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Determinants of the Economic and Financial Feasibility of Real Estate Development Projects: A Comparative Analysis between Public and Private Development Projects in South Korea

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Abstract: We analyse the factors involved in the selection of a development site to secure the economic feasibility and profitability of a public development real estate project through a comparative analysis with private development projects. Logistic regression was used as the analysis method. In the case of public development projects, whether or not the investment screening passed was used as a dependent variable, and in the case of private development projects, the successful bid rate was used as a dependent variable. Independent variables were selected based on prior research on variables suitable for the purpose and situation of the project. The results show that the greater the total development costs of a public development project and the greater the size of a private development project, the greater the rate of approval and bidding success. For public projects, the rate of approval decreases when there are several subways, train stations, and supermarkets; however, this is not the case for private projects, owing to differences in development methods and project purposes. From a public standpoint, the balanced regional development, revitalisation of old city centres, and implementation of social overhead capital projects in neighbourhoods lacking infrastructure have a strong influence. From a private sector perspective, the mobile/resident population, modification in extra demand, and feasibility analysis have a strong influence. In sum, if the private sector avoids large-scale supermarket projects, they can be conducted as public development projects to enhance residents' quality of life and revitalise the regional economy. Researchers should examine what could be benchmarked in the private sector in the operational stage and explore ways to maximise profitability and reduce financial burden.

Keywords: public development project; private development project; investment appraisal; location suitability; project feasibility analysis

Citation: Shim, H.; Kim, J. Determinants of the Economic and Financial Feasibility of Real Estate Development Projects: A Comparative Analysis between Public and Private Development Projects in South Korea. *Sustainability* **2022**, *14*, 2135. https://doi.org/10.3390/su14042135

Academic Editors: Pierfrancesco De Paola, Francesco Tajani, Marco Locurcio and Felicia Di Liddo

Received: 28 December 2021
Accepted: 8 February 2022
Published: 13 February 2022

1. Introduction

1.1. Background and Purpose

Studies have been conducted on real estate development projects concerning the similarities and differences between public and private development projects by country and time of development. If there are no significant differences between these two types of projects, it would be difficult to identify a reason for dividing them according to the project type [1]. For a private development project, to maximise financial return, the project is implemented by establishing detailed and specific strategies at the operation stage, along with identifying indicators for the selection of the development site. For public development projects, the development entities primarily focus on areas associated with total project cost, in which most resources are invested; however, there are also in-depth analyses on the adequacy of development project site selection and the operating expenses arising in the operational stage [2]. In fact, the feasibility assessment—a procedure necessary to initiate a public development project in South Korea—has different impact ranges in demand and benefits, depending on the project site and the economic feasibility analysis stage; it also includes the total project cost and operating expenses over 30 years [3,4].

This process indicates that the total project cost at the construction stage is not the only major project determinant. Additionally, since most of the financial resources for a public development project are covered by tax income, there is a pressing need to consider the rate of return, which is similar to the perspective of the private sector in terms of project site selection and operation. This is because, in the case of a development project for a public facility that is continuously in deficit in the operating stage, when analysed over 30 years (i.e., the length of time used for calculation in the economic feasibility analysis), the results will show a negative impact on the local government's fiscal soundness. In fact, 21 public real estate development projects in South Korea have had an annual operating deficit of over KRW 5 billion [5].

For some public development projects that involve public interest and cannot be developed by the private sector, operational deficits may be inevitable. However, there are many other cases of public development projects where this is not the case. Therefore, by not considering the profitability aspect of the project—such as the geographic and environmental conditions of the development site and the operational plans, even when income generation is possible—the overall fiscal soundness of the country can deteriorate, and the project can run in a neglectful manner [6]. Pushing for indiscriminate development without considering competing and similar facilities for public development projects may lead to intrusion into the private sector and concerns about duplicate investment in a facility. Consequently, this approach only results in the unnecessary division of the facility within the region without an increase in total demand while incurring additional costs. Therefore, in selecting a development site for a public development project, it is necessary to implement a project based on the understanding of the competing facilities or the surrounding environment, which are considered for private development projects [7]. Specifically, for large-scale public development projects, there is an unavoidable increase in costs in proportion to the scale of the project. That is, the larger the total project costs are, the more important it is to investigate the status of the environment and establish a development plan for project site selection.

Therefore, it is important to understand the determinants for the selection of a development site and the differences from private development projects to ensure the validity of project site selection [8]. The feasibility study and Central Investment Appraisal, which are preliminary administrative procedures for large-scale public development projects, present only the analysis results and appraisal for the planned project, rarely considering the adequacy of a location as a development site [7].

