components (factual bases, goals/objectives, policies/strategies, implementation, and coordination) examined to achieve greater sustainable urban renewal in the conclusion section.

2. Literature Review

2.1. Key Concepts for Sustainable Urban Regeneration through Adapting Smart Technologies

Sustainable development was outlined at the 1992 United Nations Conference on Environmental Development by adopting Agenda 21, which urged the cooperation of governments, businesses, and non-governmental organizations in economic, environmental, and social aspects [13]. The key aim of sustainable development is to ensure that current and future generations can meet their basic needs [14]. This has been the basis for the development of many cities, and diverse smart city/urban regeneration projects are emerging with the goal of achieving urban sustainability.

The concept of “smart city” in Korea, re-established by the Korean Ministry of Land, Infrastructure, and Transport (MOLIT) in 2017, primarily seeks sustainability by solving urban problems, improving urban competitiveness, and enhancing citizens’ quality of life, through the active adoption of interconnected information and communication technologies [15,16]. Unlike the previous ubiquitous city (U-city) concept, which targeted only newly developing areas, the central government began to develop smart cities in existing urban centers. These developments came with the primary goal of understanding the residents’ specific demands regarding various issues over modern techniques and improvements of urban environments.

Previous urban rehabilitation approaches in Korea tended to be conducted by redeveloping or reconstructing entire areas, primarily focusing on revitalizing the economic conditions of the community inhabiting the space; this eventually led to dismantlement of existing social networks and led to a loss of culture, and deemphasized the positive characteristics of the specific regions, which may cause reoccurring urban decline in the long term. Therefore, present urban regeneration projects seek sustainability through the utilization and preservation of existing human and material resources. However, citizens’ demands for urban functions are becoming more diverse and complex due to the rapid development of technology. If urban regeneration continues to focus only on maintaining and repairing existing facilities, key goals surrounding sustainability will be more difficult to achieve [17,18]. To address this issue and promote regional competitiveness, we may introduce and actively adopt smart technologies. This includes not only introducing smart infrastructure but also finding adequate ways to identify and solve local problems through the various existing state-of-the-art technologies [17].

Considering the importance of sustainability and smart development, eight principles that could further aid in sustainable urban regeneration have been outlined, as shown in Figure 1, with reference to the sustainable development goals (SDGs) adopted by the 70th UN General Assembly [19]. In particular, principles are classified according to four aspects (economy, society/culture, environment, and livability) at the local scale and their key goals are as follows: (1) Economic principles focused on fostering economy growth through the creation of high-quality jobs and innovative technology-oriented districts; (2) societal and cultural principles emphasizing the active participation of residents and the establishment of local identity by securing basic infrastructures and encouraging local culture; (3) environmental principles to better adapt to the current threats of climate change and provide eco-friendly resources and renewable energies; and finally (4) livability principles assembled to
create more comfortable living environments by enhancing local mobility and improving residential structures. The 16 detailed goals related with each principle are developed and specified in Figure 1.

Figure 1. Eight principles for achieving sustainable urban regeneration through adoption of smart technologies.

2.2. Plan Evaluations

The strengths and weaknesses of plan documents can be assessed and identified; thus, adaptive planning processes and implementations can occur through high quality plans [20,21]. Plan quality evaluations have been actively adopted in multiple domains of research since the mid-1990s, covering general comprehensive planning/land-use, climate change, hazard mitigation, stormwater management, green infrastructure, affordable housing, and low impact development [20–27]. However, to date, limited studies to our knowledge have evaluated plans pertaining to sustainable smart urban regeneration joined with smart technologies by using the step-wise plan quality assessment method. While several urban regeneration-related studies exist, they tend to focus on identifying locations in need of future urban revitalization or assessing the characteristics and conditions of existing regeneration projects. For instance, Jung [28] identified the most urgent and appropriate areas for urban regeneration in Daegu, Korea, using compounding weighted urban decline indexes developed through literature reviews and expert surveys. Choi [29] explored the relative importance of evaluation items for selecting URND project sites through analytic hierarchy process (AHP) analysis; the urgency and necessity of specific projects, as well as residential welfare, were discovered to be the most crucial factors for choosing urban regeneration sites. By employing the AHP analysis and experts’ brainstorming, Kim [30] found industrial/economic and population/social aspects were highlighted more often than other elements within existing urban regeneration projects. Kang et al. [31] analyzed risk indicators to investigate the degree of risk to climate change in urban regeneration project areas in Busan, Korea and discovered that those sites were more vulnerable to climate change, compared to other aging city centers. Additionally, other studies have evaluated the success and effectiveness of urban regeneration projects by conducting in-depth interviews and employing various performance assessment indicators. Guimaraes [32] surveyed the
business owners in one of the retail-led urban regeneration project target areas in Lisbon to investigate whether the project improved the overall vitality of the commercial district. Hemphill et al. [33] examined three European cities’ urban regeneration practices and policies by utilizing the sustainable development indicators and a point scoring system. They particularly inspected the five component areas (e.g., economy/work, resource use, building/land-use, transport/mobility, and community benefit) with 52 indicators and revealed that the urban regeneration projects had significant adherence to sustainability principles. Rydin et al. [34] qualitatively assessed whether the sustainable development concepts were appropriately incorporated within the master plan of an urban regeneration site in Southwark, London, and highlighted the significance of political processes and local governance. To examine the various possibilities of future cities, Saaty and De Paola [35] used a multi-criteria decision-making method (e.g., AHP) in defining and measuring sustainability in urban areas and provided four different potential future city models.

This study attempted to understand the level of sustainable urban regeneration integrated with smart technologies in each locality by evaluating existing urban regeneration strategic plans, which is an aspect lacking in previous studies. The results can possibly represent a meaningful guideline for urban planners and decision-makers to better acknowledge present conditions, as well as the limitations of urban revitalization strategies, with regard to sustainable and smart development aspects, and thus provide basic data for future plan amendment.

2.3. Plan Assessment Components and Indicators

Prior plan evaluation studies examining the topics of sustainability, urban regeneration, and smart cities were reviewed in order to determine the evaluation indicators for this study. In particular, these indicators were associated with five plan components (factual bases, goals and objectives, policies and strategies, coordination, and implementation), which have been often employed in previous evaluation research [22,25,26,36,37].

First, the factual bases in a plan are the basic data showing the current and future conditions of a community; these are thus crucial in establishing the future development directions, as well as major policies, of a region [22,38]. In this regard, previous urban regeneration studies primarily suggest the distribution of commercial districts, ratio of basic living recipients, and status of regional festivals. Jang [39] derived several indicators based on three aspects (physical, social, and economical) while assessing neighborhood-type urban regeneration projects in Daegu, South Korea. After examining the differences in the importance of urban regeneration performance management indexes, Shin et al. [40] suggest that the numbers of jobs, businesses, merchants, and venture start-ups are key economic aspects, while social perspectives such as population inflow rates, public participation levels and activities, and the composition of citizen councils should be highly considered during regeneration processes. Choi et al. [41] developed urban regeneration indexes by brainstorming prior literature and proposed a number of indicators for population/society (e.g., one-person household, beneficiary of national basic livelihood), industry/economy (e.g., increase/decrease rate of businesses and employees, land price changing rate), and physical/environment (e.g., percentage of deteriorated and vacant housings) elements.

