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An Analytic Hierarchy Process (AHP) Approach for Sustainable Assessment of Economy-Based and Community-Based Urban Regeneration: The Case of South Korea

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Abstract: This paper uses South Korean cases to develop an indicator-oriented approach for evaluating the outcome of urban regeneration projects, focusing on the difference between economy-based and community-based urban regeneration projects. By identifying differences in the assessment indicators and weights of two types of urban regeneration projects, we can more successfully recognize a sustainable way to implement economy-based urban regeneration projects. The results of hierarchical assessment models show the differences in critical indicators related to economy-based and community-based urban regeneration projects. Economy-based urban regeneration projects should not only aim to revitalize local economies but also be evaluated using employment- and economic-related indicators, which should receive more weight than indicators concerning community-based regeneration. In this sense, our results suggest that different evaluation and monitoring systems must be developed to separately assess these two types of urban regeneration projects, as approximately 500 urban regeneration new deal projects are being carried out in Korea.

Keywords: urban regeneration project; sustainability; economy-based urban regeneration; AHP; effect indicator

1. Introduction

In South Korea (hereafter, Korea), urban growth began to increase with industrialization in the 1960s [1,2]. Until the 1990s, urban growth continued to progress rapidly and kept pace; thus, Korea's urban policies have focused on growth. However, such growth has eventually reached its limit, and cities have started to decline. In recent years, therefore, the phenomenon of urban decline has been observed more frequently than urban growth in Korea. Urban decline has resulted in serious issues, such as outflow of the population [3,4], ageing infrastructures [5], loss of economic capacity, job shortages [6,7], and poor amenities and lack of financial resources [8–11]. These problems can finally lead to the vicious circle of urban decline. Thus, more effective and sustainable urban policies have continuously been attempted to address the serious economic, physical, social, and environmental issues caused by urban decline. The “urban regeneration” concept has become the new direction in Korea's national urban policy for creating more sustainable urban environments and revitalizing deprived communities since the late 2000s. This is because the concept of urban regeneration is not only an urban planning-based approach that can achieve sustainable economic and physical urban environments [12–14] but also a social and governance-oriented practice that can build social capital [13,15,16]. Therefore, Korea's urban regeneration strategy is strongly related to the concept of urban sustainability that has various key characteristics including intergenerational equity (social sustainability), protection of the natural environment (environmental sustainability), economic vitality

and community self-reliance (economic sustainability), and individual well-being and satisfaction of basic human needs (physical sustainability) [17], because major objectives of urban regeneration projects in Korea are identical to such characteristics.

In 2013, the central government of Korea enacted the Special Act on the Promotion and Support for Urban Regeneration to support urban regeneration projects to address urban decline issues. Based on the Special Act and related strategies, 13 areas were designated as pilot areas for urban regeneration in 2014, and the necessary budget was provided as part of the national urban regeneration policy until 2017. Then, 33 new areas were selected in 2016. After the inauguration of the new government in 2017, the implementation of urban new deal projects was announced as a more advanced urban strategy to replace urban regeneration projects. The central government plans to select approximately 100 areas per year for five years for the implementation of urban new deal projects. This plan demonstrates that urban regeneration projects, including urban new deal projects, will be carried out in more than 500 areas. Thus, assessing and monitoring the impact of regeneration projects is key to effectively delivering sustainable regeneration. However, it is difficult to measure the outcome of urban regeneration due to its complicated objectives compared to property-led renewal [18–20]. In other words, urban regeneration has wide-ranging objectives such as improving distressed physical environments, enhancing social networks, and revitalizing local economies, while property-led renewal mainly focuses on increasing property values. In addition, there are no frameworks for evaluating the outcome of urban regeneration projects in terms of urban sustainability in the process of implementing urban regeneration strategies in Korea. Therefore, it is very important to develop assessment system for urban regeneration projects which mainly focuses on urban sustainability for more successful urban regeneration in Korea.

To this end, this paper develops hierarchical assessment models for urban regeneration projects, focusing on the difference between economy-based and community-based urban regeneration in Korea. Economy-based urban regeneration mainly focuses on revitalizing deprived communities by creating new employment opportunities by introducing new economic functions or advancing the existing local economy. Whereas economy-based regeneration aims at economic sustainability, community-based urban regeneration prioritizes physical, environmental and social sustainability by improving well-being and enhancing the social environment in Korea. Therefore, we highlight key indicators to evaluate the outcomes of both economy-based and community-based urban regeneration projects in Korea in terms of urban sustainability. Achieving urban sustainability in areas from quality of life to economic growth is the main purpose of urban regeneration in Korea. By identifying differences in the assessment indicators and weights of economy-based and community-based regeneration, we can more successfully recognize a sustainable way to implement economy-based urban regeneration projects.