In this study, an analysis model is constructed as follows. A comparative analysis is performed between the public and private development projects, and the implications of the findings are presented. First, among the administrative procedures for public development projects in South Korea, we analyse those that have been requested to undergo the Central Investment Appraisal for large-scale projects over five years. Among these projects, those that were recommended for additional review for location suitability and consideration of environmental factors, such as similar and competing facilities, are judged to be projects closely matching our purpose. We investigate environmental factors and conditions and identify the factors that affect success in the Central Investment Appraisal.

Second, among the indicators that determine the business feasibility of a private development project, environmental factors around the development project site are substituted and the development site selection method is explored, as well as the measures for ensuring higher profitability and economic feasibility. By comparing the results with those for a private development project, we revise and supplement the research on the determinants of successful bidding for insolvent project financing (PF) projects conducted by Shim and Kim [9] to determine the characteristics of project sites for the business sites that underwent the bidding process in the private sector. To this end, as in the analysis method for public development projects, we derive the determinants for successful bidding in private development projects by considering the environmental factors related to location suitability.

Third, based on the results of the two analyses, we conduct a comparative analysis of public and private development projects and present measures to improve economic feasi-

bility and profitability and their implications by using development project site selection—an area that has received little attention in relation to public development projects.

1.2. Scope

Through the comparative analysis of public and private development projects, the common points and differences between the two types of development projects are analysed in terms of project site selection with the scope of improving operating balance and increasing demand, which have been largely overlooked in the public sector; thus, the measures to ensure the economic feasibility and financial feasibility of public development projects are explored. In particular, since the public and private sectors have different objectives and business development methods, it is important to achieve a balance. We provide basic data for the effective operation of public facilities and to improve the Central Investment Appraisal system. First, among the public development projects, undergoing a Central Investment Appraisal from 2016 to 2019 was a preliminary procedure for large-scale projects in South Korea. Among these, 117 projects [10] were recommended for additional review in terms of location suitability and consideration of environmental factors, such as similar facilities and competing facilities. We investigate environmental factors and conditions, such as basic infrastructure development and environmental factors within a 5-km radius [11], as well as competing facilities. We identify the factors that lead to Central Investment Appraisal success and discuss their implications. For a private development project, the main factors related to the environmental aspects around the project site, along with the indicators that determine the business feasibility of a project before implementation, are examined. We thus identify the determinants for the site selection of private development projects, the selection methods for the development site that need to be considered in public development projects, and the measures that increase profitability and economic feasibility. By comparing private and public development projects, we revise and supplement the research on the determinants of successful bidding for insolvent PF projects conducted in a previous study [9], and among the 484 sites of insolvent PF projects, we analyse the 32 business sites [12] determined by the Korea Asset Management Corporation (KAMCO) that underwent a bidding process in the private sector. Specifically, we derive the factors that lead to successful bidding for private development projects, considering environmental factors within a 5-km radius (Table 1).

Table 1. Model.

Project Type	Description
Public development project	• We identify and classify the 117 project sites that have been notified of the appraisal results in relation to the location suitability among those that underwent Central Investment Appraisal from 2016 to 2019. • We identify the environmental factors related to project characteristics and site selection based on previous studies. • We conduct regression analysis based on the approval status of the investment appraisal. • We identify factors that affect the approval of the investment appraisal and derive implications and conclusions.
Private development project	• Among the 484 sites of insolvent PF projects, the 32 project sites determined by the Korea Asset Management Corporation restored for normalisation that underwent bidding in the private sector are identified and organised. • The factors related to project site selection are similar to those for public development projects in previous studies. • We conduct regression analyses based on the bidding success status of the project site. • We identify the factors that affect the bidding success and derive implications and conclusions.
Comparative analysis	• Through a comparative analysis of the analysis results for each project type, common points and differences, as well as the implications for economic feasibility and financial profitability are derived.

2. Theoretical Background

2.1. The Economic and Financial Feasibility of a Development Project

An economic feasibility analysis was conducted to maximise the total utility by the efficient allocation of limited resources, with nationwide considerations rather than from the viewpoints of individual businesses. The social benefits received by beneficiaries and social costs were estimated to evaluate social investment efficiency. The target projects for economic feasibility analysis are public facilities, called social infrastructure, including social overhead capital such as roads, railroads, airports, ports, water resources, water supply and sewage, and tourism facilities, which are development projects in the public sector [3]. Regarding the methods of evaluating economic feasibility, decisions are made based on comprehensive considerations, including the benefit/cost (B/C) ratio, the net present value (NPV), and the internal rate of return (IRR). The B/C ratio, which is mainly used as an indicator of economic feasibility in South Korea, is the ratio of the discounted amount of total benefits to total costs; if this value is greater than or equal to 1, it is considered that economic feasibility has been achieved.