The goals in a plan are important, in that they define a desirable future state for solving problems in the community, and specific policies and action plans can be established under clear goals [36]. Lee et al. [42] and Lee et al. [18] attempt to derive goal-related indexes for achieving sustainable urban regeneration through surveys from various planning experts in related fields in academia as well as citizens living near the regeneration sites. These indexes are hierarchized as parent and child elements with economy, culture, transportation, land-use, and energy efficiency-related goals to be considered primarily, while measures regarding landscape, green space, and low-income resettlement can be relatively less emphasized. In addition, Cho et al. [43] conducted AHP and meta analyses to suggest adequate indicators for determining new urban regeneration sites in Changwon, South Korea, with the consideration of three aspects (physical, social, and economical).
Policies (or action strategies) are established on the basis of factual bases, and they generally provide specific guidelines to realize certain goals and objectives in a plan \[26,44\]. In exploring the importance of policy evaluation indicators for different types of urban regeneration projects, Jin et al. \[45\] highlight economic policy-related items, such as fostering growth of jobs and enhancing the social economy, as well as suggesting measures to prevent gentrification, a subject that is crucial for aging city center revitalization, since they can influence the results of a project. For other types of projects, indicators that may signify process and social welfare levels are deemed appropriate for determining the success of regeneration. Oh et al. \[46\] conducted resident surveys and diverse expert consultations to determine which indicators should be emphasized in pursuing smart urban regeneration in Jeon-ra Province, South Korea. They specifically note that indicators related to smart technologies must focus on responding to social conditions and resident demands and connecting with local resources. In addition, the degree of connection between various individuals’ needs and local resources can be considered for identifying a sustainable circular economy.

Coordination/cooperation indicates the level of linkage between various organizations for the smooth implementation of a plan; cooperation between local and central governments, residents, and universities in a plan is paramount, since urban regeneration requires the active involvement of diverse stakeholders. Plan evaluation studies that have examined multi-regional issues, such as ecosystem management, stormwater management, climate change, and sustainable development, often assess the quality of coordination \[21,25,38,47\]. Finally, we have chosen indicators that may efficiently implement the goals and policies within a plan. Local governments require the ability to incorporate ongoing regulations to help implement specific policies, which could be clearly stated to include certain attributes to efficiently implement an action strategy \[38,48\]. This study identifies implementation elements, such as whether responsible departments, budgets, monitoring, and plan revisions/update are sufficiently introduced in the sampled plans.

3. Research Methods

3.1. Study Area Selection

Study areas were selected through two phases. Among 152 primary local governments in Korea, 80 municipalities have established local urban regeneration strategic plans. First, localities with a population of more than 50,000 in 2018 were selected, to exclude communities with limited contextual features, such as planning, financial, and technical resources; thus, 62 local governments were initially chosen for the sample. Second, a total of 58 plans were collected via requesting online information disclosure and individual contacts. Because four plans were adopted with different structural formats, which prevented evaluating plans with the consistent criteria, 54 plans were finally chosen for the study areas (Figure 2). In addition, nine metropolitan plans were obtained to compare overall quality with relatively small local governments. The average plan adoption year for the 54 local governments was 2018, while the metropolitan governments are more likely to possess relatively older plans with an average adoption year of 2017. The average population among the study areas was about 332,000 and 2,625,000, for the local and metropolitan areas, respectively, with a mean population density of 1577 and 3763 person/m². The total number of urban regeneration projects that have been conducted or that are in progress within local governments is about 92, with 101 in the metropolitan governments. The average percentage of aging buildings was about 16% for both government groups.
3.2. Selection of Plan Evaluation Indicators

The indicators (or indexes) used for plan assessment were developed via four steps using studied sources mainly obtained in Korea. First, over 200 indicators were classified and selected by considering previous studies, projects, and guidelines, based on the eight smart and sustainable urban regeneration principles established in the previous section. Second, pilot evaluations were conducted for five metropolitan areas (Seoul, Incheon, Busan, Daegu, and Jeju) with the indicators created in the first phase. Through this process, indexes judged to be poorly specified or inconsistent with the characteristics of the strategic plan were excluded or integrated into other similar indicators; a total of 181 indexes were established in this stage. Third, an expert survey was conducted with 10 multidisciplinary professionals (urban planning (6), social science (2), and engineering (2)), from academia, institute, and city through online questionnaires sent via Google Forms. The experts were allowed to score each indicator from 1 to 5, with 5 being the highest, depending on the importance and relevance of a specific indicator to sustainable urban regeneration. Each indicator score was then aggregated for the 10 experts. Then, with a maximum admissible score of 50 for each index, 79 indicators scored below 40. Among these indicators, the research team integrated eight items of factual bases and policies/strategies, known to be theoretically important for implementing regeneration projects in various local urban regeneration guidelines, with other items. In addition, 10 indicators for factual bases and policies/strategies that were duplicated have been reorganized for the final assessment to specify key concepts of sustainable urban regeneration. Five indicators were restructured from the factual bases, which were related with the environment and livability factors, while the other five indicators were rearranged from policies/strategies component in terms of society/culture, environment, and livability factors (an asterisk has been included for these indicators in Table 1). Overall, 122 indicators were selected via this process. Finally, we evaluated the reliability of the indexes by examining the percent agreement score of two independent coders. The overall average agreement score was approximately 85%, considered acceptable (>80%) according to Miles et al. [49]. However, since the use of Krippendorff’s alpha has increased in recent plan evaluation studies for testing independent coder reliability, this value was also measured for each indicator [20]. Because alpha values below 0.67 threaten assessment reliability [20], 15 indicators were excluded in the final evaluation; thus, 107 total (factual bases: 39; goals: 16; policies: 41; implementation: 5; coordination: 6) were employed to assess the sampled plans; Table 1 outlines the indicators in detail.
Table 1. Plan Evaluation Indicators for Each Sector.