Economy-based urban regeneration is a relatively new concept while the concept of urban regeneration is generally considered to be more closely related to the physical and social renewal of declined community welfare [21,22]. Korea's economy-based regeneration emphasizes the revitalization of regional economies through not only creating jobs and attracting investment in private sectors but also introducing new business ventures and shifting to more advanced industries. Because economy- and community-based urban regeneration does not share major objectives, their outcomes should be evaluated separately. In this sense, an initial review of the literature with relevance to Korea's urban regeneration projects and the definition of Korea's two urban regeneration types are provided alongside an overview of the theoretical framework for measuring urban regeneration projects with multicriteria analysis. The use of the Delphi technique as a means of selecting key attributes of successful economy-based urban regeneration and of the analytic hierarchy process (AHP) for scoring indicator weights is discussed. Based on the AHP results, we may figure out differences in critical indicators related to economy-based and community-based urban regeneration projects. Conclusions are drawn based on the theoretical and policy implications of our results.

2. Literature Review

2.1. Sustainability and Urban Regeneration Projects in Korea

Conventional urban development, urban area expansion, and population increase have resulted in urban growth, but they have also yielded urban problems ranging from environmental challenges, such as global warming caused by air pollution, a rapid decrease in biodiversity, and destruction of local watersheds [23] (p. 383), to social inequity issues [24]. This is because urban planning practices and policies have historically focused primarily on the promotion of urban development at the cost of natural destruction but have ignored environmental protection or economic justice due to professional and fiscal constraints and narrower business interests [24,25]. For this reason, achieving urban sustainability is currently receiving much attention from policy decision-makers because the term “sustainability” suggests economic, environmental, and social solutions to urgent urban challenges [23,24].

In Korea, the continued implementation of urban growth-oriented policies caused the urbanization level to exceed 91 percent after 2010 [26]. Since then, with the advent of an era of low growth, population growth has been stagnant due to the low birthrate and an ageing population, and traditional regional economic bases, such as manufacturing, have relocated outside of cities [27]. This situation has resulted in socioeconomic decline in many local cities. However, existing urban policies focused on urban expansion and were therefore limited in solving the problems of urban decline during an era of low growth. For this reason, the central government shifted the paradigm of policies to sustainable urban regeneration in 2012, recognizing the need to enhance urban sustainability in consideration of intangible values, such as local residents’ quality of life and social integration, and physical economic growth.

The concept of sustainability represents a set of social, economic, physical, and environmental priorities in urban planning [24] (p. 302) [28]. In other words, sustainability may be defined differently depending on the value a society places on the economy, the environment, and equity [24,28–30]. The Korean urban regeneration policy seeks to realize the value of sustainable cities by restoring communities, enhancing the quality of life through improved physical environments, and increasing city competitiveness, which means that its policies target sustainability goals. This pursuit of social, economic, physical, and environmental sustainability is clearly demonstrated in the five objectives of the national urban regeneration policy, which laid a foundation for the Special Act on the Promotion and Support for Urban Regeneration. (The five objectives of the national urban regeneration policy are as follows: (1) job creation based on the creative economy and reinforcement of urban competitiveness; (2) enhancement of the quality of life and implementation of the welfare system; (3) development of a safe and pleasant settlement environment; (4) restoration of cultural value and landscape based on regional identity; and (5) strengthening of residents’ capability and community revitalization [31] (p. 47)). The objectives of the urban regeneration project for the enhancement of urban sustainability are more specifically explained in the definition of urban regeneration as presented in the Special Act. According to the Special Act, urban regeneration refers to the economic, social, physical, and environmental revitalization of a city that is declining due to depopulation, changes in industrial structure, indiscriminate urban expansion, and deterioration of the dwelling conditions. Revitalization occurs through the strengthening of local capacity, the creation and introduction of new functions, and the use of local resources (Article 2). The fundamental goal of Korea’s urban regeneration policies can be classified into three sustainability categories: (1) physical sustainability for improving residents’ quality of life; (2) economic sustainability by enhancing the local economic environment; and (3) social sustainability for enhancing the social network and social cohesion in declined cities and communities. Through the achievement of urban sustainability, the serious issues of declined and deprived cities and communities can be controlled.