The B/C ratio can be derived using the following equation:

$$\text{B/C Ratio} = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} / \sum_{t=1}^{n} \frac{C_t}{(1+r)^t},$$

where B_t is the social benefit at time t, C_t is the cost at time t, r is the social discount rate, and n is the analysis period or the duration of the facility project. That is, a benefit–cost analysis is conducted by measuring and comparing the difference between the social benefits from using the applicable facility by an individual user with the number of users and costs (i.e., the total expenses required for the construction and maintenance of the applicable facility). At this time, social costs can be divided into initial project costs and operational maintenance costs. Project costs include not only construction and land acquisition costs but also opportunity costs, considering the loss of benefits that could have been enjoyed if the best alternative was selected. In South Korea, the social discount rate of the economic feasibility analysis is applied at a uniform rate of 4.5% in all cases, and the analysis was performed considering the operating costs over 30 years [5].

A financial feasibility analysis is also called a business feasibility analysis or profitability analysis. It is conducted by an individual business that aims to maximise the assets owned by an individual project development entity. That is, the business entity conducts the development project under its own responsibility to create wealth and charges the price for service provision to users in the form of tolls, entrance fees, and usage fees for a set period, thereby seeking certain profits or returns; profitability is analysed using financial feasibility analysis [3]. The targets for financial feasibility analysis are all the economic activities that generate direct profits among social overhead capital, public facilities, and the private sector, such as individuals or corporations, investing for profit. Financial feasibility is evaluated based on the profitability index (PI), NPV, IRR, and payback period. PI, which is mainly used as an indicator for financial feasibility analysis in South Korea, is a value obtained by dividing the present value of the incoming cash flow by the business by the present value of the outgoing cash flow; if the value is greater than 1, the business is considered financially feasible. The PI can be derived using the following equation:

$$\text{PI} = \sum_{t=1}^{n} \frac{B_t}{(1+r)^t} / \sum_{t=1}^{n} \frac{C_t}{(1+r)^t},$$

where B_t is the incoming cash flow at time t; C_t is the outgoing cash flow at time t; r is the financial discount rate; and n is the analysis period, which is measured as the duration of the facility business. In financial feasibility analyses in South Korea, the present value is calculated by discounting cash flows at a real discount rate of 4.5%, while PI, NPV, and IRR are calculated based on the present value obtained. However, over the analysis period, quantification is somewhat difficult because the values vary depending on the type of

business or operating period [5]. In summary, an economic feasibility analysis is performed to determine the impact on the public and national economy by measuring the social NPV. That is, income and losses are calculated based on social benefits and social costs, while taxes such as the value-added tax are excluded. Therefore, even revenues that are not actually generated are estimated through shadow prices. In contrast, a financial feasibility analysis measures the NPV of the business entity, and the entity for the analysis is the actor that directly conducts the business or investment. Additionally, only real cash flows are estimated, and various taxes, such as corporate and property tax, are included in the analysis. Furthermore, the analysis is conducted based on the market price rather than the shadow price [13]. The two analyses are summarised in Table 2.

Table 2. Comparison between the economic and financial feasibility analyses.

Characteristic	Economic Feasibility Analysis	Financial Feasibility Analysis
Purpose	Measurements of social net present value	Net present value measurements of the business entity
Subject of analysis	Public or national economy	Business entity or the investor
Rules for including income and loss	Social benefits/costs	Incoming/outgoing cash flow
Positive (+) variables	Economic benefits of the facility user	Revenue of the business entity
Negative (−) variables	Initial investment and operating maintenance cost	Initial investment, operating maintenance cost, and corporate tax
Evaluation of income and loss	Shadow price	Market price
Distributive equality	Extensive use of weights or conditions	Not considered

2.2. Literature Review

To date, few studies have directly conducted comparative analyses on the site selection of public and private development projects [14] because the purposes and directions of project implementations differ for each project type. In the case of public development projects in South Korea, project site selection tends to be determined by political standards or by the one-sided judgement of administrative authorities [15]. Consequently, the comparison mainly entails the extensive administration performed in terms of organisational management in the operational stage, while the developments of these two types of projects have been rarely compared [1,16]. However, studies have been conducted from the development project perspective for each project entity and on sprawling development, redundant investment, the direction of the urban development project, operational style, and organisational management. These studies can be largely classified into two categories.