| Factor | Economy | Industry | Society/Culture | Environment | Livability |
|--------|---------|----------|-----------------|-------------|-----------|
| Sector | Commercial | Industry | Society | Culture | Space | Energy | Transportation | Residence |
|        | Working Age Population, Businesses and Employees, Social Economic Organization, Decrepit Industrial Complexes, High-tech Industrial Employee, Specialized Industry, Public Land | Community Facilities, Educational Facilities, Urban Regeneration Support Center, Aging, Basic Livelihood Security Recipient, Community Consultative Group, Rental Housing, Housing Occupancy, Population Transfer Rate | Culture and Sports Facilities, Cultural Programs and Organizations, Culture Tourism Resources, Local Festival | River, Green Infrastructure Ratio *, Disaster, Natural Disaster, Vulnerability Zone, CCTV Distribution | Eco-friendly, Building, Renewable Energy Generation Ratio, and Supply Supporting Programs * | "Public Transportation *
| Goals and Objectives | Activation through the Creation of Distinctive Commercial | Expansion of Basic living Infrastructure, Activating Resident Capacity and Participation, Maintenance of Sustainable Network | Expanding Cultural Infrastructure, Establishing Regional characteristics through the Utilization of Local Resources | Expanding Urban Green Infrastructure, Enhancement of Urban Resilience | Efficient Use of Energy, Building a Circular Environment of Resources | Building a Convenient Transportation System, Building a Safe Transportation System |
|        | Policies and Strategies | Provision of Community Space, Provision of Smart Elderly Care Services, Implementation Education to Strengthen Resident Capacity, Expanding Acceptance of Projects Proposed by Residents, Support Community Consultation (Union) Groups *, Expansion of the Supply of Public Rental Housing, Operation of Public Rental Shopping District, Establishment of Community Regeneration Corporation (CRC) | Securing Urban Parks and Green Areas, Expansion the Application of LID Techniques, Application of Crime Prevention through Environmental Design (CPTED), Establishing Environmental Monitoring and Pollution Notification Systems *, Designating a Disaster Risk Improvement Project District, Mixed-use | Provisions of Incentives for Green Building Certification, Establishment of Energy Efficiency Circulation System *, Introduction of Renewable Transportation, Introduction of Waste Collection Management Technology | Building a Public Transportation Convenience System *, Providing Big Data-based Transportation Services, Expansion of Bicycle Paths and Related Facilities, Operation of Smart Parking Lot, Creating a Pedestrian -centered Environment, Operation of Smart Pedestrian Safety Service, Operation of Driver Safety Service | Utilizing Space through the Maintenance of Vacant and Deteriorated Buildings, Expanding Residential Environment Improvement Project |
|        | Factual Bases (n = 39) | Creating Jobs, Fostering High-tech and Specialized Industries | Provisioning of Start-Up Venture (start-up) Business Support, Social Economy Organization Support, Provision of Smart Job Training, Enhancing Decrepit Industry, Building Industry -related Database | Provisioning of Business Services, Implementation Education to Strengthen Resident Capacity, Expanding Acceptance of Projects Proposed by Residents, Support Community Consultation (Union) Groups *, Expansion of the Supply of Public Rental Housing, Operation of Public Rental Shopping District, Establishment of Community Regeneration Corporation (CRC) | Creating Various Cultural Facilities and Programs, Fostering Culture and Art-based Industries, Promotion of Smart Historical Culture and Tourism Industries * | "Public Transportation *
|        | (CRC) | | | | | "Bicycle Path, Main Road, Parking Lot, Exclusive Pedestrian Road and Safety Zone *" |
|        | Goals and Objectives (n = 16) | | | | | | | Deteriorated and Unauthorized Buildings *, Vacant and Deserted Housing, Residential Environment Improvement Project District, Housing Type |
|        | Policies and Strategies (n = 41) | | | | | | | | |
| Factor | Economy | Society/Culture | Environment | Livability |
|--------|---------|----------------|-------------|-----------|
| Sector | Commercial | Industry | Society | Culture | Space | Energy | Transportation | Residence |
| References | Park et al., 2003; Park, 2009; Lee et al., 2011; Kim, 2013; Kim et al., 2015; Lee et al., 2015; park et al., 2015 | Gachon University et al., 2016; Busan metropolitan, 2018; Byun, 2018; Cho et al., 2018; Jin et al., 2018; Joo et al., 2018; Won, 2019 | Kim et al., 2008; Lee et al., 2009; Choi et al., 2011; Kim et al., 2011; Cho et al., 2013; Choi et al., 2015; Kim et al., 2015; Kim et al., 2016; Han et al., 2018; Kim et al., 2018; Rhee et al., 2018; LH, 2018; Mo, 2018; Cho, 2019 | Park et al., 2011; Lee et al., 2017; Kim et al., 2017; Shin et al., 2017; Jang, 2018; Jeong, 2018; Moon et al., 2018; Park, 2018; Choi et al., 2019; Heo, 2019; Park et al., 2019 | Seo et al., 2014; Seo, 2014; Ki, 2015; Kim, 2015; Lee, 2015; Lee, 2015; Choi et al., 2017; Mo et al., 2017; The presidential committee on the fourth industrial revolution et al., 2018 |

Table 1. Cont.

3.3. Plan Evaluation Process

The evaluation was conducted with a total of five planning components (factual bases, goals/objectives, policies/strategies, implementation, and coordination), with each component valued at up to 10 points (range: 0–10, with 10 being the highest value) [25,38,50]. Thus, the total potential score of an individual local urban regeneration strategic plan was 50 points [25,26,38]. In particular, every indicator was coded in a 0–2 scale, except in the goals/objectives component which was coded into 0 and 1: With a score of 2, an indicator was mentioned in detail with sufficient information; at 1, an indicator was mentioned without substantial contents; at 0, an indicator was not mentioned. Indicators’ scores were derived differently for each planning component. Factual bases were assessed by averaging both “descriptiveness” (stated within text) and “visuality” (shown as graph/table). For instance, if “descriptiveness” scored 1, and “visuality” received 2, the average score for a specific indicator was 1.5 ((1 + 2)/2). Indicators within the goals/objectives component were measured as 0 or 1 based on the existence of a specific item; this is because goal indicators are more likely to be used with comprehensive terms than are other components’ indicators, which can lead to the distortion of evaluation results. Indicators within the remaining three components were scored on a 0–2 scale, but for the policies/strategies component, an additional condition was gauged during the coding procedure, as follows: 1 point was given if an item was not fully informed and statements were described with vague commitment words (e.g., “encourage”, “recommend”, “may”, “can”, etc.), and 2 points were given when an item was clearly mentioned with firm commitment texts (“require”, “must”, “will”, “necessary”, “have to”, etc.). Equation (1) outlines the detailed calculation process for plan quality scores [51]:

$$\text{Plan Score} = \sum_{k=1}^{5} \left( \frac{10}{2m_k} \sum_{I_i=1}^{m_k} I_i \right),$$

where Plan Score specifies the entire plan quality score of five plan components for a specific plan; $I_i$ refers to the obtained score for the $i$th indicator; $m_k$ indicates to the entire number of indicators for the $k$th plan component. Goals/objectives component, however, was not divided by 2 since the scores were only coded into 0 and 1. Moreover, indicators in each plan component were not weighted.

Indicator performance was scrutinized by examining both breadth and depth scores. The breadth score (BS) indicates the degree of frequency that a specific indicator is mentioned in the plans sampled; it was calculated by counting the total number of plans that mention a specific indicator and dividing this by the universe of plans ($n = 54$). The depth score (DS) refers to the degree of detail for a certain
item, measured by adding all plans’ scores for a particular item; this value was divided by the total number of plans specifying the corresponding item. Both scores range from 0–1.

4. Results and Discussions

4.1. Plan Components

4.1.1. Factual Bases

Appendix A shows the BS and DS for eight sectors, according to the five plan components. First, the BS for factual basis scored from 0–0.98, with an average of 0.49. While the culture, residence, industry, and society sectors, in that order, received the highest scores for BS, the commercial sector received the most points in DS, followed by residence, industry, and culture (Figure 3). Within the culture sector, information related to “cultural tourism resources” was frequently mentioned in most plans sampled, with detailed schedules and proposals. This result reflects recent trends in promoting culture and tourism by each locality in Korea. In the energy sector, which had the lowest BS and DS, the condition “green buildings” was not revealed in all plans, and “renewable energy generation and distribution support programs” received the lowest score among the indicators mentioned in the plans. This indirectly indicates that existing plans are generally focused on the cultural, residential, industrial, and social sectors.