2.2. Definition of Economy-Based and Community-Based Urban Regeneration

Based on the Special Act, urban regeneration projects are divided into two types, urban economy-based regeneration and community-based regeneration, depending on the regional conditions and traits. The objective of economy-based urban regeneration is to introduce new economic functions to expand employment opportunities and distribute economic recovery effects to surrounding areas. To this end, economy-based urban regeneration encompasses relatively large-scale projects to create an urban employment base through the readjustment and development of old industrial complexes, ports, and rail station areas; the connection with surrounding areas; and the mixed-use development of relocated sites. On the other hand, the main purpose of community-based urban regeneration is to promote local businesses to revive deprived downtowns and commercial areas and maintain local communities by improving the poor living conditions of deteriorating residential areas. Therefore, community-based urban regeneration comprises small-scale projects that improve living conditions, expand living infrastructures, and revitalize communities with a focus on residents at the neighborhood level. Due to this clear distinction of project goals, each project has its own priority: the economy-based urban regeneration project gives priority to economic sustainability by introducing new economic functions, job creation, etc., whereas the community-based urban regeneration project places more emphasis on the pursuit of social and environmental sustainability by expanding living infrastructures, improving quality of life, and restoring local communities. Consequently, the effects of these two types of regeneration projects need to be assessed by using the assessment index according to their own characteristics.

2.3. Evaluation of the Outcomes of Urban Regeneration

Different approaches to assessing the outcomes of urban regeneration in terms of economic, social, physical, and environmental sustainability have been attempted. Economic sustainability is an instrument commonly used to assess the economic effects of public investment projects, such as urban regeneration projects. In general, NPV (net present value), benefit-cost ratio, and IRR (internal rate of return) are the criteria most frequently used to evaluate the economic effects of a project [32–34]. Ribeiro [35] conducted a financial analysis and calculated NPV to analyze the economic sustainability of Lisbon's old town regeneration project. Tyler et al. [36] identified criteria to evaluate the benefits of urban regeneration policies and then the socioeconomic effects of urban policies to regenerate relatively rundown and distressed parts of urban areas in England. Regional input–out analysis is also used to calculate the economic effects of urban regeneration projects because urban regeneration is generally considered to be closely related to economic growth or a dramatic shift in the economic basis of a city. In terms of the environmental impact of urban regeneration, several quantitative parameters, such as surface temperature, rainfall runoff, and greenspace diversity have been used [37–39]. While there are commonly used instruments to assess the economic and environmental impact of urban regeneration, the approach to evaluating the physical and social effects of urban regeneration depends on the main objective of a project or the purpose of research. For this reason, AHP has frequently been adopted to calculate various effects of urban regeneration on a community in many dimensions. Saaty [40] developed AHP and applied it to diverse decision problems. By pairwise comparison, it is possible to identify the relative importance of each decision criterion. Therefore, AHP and questionnaire surveys have generally been used to weight each sustainability criterion when estimating the effect of an urban regeneration project [18,41,42]. In addition, fuzzy set theory and entropy method can be used to determine the weights of indicators related to sustainability of urban regeneration [43].

3. Methodology

This paper initially seeks to identify key indicators for evaluating the sustainability-related outcomes of two types of urban regeneration projects in Korea. To this end, we developed a hierarchical evaluation model. The process of developing an integrated index to evaluate the outcomes of

economy-based and community-based urban regeneration is as follows. First, we reviewed the literature that attempts to assess urban regeneration and urban renewal projects by using three sustainability criteria: physical and environmental, economic, and social sustainability. In addition, we reviewed the quantitative goals mentioned in the proposals of ongoing urban regeneration projects in Korea. In this first stage, we created a set of economy-based and community-based urban regeneration indicators based on obtainability, objectivity, regularity, and comparability [12,44]. Then, we adopted the Delphi technique to select the final groups of indicators that can evaluate economy-based and community-based urban regeneration in Korea. In this second stage, candidate groups of significant evaluation indicators related to economy-based and community-based regeneration were selected by two rounds of the Delphi survey. In the final stage, the AHP technique was used to prioritize the selected indices and determine a weighting factor of the individual model. The process of developing hierarchical assessment is demonstrated in Figure 1.