First, research has been conducted on location suitability and environmental factors, such as the presence of competing facilities and duplicate investment for public and private development projects. Site selection analysis has been applied based on the principle of efficient utilisation of limited land, and ecological site selection analysis is regarded as a scientific approach [14]. Among them, a previous study that investigated urban growth and analysed sprawling development for newly developed areas using indicators such as employment potential, distance from roads, distance from a highway entrance, distance from educational facilities, and flood risk is representative. It analysed the suitability of the development level by simultaneously considering the various aspects of land use, such as connectivity, dispersion, density, scattering, and utilisation [17]. Another study measured the development level based on the land use plan in terms of density, continuity, concentration, compressibility, centrality, nuclear, diversity, and proximity in relation to environmental factors and suggested preventing duplicate investment in development [18]. A similar study used four indicators: the population who migrated from urban areas to the suburbs, the population growth rate relative to the increased rate of land development area, the time lost due to traffic congestion, and the area lost to open spaces [19]. Based on location theory, extant research has also assessed the level of sprawling development

related to location by using spatial information indicators such as the distance to an existing development site, distance to roads, distance to city centre, and floor area ratio [20]. One of the representative studies is the analysis of employment potential, using distance from the road, the entrance to the highway, and the risk of flooding as indicators [21]. Moreover, another study demonstrated that accessibility indicators are higher for private development compared to public development based on the psychological space of residents and movement patterns according to distance for residential development under both public and private development projects [14]. A similar study suggested indicators for residential density, residential areas, mix level of jobs and services, suction power of activity centres and downtown areas, and accessibility to road networks [22,23]. It also conducted a comparative analysis based on the distance from main roads, distance from public transportation, development density, and job–housing balance, thus identifying the development status of South Korea and arguing the necessity for the development projects that reflect the actual changes in society. Another study reported on the necessity of considering detailed development of evaluation standards related to site selection in a development project, regardless of whether the project entity is the public or private sector, thus emphasising the impact on the potential of success of a project [24].

Second, in the operating stage—that is, after the completion of the development project—prior studies mainly discussed administration in terms of organisational management. Public development projects face operational difficulties compared to private development projects in the operating stage, owing to their limitation in the continuous generation of profits [25]. A prior study proposed that for a project site where demand is derived by the coexistence of private and public sectors, the harmonisation of sustainable operation and management serves as a measure that determines project success [26]. Accordingly, there is a trend to improve operational balance through symbiotic relationships between the two sectors in terms of operations [27]. Most studies mainly reflect the level of spatial segmentation based on the level of infrastructure development as a standard indicator. Many focus on the operating stage rather than on the adequacy of the project site, and the discussion centres around the workers involved in the project and the project operation entity. Additionally, few studies have performed a direct comparative analysis between the two sectors. Therefore, in this study, in the stage prior to the implementation of real estate development projects, project site selection is comparatively analysed between the public and private development projects using quantitative data, and measures for public development projects to ensure economic feasibility and create profitability are explored. To derive variables for sprawling development, issues of redundant investment, and approaches with spatial indicators, all of which are related to site selection, the research themes in previous studies on the environmental factors of the development project were used. To ensure analysis objectivity, we considered a 5-km radius [11], which is a close distance for the consumer in transportation geography, and the derived variables were specified considering actual circumstances. Therefore, this study proposes improvement measures to ensure balanced local financing and the prevention of duplicate investments through optimal location selection for public development projects. The findings can thus support the successful implementation of projects through the selection of suitable project sites and their ramifications, such as deriving necessary projects in the region and assigning priority projects. Moreover, the results are expected to be utilised as the basic data for the implementation and validation of future development projects in countries that do not have an investment appraisal system in place for public development projects.

3. Comparative Analysis of Public and Private Development Projects

For the comparative analysis between public and private development projects, the variables were selected based on previous studies. Since each project entity has a different purpose and direction for its development project, it was not possible to unify these aspects; however, data were processed to maintain consistency between variables for the comparative analysis. The process variable selection is described below.

3.1. Variables

As a result of the literature review, for developing a model for the comparative analysis of public and private development projects, the accessibility of the project site, distance, size, and development density were identified as major determinants. The variables also reflect the circumstances specific to South Korea, where the distance within a 5-km radius [11] from the project site and the number of facilities within this range were added as additional factors. This is because the most decisive factor in the site selection of each project entity is the demand of users for the facility after actual development. Therefore, the psychological distance is set according to the sphere of influence to ensure the validity of the comparative analysis. In sum, the variables used in previous studies were organised to accommodate our purpose (Table 3) [9,11,17–20,28,29].

Table 3. Variable selection.