![Figure 3. Breadth score and depth score for factual bases.](image)

The top five highest indicators of BS were “population entry/exit” and “aging” in the society sector, “decrepit and unlicensed buildings” in the residence sector, “number of businesses and employees” in the industry sector, and “cultural tourism resources” in the culture sector. When these indicators were mentioned in a plan, information and status were also found to be fairly specific. On the other hand, indicators such as “rental housings”, “pedestrian roads and safety zones”, and “green buildings” were never identified in the sampled plans. Other than the above three items, the five indicators receiving the lowest BS were “old industrial complexes”, “CCTV status”, “disaster preparedness”, “floating population”, and “renewable energy generation and distribution support programs”. More than half of these indicators belong to the energy sector, which implies that urban regeneration plans, as well as projects in Korea overall, were likely to have weak support in energy-related sections. Among these indicators, however, “floating population (0.88)” and “disaster preparedness (0.69)” received relatively high DS compared to other items, meaning that relevant information was provided in detail when they were mentioned.
4.1.2. Goals/Objectives

BS (scale 0–1) was only derived for this component due to the characteristic of the coding procedure, with an average score of 0.37, ranging from 0–0.89 (Figure 4). While indicators in the culture section generally received high scores, “establishment of regionality through the use of local resources” was most frequently mentioned in the sampled plans. However, two goals related to the energy sector were not often revealed: “Efficient usage of energy” was not mentioned in any plan, and “building a circular environment of resources” was only specified in the City of Cheonju. Similar to the factual bases, this result reflects that the existing urban regeneration strategic plans tend to focus on social and cultural sectors, rather than on energy.

![Figure 4](image)

**Figure 4. Breadth score and depth score for goals/objectives.**

Similarly, the top five indicators for BS all belong to the society and culture sectors: “Establishing regionality through the use of local resources”, “activating resident capacity and participation”, “expanding basic infrastructure”, “maintaining sustainable social network”, and “expanding cultural infrastructure”. The five lowest indicators were likely to appear from the energy and transportation sectors. In the residence sector, “utilization of spaces through the maintenance of vacant/deteriorated buildings” (BS: 0.09) was an index not often stated in the present plans. Moreover, this indicator had a significant BS gap with the “expansion of residential environment improvement project”, which was frequently mentioned in most of the plans (BS: 0.50).

4.1.3. Policies/Strategies

The BS of the policies and strategies ranged between 0–0.93, but the average score was 0.32, which was the lowest in all five plan components. When its order was considered, indicators within the culture sector received the highest scores, followed by commercial, society, residence, and space. While the DS showed similar rankings, the industry sector took third place (see Figure 5), which indicates that when policies related to the industry sector were mentioned in a plan, they tend to be relatively well described with firm statements, even though policies were not frequently stated. Both BS and DS were highest in the culture sector. Specifically, several plans have adopted policies such as “promoting smart historical culture and tourism industry” by introducing a sequence of videos and still images, such as virtual touring services utilizing virtual reality (VR). Strategies that showed high BS were likely to be related with establishing parks, special districts, and cultural facilities, as well as promoting street maintenance projects. However, DS for “providing themes within commercial areas” and “creating a pedestrian-friendly environment” was relatively low, meaning that the degree of detail was not strong when these were mentioned in a plan. While indicators such as “establishing
civic group cooperation”, “creating an environmental monitoring and pollution notification system”, “providing incentives to green building certification”, “providing big data-based transportation service”, and “offering a GIS-based urban information guide” were never mentioned in any of plans in the sample, “smart manpower training”, “industry-related database”, “mixed use district”, “renewable transportation”, “up-to-date waste collection management technology”, and “driver safety service” scored fairly low in BS, with DS distributed around 0.5. This result implies that most existing plans failed to integrate smart technologies when developing their action strategies. In addition, indicators within the energy sector, such as “introduction of renewable transportation” and “establishment of energy self-reliance and linkage system”, were not typically mentioned in sampled plans. Since the policies and strategies are established based on the scrutinized factual bases and clear goals, we can anticipate that poor evaluation scores on energy were influenced by these two plan components.

![Figure 5. Breadth score and depth score for policies/strategies.](image)

**4.1.4. Implementation**

Five items were chosen in this component to explore the degree of implementation for each municipality. BS appeared between 0.26–0.87, with a mean of 0.59. Due to the small difference between median and average scores, overall indicator variation was lower than for other plan components. As shown in Figure 6, “monitoring”, “budget plan”, and “strategy responsible department” were relatively well described, with BS above 0.74. However, the sampled plans occasionally provided an overall “timeline”, as well as “schedule for the update”. DS was revealed to be above 0.53 for all indicators, which implies that specific implementation strategies were distinctively illustrated when mentioned in a plan. For instance, implementation timelines were generally made with clear graphs and tables, which enabled readers to understand readily. In addition, the monitoring schemes and tactics were obviously provided by indicating past, present, and future performances.

**4.1.5. Coordination**

While the average BS for coordination was 0.51 (range: 0.19–0.87), local plans seem to most emphasize cooperation with residents (BS: 0.87), followed by private entrepreneurs (civic groups; BS: 0.57) and local universities (BS: 0.50; See Figure 7). However, the majority of plans did not fully express regeneration approaches to coordinate with the central government (e.g., the Ministry of Land, Infrastructure, and Transportation) or affiliated organizations (e.g., Incheon Metropolitan City Development Corporation and Incheon Transit Corporation). Approximately half of municipalities referred to specific organizations while configuring their plans. DS ranged from 0.50–0.71, indicating that
each indicator was mentioned in some detail when stated in a plan. In particular, plans tend to explicitly describe cooperating with the central government and local universities for establishing urban regeneration policies, compared to the other stakeholders.

Figure 6. Breadth score and depth score for implementation.

Figure 7. Breadth score and depth score for coordination.

4.2. Plan Scores for Municipalities Sampled

The five plan component scores of local and metropolitan governments did not show a large gap, except in “goals and objectives”, and the total plan evaluation score for local governments (17.5) was higher than for metropolitan governments (16.8) (see Figure 8 and Appendix B for more detailed scores). This result was in contrast to our initial hypothesis that metropolitan governments would obtain higher plan quality scores than local governments, since they tend to possess better planning capacities and financial resources. The median score for metropolitan governments (17.4), however, was about 1 point higher than for local governments (16.5). While the lowest plan quality score for local governments was 11.0, which was lower than the metropolitan governments (14.7), the highest plan score was also from local governments (City of Goyang: 25.2). Among nine metropolitan governments, the City of Incheon received the highest score, 19.4.
Score differences between the two government groups in factual bases were not statistically significant after running the two-sample t-test ($p = 0.373$). The gap between the two groups has been reduced, since local governments scored high in cultural, commercial, and transit sectors, while metropolitan governments received high scores in housing and society sectors. For local governments, several indicators related to local festivals were often stated as promoting cultural and tourism activities during the urban regeneration process. On the other hand, metropolitan governments were likely to be sensitive to gentrification issues and frequently highlighted these indicators within the plans. The largest gap between the two government groups was shown in goals and objectives. Both groups have properly mentioned indicators within the cultural sector, but goals related to the expansion of cultural infrastructure were mostly discovered in local governments’ plans. Metropolitan governments, however, had established sufficient goals in the society sector, especially in maintaining sustainable social networks, which had the highest gap with local governments. This may reflect the sensitivity of metropolitan governments on gentrification, which was also speculated in the factual bases. Goals related to energy, transportation, and space were continuously not established in either government groups’ plans.