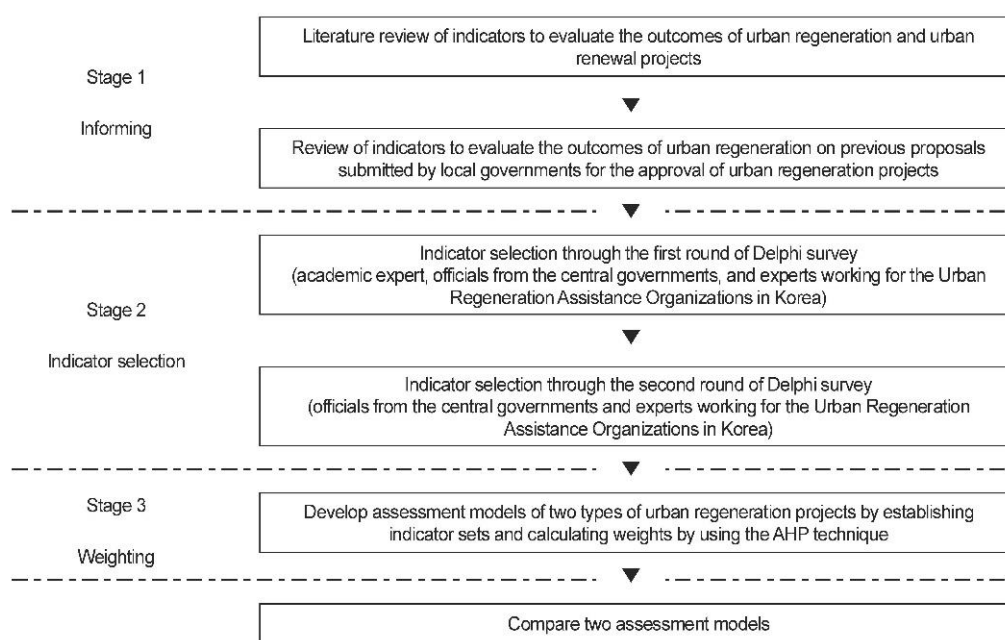


Figure 1. Methodology approach.

The Delphi technique is a direct method for predicting the future through the iterative collection and exchange of opinions from a variety of experts. To overcome the limitations of the brainstorming technique that generates opinions through open discussion, the Delphi technique is characterized by (1) iteration and controlled feedback, (2) anonymity, (3) consensus, and (4) statistical group response [45]. Because it seeks to achieve consensus through a series of iterative questionnaires for experts, the Delphi technique not only makes it possible to reach consensus through iteration and controlled feedback while ensuring anonymity but also allows for statistical group response based on the collected data [46] (p. 121).

Analytic hierarchy process is a multiple-criteria decision-making method that enables the systematic assessment of mutually less relevant and exclusive alternatives when several complex goals or criteria are involved in decision-making. It is a method that renders an objective and consistent assessment of the value of a given alternative, thereby determining its importance or weight. Analytic hierarchy process allows for the (1) establishment of a hierarchical structure; (2) evaluation of relative importance; (3) simultaneous reflection of both quantitative and qualitative factors; (4) integrated evaluation of factors with different criteria; (5) verification of logical consistency; and (6) effective group decision-making. Therefore, the AHP technique can be used to select reasonable alternatives, prioritize projects for implementation, and assess the outcome of various projects in the process of establishing space planning or policies.

4. Results and Discussion

4.1. Indicator Selection

To select indicators for the analysis of the effects of urban regeneration projects, we first examined the indicators presented in the literature regarding urban regeneration and sustainable development. Next, we synthesized and organized the details of project performance and the effects provided by local governments in their own gateway review and annual performance assessment, based on the proposals of pilot projects selected in 2014 and ongoing regeneration projects selected in 2016. On the basis of this work, effect indicators were derived, as shown in Table 1. These indicators were used to effectively evaluate the ultimate objectives of urban regeneration: (1) physical sustainability—housing welfare and improved quality of life; (2) economic sustainability—job creation and restoration of urban vitality; and (3) social sustainability—community restoration and social integration [47] (p. 2).

Table 1. Selection of sustainability-related regeneration indicators.