Study	Variables							
	Size	**Road Accessibility**	**Access to Public Trans-portation**	**Distance to the City Centre**	**Floor Area Ratio or Building-to-Land Ratio**	**Development Density**	**Convenience Facilities**	**Educational Facilities**
Shim et al. (2018)	○	○	○	○	○	○	○	○
Poelmans et al. (2009)		○	○					
Galster et al. (2000)	○	○	○	○		○	○	○
Jiang et al. (2007)		○	○	○	○	○	○	○
Shin et al. (2015)	○	○	○	○		○	○	○
Angel et al. (2007)						○	○	○

Concerning project size, the public development projects were analysed based on the Central Investment Appraisal, a preliminary procedure for large-scale projects; thus, the size of a project was added as a variable. Moreover, because the size is, to some extent, linked to the gross floor area or building-to-land ratio, these factors were also selected as variables for the public and private sectors, respectively. For public development projects, it is common practice to develop projects on public land; in the case of private development projects, a similar variable, which is the rate of project site purchase, was selected. For accessibility to roads and public transportation, the range was limited to subways and train stations within a 5-km radius, considering the nature of most projects located in the Seoul metropolitan area. In addition, regarding the development level around the project site, which is closely related to the development density, this variable was divided into cultural/convenience facilities and educational facilities. These variables are detailed in Tables 4 and 5.

Table 4. Variables for public development projects.

Variable		Description	Unit
Dependent variables	Approval status	Approval status for the Central Investment Appraisal; 0 for an approved project and 1 for a failed project	Dummy
Subfactors of independent variables			
Project characteristics	Total project cost	Total project cost required for the public development project	100 million won
	Project period	Period required for the project duration	Months
Building characteristics	Gross floor area	Gross floor area of the building	m^2
Public transportation	Adjacent subways/train stations	Number of subway stations within a 5-km radius	No.
Culture/convenience facilities	Adjacent large-scale supermarkets	Number of large-scale supermarkets within a 5-km radius	No.
	Adjacent cultural facilities	Cultural facilities within a 5-km radius	No.
Educational facilities	Elementary, middle, or high schools or colleges within a 5-km radius	Distance to the elementary, middle, or high schools or colleges adjacent to the project site	km

Table 5. Variables for private development projects.

Variables		Description	Unit
Dependent variables	Bidding success status	Status of the bidding success of the project site; 1 for bidding success and 0 for bidding failure	Dummy
Subfactors of independent variables			
Building characteristics	Building-to-land ratio	Building-to-land ratio	%
	Size	Number of households in the building	No.
Project progress	Rate of project site purchase	Rate of project site purchase	%
	Project suspension period	Period of the project suspension	Months
Public transportation	Subways within a 5-km radius	Number of subway stations within a 5-km radius	No.
Culture/convenience facilities	Adjacent cinema complex	Distance to the cinema complex most adjacent to the building	km
	Adjacent large-scale supermarkets	Distance to the large-scale supermarket most adjacent to the building	km
	Large-scale supermarkets within a 5-km radius	Number of large-scale supermarkets within a 5-km radius	No.
Educational facilities	Elementary, middle, or high schools or colleges within a 5-km radius	Number of elementary, middle, or high schools or colleges within a 5-km radius	No.

3.2. Analysis of Public Development Projects

For the construction of analysis models of public development projects, analysis was performed for the projects [10] that were recommended for additional review in terms of location suitability and environmental factors, such as similar and competing facilities. The data used for the analysis were for 117 projects from 2016 to 2019, and environmental factors and conditions such as the development of basic infrastructure, including environmental factors within a 5-km radius [10] were identified, as well as competing facilities to determine which factors affected Central Investment Appraisal approval. As a result of conducting descriptive statistical analysis prior to the empirical analysis, 81 (68.6%) projects were approved in the Central Investment Appraisal, and

36 (31.4%) failed to obtain approval. The total project cost was KRW 29.7 billion on average, and the mean gross floor area was 9876.18 m^2, which indicate that most projects were large-scale ones. For public transportation facilities, there were 68 project sites (58.1%) with subways and train stations within a radius of 5 km, mainly distributed in Seoul and its metropolitan area, which is believed to have contributed to the Central Investment Appraisal approval. In addition, 68 project sites (58.1%) were for large-scale supermarkets and culture/convenience facilities, and 103 (88.0%) project sites were for cultural facilities, thereby indicating that most cultural facilities are located within a 5-km radius. Elementary, middle, or high schools or colleges were located within 0.99 km from the project site on average, and the distance to the farthest facility was 3.86 km, which shows that the proximity to educational facilities was high (Table 6).

Table 6. Descriptive statistics.