Although the score differences were not large for the policies/strategies, both groups received the lowest scores in this plan component. Among 41 indicators, land-use policies on facilitating pedestrian-centered and residential environments were relatively well-established. These policies are highly related with the primary purpose of the URND projects, to enhance residents’ sense of place, and localities seem to actively focus on revitalizing previously sluggish urban environments through physical developments. While the goals/objectives in the cultural and commercial sectors were weak for metropolitan governments, some strategies (e.g., “fostering culture and art-based industries” and “providing themes within commercial areas”) were mentioned in all metropolitan plans. In particular, policies involving urban regeneration governance (e.g., “generating networks between commercial and neighboring residential areas”, “supporting residents’ union”, and “establishing community regeneration corporation” ) were frequently revealed within the plans. This can be interpreted as meant to reinforce the social networks in large cities that have been weakened during previous urbanization processes. However, indicators using smart technologies were weakly reflected in the two organizations’ plans. Only limited indicators, such as “operating pedestrian safety services” and “establishing smart parking lots”, were occasionally shown in the plans. Because newly developed towns are pursuing smart cities by adopting various modern technologies, previous aging city centers, where regeneration projects were held, may continuously be neglected if they fail to embrace the latest infrastructure. To reduce potential gaps between these two areas that may arise in the future,
regeneration plans should gradually introduce strategies that could revitalize areas with appropriate levels of smart technologies.

Unlike the internal components of a plan (factual bases, goals/objectives, and policies/strategies), implementation and coordination can be considered as external components [22]. Metropolitan governments received higher scores in these two plan components, which can be explained by the size of the municipalities. With regard to the implementation, metropolitan governments generally received higher indicator scores as compared to local governments, except in the areas of “identification of strategy responsible departments”. While both government groups’ plans have successfully prepared financing resources and monitoring schemes for implementation, roadmaps and plan update-related information were not sufficiently covered, which brought no noteworthy score differences between the two government groups. The primary reason that metropolitan governments did not include contents related to responsible departments can be potentially explained because they usually create separate organizations for urban regeneration; thus, specific tasks undertaken by each department seem to be excluded from the plans. However, local governments, which have comparatively insufficient labor, tend to clearly assign the responsible departments for certain action strategies. Regarding coordination, the gap between indicator scores for the two government groups was less than 0.1. Since metropolitan governments are larger than local governments, they tend to incorporate more affiliated organizations and universities. Therefore, they have identified and listed more concrete cooperation schemes with these entities. Although local governments have limited resources, they need to actively consider ways to cooperate with various stakeholders distributed in the upper level of municipalities.

5. Conclusions

This study has evaluated the quality of local urban regeneration strategic plans in Korea, based on the existence of linkages between smart technologies and sustainable urban regeneration, and provides further policy alternatives to be considered when adopting future regeneration plans. The average plan quality score of 54 local governments’ plans was 17.5 out of 50, which indicates that existing plans are unlikely to reflect the key principles of sustainable urban regeneration with a focus on integrating smart technologies. Analysis of planning performance revealed that indicators in the cultural sector were mentioned most often in three internal planning components (factual bases, goals/objectives, and policies/strategies) among eight sectors with a BS above 0.7. However, the DS was lower than for the commercial sector in factual bases and similar to the social sector in goals/objectives, which indicates that cultural contents were not adequately addressed in each plan. As discussed above, the energy sector received the lowest BS and DS, which signifies that much effort is needed to provide basic information and policies with regard to energy self-reliance and linkage systems.

Comparing average plan component scores for two government groups revealed that local governments tend to build robust factual bases and goals in the cultural sector, while metropolitan governments receive comparatively high scores in the social sector. This finding reveals that the tendency of urban regeneration in local governments focuses on revitalizing cultural assets, while metropolitan governments focus on mitigating gentrification issues that may arise during the urban regeneration processes. However, it may also indicate that local municipalities greater emphasize cultural goals because they have comparatively less cultural activities overall than metropolitan government groups; thus, metropolitan governments scored less points related to the cultural elements, but have acute social problems derived from agglomeration and densification. Although characteristics within the policies/strategies component were not significantly highlighted due to their scarce presence in the sampled plans, local governments have well-established land-use strategies regarding the transportation and housing sectors, while the degree of frequency for governance-related elements within the social and cultural sectors was high for metropolitan governments. This result signifies that relatively smaller local governments consistently focus on renewing the overall urban environment, while metropolitan governments seek the reinforcement of social networks weakened during past physical-oriented developments.
Evaluation results generally revealed that the existing plans were primarily devoted to specific sectors, such as society, culture, or housing. In addition, the plan contents and policies may not fully and adequately incorporate smart technologies and services. The concentration of content in specific sectors can be effective in dealing with the effects of urban regeneration in the short term, but it will ultimately limit the development of various policies for achieving sustainable development. Thus, a variety of stakeholders should be involved during the plan making process, with long-term attention evenly given to all eight sectors. Although indicators used in this research were mainly concentrated on infrastructure and technologies, greater educational initiatives centered around smart technologies should be provided to various entities within local municipalities. In addition, planners ought to understand the necessity of smart technology-based infrastructure in aging city centers and provide multiple communication platforms so that residents may readily express their opinions to facilitate greater public led initiatives. Additionally, by more smoothly establishing the overall administration system there can be an eventual minimization of the potential gaps that may rise between new smart cities that are under development in the outskirts of existing urban areas and the older urban centers. Furthermore, as 61% (39 out of 63) of urban regeneration strategic plans have been developed with external consultants while their scores were relatively low, local planners should reduce their reliance on private consultants and engage more citizen inputs during the amendment process to reflect the inherent characteristics of a specific region. Because the majority of local plans received high breadth and depth scores in monitoring developed policies and strategies, municipalities need to effectively use this information and understand communities’ conditions to determine suitable locations for the implementation of smart infrastructure and choose proper technology types for specific areas rather than simply adopting state-of-the-art technologies. This study, however, evaluated only the local urban regeneration strategic plans. Although these plans have the highest hierarchy among other urban regeneration related plans and contain long-range redevelopment directions for the communities, they may not fully integrate specific policies or strategies related to the concepts of sustainable urban regeneration. This is because many of these plans are working alongside other plans, such as comprehensive plans, national territorial plans, and master plans for urban/residential environment rearrangement, which all may cover certain issues related to sustainable urban regeneration. Therefore, decision-makers should cautiously interpret the results of this study and provide policy alternatives after assessing other related plans which will impact their own plans. Because each municipality has their own geographical, cultural, and historical attributes, different evaluation standards should be further developed and applied based on these attributes of the community’s plan being evaluated.