Objective	Indicator
Physical sustainability: housing welfare & improvement of quality of life (17 indicators)	resident satisfaction, number of parking lots, maintenance of vacant houses (commercial facilities), maintenance of deteriorated houses (commercial facilities), provision of public rental housing, provision of pedestrian roads, improvement of a poor pedestrian environment, road construction, repair of roads in poor condition, maintenance of deteriorated water and sewage pipes, maintenance of antennas, installation of CCTV cameras, installation of security lights, number of cultural facilities, number of welfare facilities, number of energy facilities, number of green space including parks
Economic sustainability: job creation & restoration of urban vitality (15 indicators)	job creation, tax revenue increase, increase in business start-ups, growth in employed population, increase in the number of businesses, increase in moving-in population, increase in floating population, use of idle land, increase in fiscal self-reliance ratio, increase in workers per business unit, upzoning in land use, increase in the number of visitors, sales growth, population growth, increase of land value
Social sustainability: community restoration & social integration (9 indicators)	conclusion of win-win agreements, community space creation, fundraising, provision of public rental commercial facilities, implementation of real estate price survey, system improvement related to leasing practices, discovery of the assets and potential of local communities, resident participation and activity in organizations, satisfaction with urban regeneration promotion councils

A candidate group of 41 indicators was identified through expert review for analysis of the effects of urban regeneration, and then the final set of indicators for AHP was determined through two rounds of the Delphi survey. In principle, the first-round of the Delphi survey should consist of completely open-ended questionnaires that asks a panel of 28 experts, including academic experts and officials from the Ministry of Land, Infrastructure, and Transport and other public institutions, (based on the Special Act on Urban Regeneration, Urban Regeneration Assistance Organizations can be established in three public institutions by the central governments: LH (Korea Land and Housing Corporation), KRIHS (Korea Research Institute for Human Settlements), and AURI (Architecture and Urban Research Institute). These organizations support national and local governments through project management, consulting, and training) whether the individual indicators presented in Table 1 are appropriate for assessing the performance of urban regeneration projects. Specifically, the assessment of yes/no questions determines the suitability of the indicators, and opinions on required indicators can be suggested. The results are shown in Table 2. Based on the survey results, 28 initial indicators were proposed to assess the project's effects according to three objectives of urban regeneration. Consequently, a total of 12 indicators, including resident satisfaction and physical indicators regarding living environment were derived as effect indicators in the physical sustainability category. A total of 11 effect indicators, including growth in the employed population; increase in small enterprises; and other indicators related to the population, jobs, and vitalization of local economies were selected to assess economic sustainability. For social sustainability, five indicators, including the conclusion of

win-win agreements and the provision of public rental commercial facilities were selected to minimize the impact of real estate markets and maintain good relationships within a community.

Table 2. The results of the first-round Delphi survey on the assessment indicators.

Objective	Indicator
Physical sustainability: housing welfare & improvement of quality of life (12 indicators)	resident satisfaction, number of parking lots, maintenance of vacant houses (commercial facilities), maintenance of deteriorated houses (commercial facilities), provision of public rental housing, provision of pedestrian roads, repair of roads in poor condition, installation of CCTV cameras, number of cultural facilities, number of welfare facilities, number of energy facilities, number of green spaces including parks
Economic sustainability: job creation & restoration of urban vitality (11 indicators)	job creation, tax revenue increase, increase in business start-ups, employed population growth, increase in floating population, increase in the number of businesses, increase in moving-in population, upzoning in land use, increase in the number of visitors, sales growth, population growth
Social sustainability: community restoration & social integration (5 indicators)	conclusion of win-win agreements, community space creation, fund raising, provision of public rental commercial facilities, implementation of real estate price survey

The second-round Delphi survey was conducted with a panel of 13 experts who participated in the first-round survey based on a total of 28 indicators drawn from the first-round survey. Unlike the first round, the second round requested the selection of indicators to comprehensively assess the effects of urban regeneration by separating economy-based regeneration from community-based regeneration. In addition, the same or similar indicators were integrated or discarded based on the conceptual interpretation of the assessment indicators, thereby producing the result shown in Table 3. The measurement method of individual performance indicators is demonstrated in Table 4.

Table 3. The results of the second-round Delphi survey on the assessment indicators.

Objective	Economy-Based Regeneration	Community-Based Regeneration
Physical sustainability	resident satisfaction, number of parking lots, maintenance of vacant houses, maintenance of deteriorated houses, repair of roads in poor condition, number of cultural facilities	resident satisfaction, number of parking lots, maintenance of vacant commercial facilities, maintenance of deteriorated commercial facilities, provision of public rental housing, provision of pedestrian roads
Economic sustainability	tax revenue increase, increase in business start-ups, growth in employed population, increase in the number of businesses, increase in floating population	tax revenue increase, job creation, increase in moving-in population
Social sustainability	conclusion of win-win agreements, fund raising, creation of public rental commercial facilities, implementation of real estate price survey	conclusion of win-win agreements, fund raising, implementation of real estate price survey, community space creation

Table 4. The measurement method of assessment indicators.