Variable	N	Min.	Max.	Mean	Std. Dev.
Approval status	117	0	1	0.31	0.46
Total project cost	117	73	1240	297.15	220.52
Project period	117	0	156	40.82	26.97
Gross floor area	117	1000	65,000	9876.18	11,828
Adjacent subways/train stations	117	0	55	8.52	14.25
Adjacent large-scale supermarkets	117	0	16	2.74	4.01
Adjacent cultural facilities	117	0	255	28.82	52.58
Elementary, middle, or high schools or colleges within a 5-km radius	117	0	3.86	0.99	0.88

In the analysis, the -2-log likelihood value was 27.944. In terms of the assessment of goodness-of-fit of the model, *Cox* and *Snell's* R^2 and Nagelkerke's R^2, both with the same utility for the model fit decisions, accounted for 33.8% and 58.4% of the total variance, respectively. Additionally, the model fit was verified by the Hesmer–Lemeshow test: Pearson's chi-square statistic was 15.316 (p = 0.053), thereby indicating that the fit of the model was significant. The analysis showed that the significant variables were the total project cost (Exp(β) = 1.003), adjacent subways/train stations (Exp(β) = 0.929), and adjacent large-scale supermarkets (Exp(β) = 1.153). In summary, for large-scale projects with a large total project cost, the rate of Central Investment Appraisal approval was high and decreased with increasing numbers of subways/train stations in the adjacent area. Furthermore, the approval rate increased with the increasing number of large-scale supermarkets in adjacent areas (Table 7).

Table 7. Analysis results.

	Category	B	S.E.	Wald	DoF	p	Exp(β)
Step 1	Total project cost	0.003	0.001	8.647	1	0.003	1.003
	Project period	0.013	0.081	0.025	1	0.876	1.013
	Gross floor area	0.000	0.000	1.761	1	0.184	1.000
	Adjacent subways/train stations	−0.074	0.035	4.384	1	0.036	0.929
	Adjacent large-scale supermarkets	0.143	0.067	4.472	1	0.034	1.153
	Adjacent cultural facilities	0.009	0.007	1.573	1	0.210	1.009
	Elementary, middle, or high schools or colleges within a 5-km radius	0.180	0.167	1.162	1	0.281	1.197
	Constant term	−1.617	0.425	14.491	1	<0.001	0.198

3.3. Results

Here, to identify the factors for project site selection for private development projects, 32 insolvent PF business sites that underwent the bidding process in the private sector and had their construction suspended were investigated (Table 8) [20]. Of the 32 sites, 15 succeeded in bidding in the private sector, and 17 failed to bid. The model was further developed based on the bidding success statuses of the projects, and the location suitability factors were analysed according to the surrounding environment for the simultaneous analysis of internal and external factors. Additionally, to ensure consistency with public development projects, facilities within a 5-km radius were considered. As a result of conducting descriptive statistical analysis prior to the empirical analysis, 15 sites (46.8%) succeeded in bidding, and 17 (53.2%) failed. The ratio of the holding bonds of the project site (amount of holding bonds/amount of total bonds) was 78.1% on average, and the project site purchase rate was 91.3% on average, which indicate that the land purchase rate at the project site was relatively easy. In the case of public transportation facilities, 17 project sites (53.1%) had subways within a 5-km radius and were primarily distributed in Seoul and its metropolitan area, which is believed to have contributed to the bidding success. Furthermore, in the case of cultural and convenience facilities, cinema complexes were located within 2.47 km, on average, from the project site, and the distance to the farthest cinema complex was 14.68 km, thereby indicating that the facilities were distributed within 15-km or 20 min by car.

Table 8. Basic statistics.

Variable	N	Min.	Max.	Mean	Std. Dev.
Bidding success status	32	0	1	0.469	0.502
Building-to-land ratio	32	0.13	0.66	0.262	0.153
Size	32	38	2059	528.688	463.937
Rate of project site purchase	32	0.53	1	0.913	0.143
Project suspension period	32	4	111	53.200	21.017
Subways within a 5-km radius	32	0	54	6.750	11.670
Adjacent cinema complex	32	0.27	14.68	2.741	3.456
Adjacent large-scale supermarkets	32	0.22	11.63	2.684	3.180
Elementary, middle, or high schools or colleges within a 5-km radius	32	8	161	64.313	42.106

In the analysis model of this study, the -2-log likelihood value was 71.616. Concerning the assessment of goodness-of-fit of the model, *Cox* and *Snell's* R^2 and Nagelkerke's R^2 accounted for 47.1% and 62.9% of the total variance, respectively. In addition, the fit of the model was verified by the Hesmer–Lemeshow test. Consequently, the Pearson's chi-square statistic was 8.945 (p = 0.347), thereby indicating that the fit of the model was significant.