Although the results of this study can be used as insightful base data and guidelines for local planners’ decision-making processes in achieving sustainable urban regeneration by integrating smart technologies, several points should be further considered for future studies examining similar issues. First, this study employed only five plan components when assessing the quality of urban regeneration strategic plans. While these components appeared frequently in previous plan evaluation studies [25,26,51], future studies should consider additional components representing plan quality, such as government support, citizen participation, and monitoring. In addition, indicators for assessing the degrees of coordination and implementation need to be advanced by incorporating more detailed measurements and indices. Second, it is highly recommended that future research should analyze whether all the indicators, factors, and sectors have the same weight in the final plan score. Third, the evaluation indicators developed for internal plan components were predominantly derived from previous domestic urban regeneration studies and cases. Although the target area of this study was limited to 63 municipalities in Korea, other countries’ successful urban revitalization cases as well as political processes and local governance contexts should be further considered for developing indexes of diverse sustainability aspects (e.g., social equity of public health, local identity, feelings of belonging), which would better measure the overall quality of a plan as well as the characteristics of different degrees of urban sustainability. Fourth, we conducted expert surveys while selecting the evaluation indicators to create and enhance the reliability of the measurements.
Further study, however, is suggested to include greater numbers of planning experts and residents’ opinions while developing assessment indexes in order to select indicators that could exemplify the key concepts of sustainable urban regeneration. Along with the survey, principal component analysis can be additionally conducted to reduce the set of key indicators for each plan component. Moreover, initial indicators are recommended to be verified by diverse entities to be fully inclusive of the various features of urban regeneration. Fifth, even though this study included the characteristics of 63 local and metropolitan governments’ urban regeneration strategic plans, we still face limitations in generalizing the findings to other regions. With the refined evaluation method, sufficient input of human and material resources will be needed in the future studies to collect and evaluate more plans, which are in progress or readily available from local governments, and possibly include more comprehensive and practical features of Korean urban regeneration strategic plans and thus provide additional policy strategies for accomplishing smarter and sustainable urban regeneration that could not be fully proposed in this study. Urban regeneration activation plan, which is established for every individual URND project, needs to be further assessed to determine whether broad goals and objectives created in the strategic plan are thoroughly followed and implemented in practice. Finally, the plan quality scores obtained from this study can be used for further study. By using statistical analyses, we highly recommend the future study to examine the degree to which factors impact the overall plan score and identify statistical differences between local and metropolitan governments’ plans.

Author Contributions: H.W.K. conceptualized and designed the study, performed analysis, wrote the manuscript, and supervised the project. D.A.M. reviewed previous studies and contributed on writing/editing the manuscript. J.L. collected the data, conducted analysis, and reviewed the overall manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This study was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (grant number: NRF-2019S1A5A803354).

Acknowledgments: The authors would like to thank two students (Jin Hee Lee and Kichan Kim) from Incheon National University, who heavily participated on assessing local urban regeneration strategic plans. Moreover, we appreciate the anonymous reviewers for their constructive comments.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Breadth and depth scores for each plan evaluation indicator.

| Sector      | Factual Basis (n = 39)             | Breadth | Depth |
|-------------|-----------------------------------|---------|-------|
| Commercial  | Existing (Declining) Commercial Distribution | 0.44    | 0.79  |
| (n = 3)     | Traditional Markets               | 0.7     | 0.81  |
|             | Floating Population               | 0.07    | 0.88  |
| Industry    | Working Age Population            | 0.87    | 0.9   |
| (n = 7)     | Businesses and Employees          | 0.98    | 0.92  |
|             | Social Economic Organization      | 0.72    | 0.74  |
|             | Decrepit Industrial Complexes     | 0.06    | 0.5   |
|             | High-tech Industrial Employee     | 0.7     | 0.84  |
|             | Specialized Industry              | 0.33    | 0.63  |
|             | Public Land                       | 0.26    | 0.8   |
| Sector       | Factual Basis (n = 39) | Breadth | Depth |
|--------------|------------------------|---------|-------|
| Society      |                        |         |       |
| (n = 9)      |                        |         |       |
| Educational Facilities | 0.87       | 0.7     |       |
| Basic Livelihood Security Recipient | 0.57       | 0.9     |       |
| Aging Rate | 0.98                  | 0.93    |       |
| Urban Regeneration Support Center | 0.44       | 0.58    |       |
| Community Consultative Group | 0.56       | 0.68    |       |
| Community Facilities | 0.52       | 0.7     |       |
| Rental Housing | 0          | 0       |       |
| Housing Occupancy | 0.13       | 0.75    |       |
| Population Transfer Rate | 0.96       | 0.97    |       |
| Culture      |                        |         |       |
| (n = 4)      |                        |         |       |
| Culture and Sports Facilities | 0.81    | 0.76    |       |
| Cultural Programs and Organizations | 0.24       | 0.62    |       |
| Culture Tourism Resources | 0.98       | 0.86    |       |
| Local Festival | 0.83         | 0.69    |       |
| Space        |                        |         |       |
| (n = 5)      |                        |         |       |
| River        | 0.44                  | 0.67    |       |
| Green Infrastructure | 0.85       | 0.73    |       |
| Disaster     | 0.07                  | 0.69    |       |
| Natural Disaster Vulnerability Zone | 0.24       | 0.77    |       |
| CCTV Distribution | 0.06       | 0.67    |       |
| Energy       |                        |         |       |
| (n = 2)      |                        |         |       |
| Renewable Energy Generation Rate and Supply Support | 0.04       | 0.38    |       |
| Transportation|                        |         |       |
| (n = 5)      |                        |         |       |
| Public Transportation | 0.39       | 0.61    |       |
| Bicycle Path | 0.13                  | 0.68    |       |
| Main Road    | 0.76                  | 0.65    |       |
| Parking Lot | 0.7                   | 0.64    |       |
| Exclusive Pedestrian Road and Safety Zone | 0         | 0       |       |
| Residence    |                        |         |       |
| (n = 4)      |                        |         |       |
| Deteriorated and Unauthorized Buildings | 0.96       | 0.97    |       |
| Vacant and Deserted Housing | 0.26       | 0.84    |       |
| Residential Environment Improvement Project District | 0.44       | 0.73    |       |
| Housing Type | 0.7                   | 0.57    |       |
| Sector       | Goals & Objectives (n = 16) | Breadth |
| Commercial   | Activation through the Creation of Distinctive Commercial | 0.44 |
| (n = 1)      |                        |         |       |
| Industry     | Creating a Job        | 0.37    |       |
| (n = 2)      | Fostering high-tech and Specialized Industries | 0.39 |
| Society      | Expansion of Basic Living Infrastructure | 0.65 |
| (n = 3)      | Activating Resident Capacity and Participation | 0.85 |
|               | Maintenance a Sustainable Network | 0.56 |
| Culture      | Expanding Cultural Infrastructure | 0.54 |
| (n = 2)      | Establishing Regional Characteristics through the Utilization of Local Resources | 0.89 |
| Space        | Expanding Urban Green Infrastructure | 0.24 |
| (n = 2)      | Enhancement Urban Resilience | 0.17 |
| Energy       | Efficient Use of Energy | 0       |
| (n = 2)      | Building a Circular Environment of Resources | 0.02 |
| Transportation| Building a Convenient Transportation System | 0.13 |
| (n = 2)      | Building a Safe Transportation System | 0.11 |
| Residence    | Utilizing Space through the Maintenance of Vacant and Deteriorated Buildings | 0.09 |
| (n = 2)      | Expanding Residential Environment Improvement Project | 0.5 |
|               |                        |         |       |
Table A1. Cont.