Objective	Indicator	Measurement	Unit
Housing welfare and improvement in quality of life	resident satisfaction	respondents who checked either “satisfied” or “very satisfied” after completion of regeneration/total respondents	A site for regeneration
	number of parking lots	the number of parking lots planned to be built in regeneration/the number of insufficient parking lots	
	maintenance of vacant houses (commercial facilities)	vacant houses (commercial facilities) planned to be maintained in regeneration/total vacant houses (commercial facilities)	
	maintenance of deteriorated houses	deteriorated houses (commercial facilities) planned to be maintained in regeneration/total deteriorated houses (commercial facilities)	
	provision of public rental housing	public rental housing planned to be constructed in regeneration/total households	
	repair of roads in poor condition	roads in poor condition planned to be repaired in regeneration (m)/total roads in poor condition (m)	
	provision of pedestrian roads	pedestrian roads planned to be constructed in regeneration (m)/total population	
	number of cultural facilities	cultural facilities planned to be constructed in regeneration (m ²)/total population	
Job creation and restoration of urban vitality	job creation	employed population planned to create in regeneration */total employed population *	Local government (city, county, district)
	tax revenue increase	(per capita local taxes * – per capita local taxes **)/per capita local taxes **	
	increase in business start-ups	(number of business start-ups * – number of business start-ups **)/number of business start-ups **	
	growth in employed population	(total workers * – total workers **)/total workers **	
	increase in moving-in population	(net migration rate * – net migration rate **)/net migration rate ** * net migration rate = (number of total moving-in population – number of total moving-out population)/number of total moving-in population	
	increase in the number of businesses	(number of total businesses * – number of total businesses **)/number of total businesses **	
	increase in floating population	(floating population * – floating population **)/floating population **	
Community restoration and social integration	conclusion of win-win agreements	number of win-win agreements concluded/the number of total commercial shops	A site for regeneration
	community space creation	planned creation of community space in regeneration (m ²)/total population	
	fundraising	planned fund raising in regeneration (won)/total population	
	provision of public rental commercial facilities	planned number of shops to be provided in public rental commercial facilities in regeneration/number of total shops	
	implementation of real estate price survey	whether real estate price survey is implemented (0: not implemented, 1: already implemented)	

* Completion year of regeneration projects. ** Selection year of regeneration projects.

4.2. Results of AHP

This study divided urban regeneration projects into community-based and economy-based projects based on legal parameters and primarily extracted the relative weights among the three sustainable objectives of urban regeneration for each project type. Second, the final weights for individual indicators were derived by comparing the assessment indicators of each objective.

The results of AHP are demonstrated in Tables 5–8. The analysis of the relative weight and priority among the urban regeneration objectives shows that in the model for economy-based regeneration, the relative weight of economic sustainability assessed by job creation and the restoration of urban

vitality (0.574) was highest, followed by the weights of social sustainability estimated by community restoration, social integration (0.240), and physical sustainability, defined as housing welfare and improvement of quality of life (0.186). On the other hand, in the model for community-based regeneration, the AHP results indicated the following order of importance: physical sustainability (0.392), economic sustainability (0.323), and social sustainability (0.285). This result is interpreted to mean that the ongoing economy-based regeneration projects place a greater priority on the economic sustainability that can be achieved through job creation, employment, and economic vitalization and that the effect of social integration, including responses to the impact of the real estate market, is also considered important. However, similar to general welfare-oriented regeneration, the results show that community-based regeneration should place greater significance on physical sustainability.

Table 5. Weights of three sustainable objectives.

Objective	Economy-Based Regeneration		Community-Based Regeneration	
	Weights	CR *	Weights	CR
Physical sustainability: housing welfare and improvement of quality of life	0.186	0.029	0.392	0.022
Economic sustainability: job creation and restoration of urban vitality	0.574		0.323	
Social sustainability: community restoration and social integration	0.240		0.285	

* CR: Consistency Index.

The analysis of the relative weights among the detailed assessment indicators in each objective category shows that in the model for economy-based regeneration, the weight of the maintenance of vacant commercial facilities (0.229) was highest in physical sustainability, followed by the maintenance of deteriorated commercial facilities (0.176), repair of roads in poor condition (0.161), and number of cultural facilities (0.158). On the other hand, the AHP reveals that in the model for community-based regeneration, the weight of resident satisfaction (0.245), which was very low in economy-based regeneration, was highest, followed by the maintenance of deteriorated houses (0.190).