The significant variables were the building-to-land ratio (Exp(β) = 0.004); size (Exp(β) = 1.002); subways within a 5-km radius (Exp(β) = 1.267); adjacent large-scale supermarkets (Exp(β) = 0.308); and elementary, middle, or high schools or colleges within a 5-km radius (Exp(β) = 0.968) (Table 9). In summary, when the building-to-land ratio is high, the bidding success rate decreases, and as the size of the project increases, the bidding success rate also increases. The higher the number of subway stations located within a 5-km radius, the better the connection to adjacent areas and, therefore, the higher the rate of bidding success. Additionally, the larger the size of the project, the higher the rate of bidding success, and the lower the rate of bidding success for adjacent large-scale supermarkets, elementary, middle, or high schools and colleges within a 5-km radius.

Table 9. Analysis results.

	Category	B	S.E.	Wald	DoF	*p*	Exp(β)
Step 1	Building-to-land ratio	−5.616	2.665	4.441	1	0.035	0.004
	Size	0.002	0.001	4.778	1	0.029	1.002
	Project suspension period	−0.023	0.015	2.266	1	0.132	0.978
	Subways within a 5-km radius	0.237	0.088	7.166	1	0.007	1.267
	Adjacent cinema complex	−0.439	0.317	1.922	1	0.166	0.645
	Adjacent large-scale supermarkets	−1.176	0.363	10.481	1	0.001	0.308
	Elementary, middle, or high schools or colleges within a 5-km radius	−0.032	0.016	3.955	1	0.047	0.968
	Constant term	5.166	1.663	9.647	1	0.002	175.137

4. Implications of the Comparative Analysis

To ensure the economic feasibility and profitability of public development projects, the analysis used similar variables for the two project types to identify the factors considered in the implementation of private development projects. To this end, a model was constructed for each project entity, and the analysis was performed accordingly. Significant variables in the rate of approval for public development projects and the rate of bidding success for private development projects are outlined in Table 10.

Table 10. Comparative analysis results.

Public Development Project		Private Development Project	
Variable	**Analysis Results**	**Variable**	**Analysis Results**
Total project cost	The higher the value, the higher the rate of approval	Building-to-land ratio	The higher the value, the lower the rate of bidding success
Adjacent subways/train stations	The higher the value, the lower the rate of approval	Size	The higher the value, the higher the rate of bidding success
		Subways within a 5-km radius	The higher the value, the higher the rate of bidding success
Adjacent large-scale supermarkets	The higher the value, the higher the rate of approval	Adjacent large-scale supermarkets	The higher the value, the lower the rate of bidding success
		Elementary, middle, or high schools or colleges within a 5-km radius	The higher the value, the lower the rate of bidding success

First, when increasing the total cost of a public development project and the size of a private development project, the rates of approval and of bidding success also increased. Considering that total project cost increases with project size because of the nature of real estate development projects, it would be reasonable to consider these two items as similar. That is, both public and private development projects increase their expectations of success through the principle of economies of scale. In the analysis results, subways/train stations and large-scale supermarkets are important factors to consider. These two variables had opposite results for public and private development projects. For public development projects, the rate of approval decreased with the increasing number of subways and train stations adjacent to the project site; however, for private development projects, the rate of bidding success increased. The opposite results are interpreted as differences in the project development method and the purpose of project implementation. For a public development project, it is common practice to develop on a previously secured public land rather than purchase private land. However, most of the areas adjacent to subways and train stations are located on private land. Therefore, to prevent negative effects such as civil complaints and project delays that occur in the process of purchasing private land, the development of public

land is necessary. Owing to the specific circumstances of South Korea, most development projects receive additional points in the appraisal process to secure governmental funding when the project site is public land, which has been considered in the interpretation of the results. Additionally, since most areas adjacent to subways and train stations tend to have basic infrastructure already in place, the development of the underprivileged area is more important when considering the project in terms of public interest and balanced regional development. In contrast, for private development projects, financial profitability is prioritised over economic feasibility. Therefore, the demand derived from areas adjacent to subways and train stations is predicted to be high, and development projects are mainly conducted in these areas. The rate of approval increased with the number of large-scale supermarkets in the public sector, while in the case of the private sector, the rate of bidding success decreased. This finding is thought to be the result of concerns over the increasing percentage of supply, rather than additional demand owing to excessive development around the project site and over the unsold estate due to an increase in sale price. For public development projects, unlike in the case of subways/train stations, the rate of approval increases when there are many large-scale supermarkets adjacent to the project site. Therefore, for investment appraisal approval, measures to consider competing facilities without interfering with the private sector should be explored.

5. Conclusions

This study analysed the factors that should be considered when selecting a development project site through a comparative analysis between private and public development projects to ensure the economic feasibility and profitability of public development projects among real estate development projects. Most public development projects focus on total project cost before the start of construction, in which most resources are invested, and there has been less interest in the adequacy of project site selection and operating expenses arising in the operational stage. In this context, the main environmental factors considered in public and private development projects were examined, and through direct comparative analysis, their characteristics, similarities, and differences were identified and the implications of the findings presented.