| Sector | Policies & Strategies (n = 41) | Breadth | Depth |
|--------|--------------------------------|---------|-------|
| Commercial | Providing Themes within Commercial | 0.85 | 0.68 |
| (n = 2) | Network Formation between Merchants and Neighboring Residents | 0.07 | 0.5 |
| Industry | Venture(start-up) Business Support | 0.56 | 0.65 |
| (n = 5) | Social Economy Organization Support | 0.43 | 0.63 |
| | Provision of Smart Manpower Training | 0.02 | 0.5 |
| | Enhancing Decrepit Industry | 0.3 | 0.53 |
| | Building Industry-related Database | 0.02 | 0.5 |
| Society | Provision of Community Space | 0.8 | 0.72 |
| (n = 8) | Provision of Smart Elderly Care Services | 0.04 | 0.5 |
| | Implementation Education to Strengthen Resident Capacity | 0.81 | 0.7 |
| | Expanding Acceptance of Projects Proposed by Residents | 0.19 | 0.5 |
| | Support Community Consultation Group | 0.43 | 0.7 |
| | Expansion of the Supply of Public Rental Housing | 0.35 | 0.58 |
| | Operation of Public Rental Shopping District | 0.19 | 0.6 |
| | Establishment of Community Regeneration Corporation (CRC) | 0 | 0 |
| Culture | Creating Various Cultural Facilities and Programs | 0.87 | 0.78 |
| (n = 3) | Fostering Culture and Art-based Industries | 0.61 | 0.74 |
| | Promotion of Smart Historical Culture and Tourism Industry | 0.93 | 0.78 |
| Space | Securing Urban Parks and Green Areas | 0.91 | 0.77 |
| (n = 6) | Expansion the Application of LID Techniques | 0.11 | 0.67 |
| | Application of Crime Prevention Design (CPTED) | 0.74 | 0.68 |
| | Establishing an Environmental Monitoring and Pollution Notification System | 0 | 0 |
| | Designating a Disaster Risk Improvement Project District | 0 | 0 |
| | Mixed-use | 0.02 | 0.5 |
| Energy | Provision of Incentives for Green Building Certification | 0 | 0 |
| (n = 4) | Establishment of Energy Self-reliance and Linkage System | 0.22 | 0.5 |
| | Introduction of Renewable Transportation | 0.02 | 0.5 |
| | Introduction of Waste Collection Management Technology | 0.02 | 0.5 |
| Transportation | Building a Public Transportation Convenience System | 0.28 | 0.67 |
| (n = 7) | Providing Big Data-based Transportation Services | 0 | 0 |
| | Expansion of Bicycle Paths and Related Facilities | 0.26 | 0.54 |
| | Operation of Smart Parking Lot | 0.07 | 0.5 |
| | Creating a Pedestrian-centered Environment | 0.85 | 0.68 |
| | Operation of Pedestrian Safety Service | 0.04 | 0.5 |
| | Operation of Driver Safety Service | 0.02 | 0.5 |
| Residence | Support for Remodeling of Deteriorated Housing and Empty Housing | 0.69 | 0.7 |
| (n = 6) | Building Public Facilities through Purchase Building | 0.46 | 0.62 |
| | Activation Construction Agreement | 0.02 | 0.5 |
| | Supply of Various Housing | 0.06 | 0.5 |
| | Implementation of Residential Environment Improvement Project | 0.8 | 0.76 |
| | Geographic Information System (GIS) Based Urban Information Guide | 0 | 0 |
Table A1. Cont.

|                          | Implementation (n = 5) |       | Coordination (n = 6) |       |
|--------------------------|------------------------|-------|----------------------|-------|
|                          | Breadth | Depth | Breadth | Depth |
| Implementation Timeline  | 0.26    | 0.64  |          |       |
| Strategy Department      | 0.74    | 0.8   |          |       |
| Budget Plan              | 0.8     | 0.72  |          |       |
| Monitoring Plan          | 0.87    | 0.94  |          |       |
| Update Plan              | 0.3     | 0.53  |          |       |
| Organization Reference in Plan Configuration | 0.48 | 0.62 |          |       |
| Local Government-Central Government and Public Enterprise Cooperation | 0.44 | 0.71 |          |       |
| Local Government-Affiliated Organization Cooperation | 0.19 | 0.5  |          |       |
| Local Government-Resident Cooperation | 0.87 | 0.6  |          |       |
| Local government-University Cooperation | 0.5 | 0.69 |          |       |
| Local Government-Company (Civic Group) Cooperation | 0.57 | 0.58 |          |       |

Appendix B

Figure A1. Total plan quality scores for 54 local governments and 9 metropolitan governments.
Appendix B

Figure A1. Total plan quality scores for 54 local governments and 9 metropolitan governments.

Figure A1. 3-dimensional (a) and 2-dimensional (b) space of the pressure measurements.