Table 6. Weights of assessment indicators in physical sustainability.

Objective	Economy-Based Regeneration		Community-Based Regeneration	
	Weights	CR	Weights	CR
resident satisfaction	0.120	0.008	0.245	0.018
number of parking lots	0.156		0.134	
maintenance of vacant houses (commercial facilities),	0.229		0.147	
maintenance of deteriorated houses (commercial facilities)	0.176		0.190	
provision of public rental housing	-		0.140	
repair of roads in poor condition	0.161		-	
provision of pedestrian roads	-		0.143	
number of cultural facilities	0.158		-	

In the model for economy-based regeneration, the AHP results indicate that in the economic sustainability category, the weights of the indicators related to local economic vitalization, such as employed population growth (0.309) and an increase in the number of businesses (0.205), were the highest. As the model for community-based regeneration focuses on improvement of the regional physical and social environment rather than on economic goals, it did not include indicators that can verify the economic revitalization across the region. Accordingly, job creation (0.394) and the increase in the moving-in population (0.335) derived from the promotion of community-based regeneration were identified as important indicators to assess the restoration of urban vitality. The indicator of tax revenue increase was determined to be of the least importance as it was in economy-based regeneration.

Table 7. Weights of assessment indicators in economic sustainability.

Objective	Economy-Based Regeneration		Community-Based Regeneration	
	Weights	CR	Weights	CR
tax revenue increase	0.115		0.271	
increase in business start-ups	0.161		-	
growth in employed population	0.309		-	
increase in the number of businesses	0.205	0.023	-	0.000
increase in floating population	0.210		-	
job creation	-		0.394	
increase in moving-in population	-		0.335	

Finally, in the model for economy-based regeneration, the AHP results show that the weight of the conclusion of win-win agreements (0.316) to respond to the displacement problem caused by gentrification was highest in the community restoration and social integration category. In the model for community-based regeneration, community space creation (0.358) for community revitalization was the most important indicator. Similarly, in the model for economy-based regeneration, the creation of public rental commercial facilities (0.292) for the protection of small merchants was relatively important; in addition, fundraising was somewhat important in both economy-based regeneration (0.237) and community-based regeneration (0.217).

Table 8. Weights of assessment indicators in social sustainability.

Objective	Economy-Based Regeneration		Community-Based Regeneration	
	Weights	CR	Weights	CR
conclusion of win-win agreements	0.316		0.262	
fund raising	0.237		0.217	
creation of public rental commercial facilities	0.292	0.008	-	0.004
implementation of real estate price survey	0.155		0.164	
community space creation	-		0.358	

4.3. Discussion

A final hierarchical assessment model for economy-based and community-based urban regeneration projects is presented in Table 9. The AHP results indicate that the set of sustainability-related indicators used to evaluate the effects of urban regeneration projects varies depending upon the specific objective and background of the project approach. The table shows that different sets of indicators are used to assess the sustainability effects of economy-based and community-based regeneration projects. In particular, five economic sustainability indicators correspond to economy-based regeneration, while only three criteria were included for community-based regeneration. This finding could indicate that the expert groups believe that the economy-based urban regeneration projects should contribute to economic sustainability that can be distributed beyond the community because the indicators for estimating the effects of economy-based regeneration focus on employment- and profit-related factors, such as the number of jobs and new enterprises created. On the contrary, the indicators for evaluating community-based regeneration emphasize the benefits within the community.

Table 9. Comparison of assessment index between economy-based and community-based regeneration projects.

Objective	Economy-Based Regeneration		Community-Based Regeneration	
	Weights	Rank	Weights	Rank
Physical Sustainability	0.186	3	0.392	1
resident satisfaction	0.120	6	0.245	1
number of parking lots	0.156	5	0.134	6
maintenance of vacant houses (commercial facilities),	0.229	1	0.147	3
maintenance of deteriorated houses (commercial facilities)	0.176	2	0.190	2
provision of public rental housing	-	-	0.140	5
repair of roads in poor condition	0.161	3	-	-
provision of pedestrian roads	-	-	0.143	4
number of cultural facilities	0.158	4	-	-
Economic Sustainability	0.574	1	0.323	2
tax revenue increase	0.115	5	0.271	3
increase in business start-ups	0.161	4	-	-
employed population growth	0.309	1	-	-
increase in the number of businesses	0.205	2	-	-
increase in floating population	0.210	3	-	-
job creation	-	-	0.394	1
increase in moving-in population	-	-	0.335	2
Social Sustainability	0.240	2	0.285	3
conclusion of win-win agreements	0.316	1	0.262	2
fund raising	0.237	3	0.217	3
creation of public rental commercial facilities	0.292	2	-	-
implementation of real estate price survey	0.155	4	0.164	4
community space creation	-	-	0.358	1