For public development projects, among the projects requested to undergo Central Investment Appraisal from 2016 to 2019, which is a preliminary procedure for large-scale projects in South Korea, 117 projects were recommended for additional review on location suitability and environmental factors such as similar and competing facilities to avoid duplicate investment. For private development projects, among the 484 sites of insolvent PF projects, project characteristics were investigated for the 32 business sites [12] determined by KAMCO, which were normalised and underwent bidding in the private sector. To this end, a model was constructed to select variables applicable to each project entity based on a previous study. In the variable selection process, for both types of development projects, the sphere of influence within a radius of 5-km was set to consider environmental factors and select the final variables. The results showed that for large total project costs and large-scale projects, both the public and private sectors showed positive responses to project development. This finding is similar to the trend in which various types of facilities are accommodated in a single building or for mixed-use projects for public social overhead capital (SOC) or private development projects. That is, through economies of scale, operating costs and rental fees can be saved by integrating facilities, with diverse types of facilities being enjoyed in a single building. Furthermore, in preparation for the post-COVID-19 period, this result also reflects a change in design development, in which the radius of action is increased with the expansion of public spaces. These results indicate that both the public and private sectors consider that increases in total project cost and size augment the possibility of success for a development project. In the analysis results, subways/train stations and large-scale supermarkets are important factors to consider. For public development projects, the more adjacent subways/train stations are available, the lower the approval rate is. This aspect is true because station areas are usually equipped

with basic infrastructure, and it is thus not reasonable to input additional public resources in such areas. In addition, these results reflect the recent trend of promoting development projects in areas with weak infrastructure as part of the balanced regional development and revitalisation of old city centres in South Korea. Another point to consider is that most areas around subways/train stations are private land rather than public. Therefore, to prevent negative effects such as civil complaints and project delays occurring in the process of purchasing private land, the public sector is thought to prefer developments on public land.

In contrast, for the private sector, the bidding success rate increased. This difference is interpreted as the expectation for additional demand derived from the accumulation of migrant and resident populations around the station area. This result deserves attention for public development projects as well. Regarding the construction of facilities, in all cases, the number of facilities is not the only relevant one, but also the fact that the areas are equipped with basic infrastructure that can provide adequate services in proportion to the population in the area. Therefore, for project areas such as sports, culture, and tourism, which can generate income for the public sector, demand should be estimated by considering the competing or duplicate facilities adjacent to the station area while not interfering with the private sector. If there are cases where the public requires the use of a facility, but it cannot be used because of inadequate SOC and infrastructure, this facility is provided by the public sector to improve the quality of life and enhance residential welfare. The rate of approval increased when there for many adjacent large-scale supermarkets, whereas the rate of bidding success decreased in the private sector. In the private sector, it is the result of concerns over the increasing percentage of supply rather than the additional demand owing to excessive development around the project site and unsold estate owing to an increase in sale price. In the public sector, unlike for subways/train stations, the rate of approval increased when there were many large-scale supermarkets adjacent to the project site. This result indicates a difference in approaches between the public and private sectors, in that for project areas with a strong public interest, it is difficult to consider whether it is wrong to conduct a development project in an area. This perspective is because if the private sector currently tends to avoid development projects adjacent to large-scale supermarkets, it is possible that it conducts the development project to improve the quality of life for local residents and revitalise the local economy in terms of public interest. Nevertheless, as described above, the public sector should make efforts to reduce the financial burden by seeking ways to obtain the most profits in the operating stage. Additionally, it is possible that there is an area with private development adjacent to a large-scale supermarket already in operation. For the future approval of investment appraisal, preparation is needed in advance to prevent duplicate investment without intruding in private sector projects already in operation.

The significance of this study lies in the following: (1) it examines the key factors for the selection of project sites for public and private development projects in the presence of competing and redundant facilities to avoid duplicate investment issues, and (2) it explores methods to increase the economic feasibility and profitability of public development projects through a direct comparative analysis with private development projects. However, because the purpose and direction of each development project are inconsistent, the same variables could not be applied to both project types. In addition, although the variables were selected using an objective estimation method, it is possible that they may vary depending on the perspectives adopted by public and private development projects. Finally, the results and the actual evaluation of experts may be different, and the inability to consider experts' evaluation is another limitation of this study. If enough data are published in the future, useful results can be derived from multiple perspectives through systematic improvement and supplementation of internal and external factors of development projects.

Author Contributions: H.S. conceived, designed, analysed, and wrote this paper. J.K. advised on this research, from concept to writing. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: This work was supported by a research grant from the Kongju National University in 2021.

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

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