References

1. Hollander, J.B.; Pallagst, K.; Schwarz, T.; Popper, F.J. Planning shrinking cities. Prog. Plan. 2009, 72, 223–232.
2. Koo, H.S.; Kim, T.H.; Lee, S.W. The problem of the “reduced city” in the age of demographic cliff: Overcome with city diet. KRIHS Policy Br. 2017, 616, 1–9.
3. Wolff, M.; Wiechmann, T. Urban growth and decline: Europe’s shrinking cities in a comparative perspective 1990–2010. Eur. Urban Reg. Stud. 2018, 25, 122–139. [CrossRef]
4. You, A.; Yoo, H. A study of the policy improvement for the housing area as the urban regeneration of new deal project. J. Archit. Inst. Korea Plan. Des. 2018, 34, 55–64.
5. Kang, H.; Choi, J. A critical study on the urban regeneration new deal project from the public values perspectives. J. Policy Dev. 2018, 18, 239–271.
6. Hwang, Y.; Kim, S.; Kim, K. A study on the problems and improvements of Incheon city’s urban renewal new deal. IDI Urban Res. 2019, 16, 185–208.
7. Lee, H.; Lim, S. An analytic hierarchy process (AHP) approach for sustainable assessment of economy-based and community-based urban regeneration: The case of South Korea. Sustainability 2018, 10, 4456.
8. Church, A. Transport and urban regeneration in London Docklands: A victim of success or a failure to plan? Cities 1990, 7, 289–303. [CrossRef]
9. Couch, C.; Karecha, J.; Nuissl, H.; Rink, D. Decline and sprawl: An evolving type of urban development—Observed in Liverpool and Leipzig. Eur. Plan. Stud. 2005, 13, 117–136. [CrossRef]
10. Mcdonald, S.; Malys, N.; Maliene, V. Urban regeneration for sustainable communities: A case study. Technol. Econ. Dev. Econ. 2009, 15, 49–59. [CrossRef]
11. Lee, B. Concept of Smart Urban Facilities and Direction for Creating Connections with Urban Regeneration. KRIHS Policy Brief 2018, 664, 1–6.
12. European Union Agency for Cybersecurity Smart Infrastructure. Available online: https://www.enisa.europa.eu/topics/iot-and-smart-infrastructures/smart-infrastructure#:~:text=SmartInfrastructurescomprisesseveraloperators,interactwiththephysicalworld (accessed on 18 February 2020).
13. Lee, S. Assessment of Urban Master Plan Based on Urban Resilience Index with Special Reference to Eight Cities and Counties; Semyung University: Jecheon, Korea, 2013.
14. Naess, P. Urban planning and sustainable development. Eur. Plan. Stud. 2001, 9, 503–524. [CrossRef]
15. Lim, M.; Kim, S. A study on VR simulation for smart urban regeneration contents implementation. J. Korea Soc. Art Des. 2019, 22, 185–200.
16. Shin, W.; Kim, D.; Cho, Y.; Park, S. Comparative analysis research on the difference between u-city and smart city for the establishment of international competitiveness of u-city. J. Urban Des. Inst. Korea 2015, 16, 5–16.
17. Nam, K. The role of smart city in urban regeneration. Plan. Policy 2018, 445, 42–48.
18. Lee, J.; Lee, J. A study on the urban planning elements for sustainable urban regeneration. J. Urban Des. Inst. Korea 2011, 12, 101–114.
19. United Nations. About the Sustainable Development Goals. Available online: https://www.un.org/sustainabledevelopment/sustainable-development-goals (accessed on 8 February 2019).
20. Stevens, M.R.; Lyles, W.; Berke, P. Measuring and reporting intercoder reliability in plan quality evaluation research. J. Plan. Educ. Res. 2014, 34, 77–93. [CrossRef]
21. Woodruff, S.C.; Stults, M. Numerous strategies but limited implementation guidance in US local adaptation plans. Nat. Clim. Chang. 2016, 6, 796–802. [CrossRef]
22. Berke, P.; Godschalk, D. Searching for the good plan: A meta-analysis of plan quality studies. J. Plan. Lit. 2009, 23, 227–240. [CrossRef]
23. Chae, J.; Byun, B. Evaluation on the climate change response plans of Incheon and Ulsan. Geogr. J. Korea 2010, 44, 167–179.
24. Kang, J.; Hyun, K.; Park, J. Assessment of Low Impact Development (LID) integrated in local comprehensive plans for improving urban water cycle. J. Korean Soc. Civ. Eng. 2014, 34, 1625–1638. [CrossRef]
25. Kim, H.; Li, M. Managing stormwater for urban sustainability: An evaluation of local comprehensive plans in the Chesapeake Bay Watershed region. J. Environ. Plan. Manag. 2017, 60, 1702–1725. [CrossRef]
26. Kim, H.; Tran, T. An evaluation of local comprehensive plans toward sustainable green infrastructure in US. Sustainability 2018, 10, 4143. [CrossRef]
27. Lyles, W.; Stevens, M. Plan quality evaluation 1994–2012: Growth and contributions, limitations, and new directions. J. Plan. Educ. Res. 2014, 34, 433–450. [CrossRef]
28. Jung, J. A study on the Selection and Application of Multiple Decline Index for Urban Regeneration: For Daegu, Jung-gu, Nam-gu and Seo-gu. Master’s Thesis, Dept. of Urban Planning and Engineering, Daegu University, Daegu, Korea, 2017.
29. Choi, J. Valuation Index of Urban Regeneration New Deal Business Selection: Focusing on Housing Regeneration. Master’s Thesis, Graduate School of Public Administration, Kyungpook National University, Daegu, Korea, 2018.
30. Kim, K.; Kim, G.; Lee, J. A study of evaluation indexes of site selection for the urban regeneration scheme: Focused on the special actson the promotion and support for urban regeneration. Korea Real Estate Acad. Rev. 2015, 61, 31–45.
31. Kang, Y.; Kim, K.; Jung, J.; Son, S.; Kim, E.-J. How vulnerable are urban regeneration sites to climate change in Busan, South Korea? Sustainability 2020, 12, 4032. [CrossRef]
32. Guimaraes, P.P.C. An evaluation of urban regeneration: The effectiveness of a retail-led project in Lisbon. Urban Res. Pract. 2017, 10, 350–366. [CrossRef]
33. Hemphill, L.; McGreal, S.; Berry, J. An indicator-based approach to measuring sustainable urban regeneration performance: Part2, empirical evaluation and case-study analysis. Urban Stud. 2004, 41, 752–772. [CrossRef]
34. Rydin, Y.; Holman, N.; Hands, V.; Sommer, F. Incorporating sustainable development concerns into an urban regeneration project: How politics can defeat procedures. J. Environ. Plan. Manag. 2003, 46, 545–561. [CrossRef]
35. Saaty, T.L.; De Paola, P. Rethinking Design and Urban Planning for the Cities of the Future. Buildings 2017, 7, 76. [CrossRef]
36. Brody, S.D. A Model for Ecosystem Management through Land-Use Planning: Implementing the Principles of Ecosystem Management in Florida. Ph.D. Thesis, The University of North Carolina at Chapel Hill, Chapel Hill, NC, USA, 2001.
37. Kaiser, E.J.; Godschalk, D.R.; Chapin, F.S. Urban Land Use Planning, 4th ed.; University of Illinois Press: Champaign, IL, USA, 1995.
38. Brody, S.D. Ecosystem Planning in Florida: Solving Regional Problems through Local Decision-Making; Routledge: Abingdon-on-Thames, UK, 2016.
39. Jang, C. Analysis of the Evaluation and Effects on Urban Regeneration Project for Improving the Urban Environment. Ph.D. Thesis, Kyungpook National University, Daegu, Korea, 2018.
40. Shin, W.; Shin, W. A study on the priority among achievement indexes depending on the types of urban regeneration projects. J. Korean Reg. Dev. Assoc. 2017, 29, 39–52.
41. Choi, S.; Lee, S.; Jo, A. Development of Urban Regeneration Indicators in Suwon; Suwon Research Institute: Suwon, Korea, 2017; Available online: https://www.suwon.go.kr/web/board/BD_board.view.do?q_currPage=1&bbsCd=1281&q_rowPerPage=10&seq=20180214194508519&showSummaryYn=N&q_searchKeyType=TITLE___1002 (accessed on 25 October 2019).
42. Lee, J.; Kim, Y.; Hong, S. A study on the development of assessment index for urban regeneration project using AHP. J. Resid. Environ. Inst. Korea 2017, 15, 333–348. [CrossRef]
43. Cho, J.; Kim, Y.; Shin, J.; Kim, J. A study on the establishment of evaluation indicators in Changwon urban regeneration projects. J. Resid. Environ. Inst. Korea 2018, 16, 123–137. [CrossRef]
44. Brody, S.D.; Carrasco, V.; Highfield, W.E. Measuring the adoption of local sprawl: Reduction planning policies in Florida. J. Plan. Educ. Res. 2006, 25, 294–310. [CrossRef]
45. Jin, E.; Lee, W. Criticality analysis of performance indicators by urban regeneration project type: With a focus on central city type, general neighborhood type, urban residential district regeneration and town regeneration projects. KIEAE J. 2018, 18, 29–41. [CrossRef]
46. Oh, B.; Lee, J.; Ko, Y. Application Plan of Jeollabuk-Do Smart Urban Regeneration New Deal; Jeonbuk Research Institute: Jeonju, Korea, 2018; Available online: http://repository.jthink.kr/handle/2016.oak/518 (accessed on 5 November 2019).
47. Berke, P.; Spurlock, D.; Hess, G.; Band, L. Local comprehensive plan quality and regional ecosystem protection: The case of the Jordan Lake Watershed, North Carolina, USA. Land Use policy 2013, 31, 450–459. [CrossRef]
48. Stevens, M.R. Evaluating the quality of official community plans in Southern British Columbia. J. Plan. Educ. Res. 2013, 33, 471–490. [CrossRef]
49. Miles, M.B.; Huberman, A.M. Qualitative Data Analysis: An Expanded Sourcebook; SAGE Publications: Thousand Oaks, CA, USA, 1994.
50. Fu, X.; Tang, Z. Planning for drought-resilient communities: An evaluation of local comprehensive plans in the fastest growing counties in the US. Cities 2013, 32, 60–69. [CrossRef]
51. Tang, Z.; Brody, S. Linking planning theories with factors influencing local environmental-plan quality. Environ. Plan. B Plan. Des. 2009, 36, 522–537. [CrossRef]

© 2020 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).