The weights of the three sustainability objectives, physical, economic, and social sustainability, and the weights of each indicator in the three objective categories, differ for economy-based and community-based regeneration in Korea. Not surprisingly, the AHP results emphasize physical sustainability for community-based urban regeneration because the main purpose of urban regeneration is to improve the living environment in deprived communities. Economic sustainability was found to be more important for economy-based regeneration because this new concept was implemented to revitalize the local economy in socioeconomically-deprived communities. In particular, physical sustainability was found to have the lowest importance among the three objectives for economy-based regeneration; this could be because the expert groups prioritize social sustainability over physical sustainability because some indicators used to assess social sustainability are strongly linked with a stable economic environment. Therefore, this finding may indicate that expert groups and stakeholders in the government sector believe that revitalizing the local economy with a stable economic environment is a critical effect of the economy-based urban regeneration projects in Korea.

5. Conclusions

This study is an initial attempt to develop hierarchical assessment models for evaluating the effects of economy-based and community-based urban regeneration projects by comparing a set of indicators and weights for urban sustainability, that is, physical, economic, and social sustainability. Urban regeneration should contribute to broad aspects of urban sustainability [29]. It may improve physical sustainability, which is associated with the welfare and quality of life of residents in a declined community, by offering amenities, increasing the accessibility of public facilities, and eliminating vacant or deprived buildings. Additionally, economic sustainability can motivate economic revitalization through the creation of jobs and enterprises and the increase in revenue that can be invested in the community. Finally, urban regeneration can develop social sustainability by creating a social network.

Even if it is difficult to evaluate the effects of urban regeneration due to the absence of commonly used criteria, our results suggest that urban regeneration should be evaluated differently depending on whether it is economy-based or community-based regeneration. Given that economy-based urban regeneration projects have more economy-oriented purposes and are generally implemented in declined communities suffering from the outflow of population, concentration of aged populations, loss of economic capacity, lack of jobs, and a shortage of investment, we understand that this type of project should not only seek to revitalize local economies but also be evaluated using employment- and economic-related indicators, which should receive more weight than indicators concerning community-based regeneration. In this sense, our results suggest that different evaluation and monitoring systems must be developed to separately assess these two types of urban regeneration projects, as approximately 500 urban regeneration new deal projects are being carried out in Korea. Even if we use only Korean cases to identify key indicators to assess sustainable urban regeneration, anyone who aims to evaluate sustainability of urban regeneration or urban renewal can easily modify our results depending on the objective of the project, because our approach is based on the local community where the regeneration project is implemented. Since we highlight the outcome of urban regeneration within the community, our approach is more appropriate to small-scale community-oriented urban regeneration projects.

By developing hierarchical assessment models for economy-based and community-based regeneration based on differences in the perceived criteria and weighting by professionals, this study targets only physical, economic, and social sustainability, not environmental sustainability. In addition, we omit several commonly used indicators, such as accessibility to amenities, land use, and structural factors and some qualitative indicators, such as preservation of historical and cultural integrity. This is because we believe the results of this paper could be used to evaluate ongoing urban regeneration projects in Korea, and to this end, we believe the considered indicators must rely on previous proposals submitted by local governments for the approval of urban regeneration projects rather than on our literature review. Therefore, in future studies, qualitative indicators and environmental factors should be sought. Furthermore, the opinions of residents who live in deprived communities where urban regeneration projects are implemented should be included when a survey is conducted. This is because AHP does not remove each expert's biases and errors and we cannot cover all applicable indicators based on Delphi method, while these methods are useful to find related indicators and determine weights of each indicator by taking into account experts' opinions. This fact may be a limitation of this paper, even if Delphi and AHP are commonly used due to their convenience within limited time and resources. In addition, we do not cover feasibility of each urban regeneration project considering its objectives and project costs. Therefore, future research should identify the optimal level of each indicator based on the project costs and provide the framework for calculating value for money for sustainable urban regeneration.

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