A PROFIRABILITY MODEL BASED ON PRIMARY FACTOR ANALYSIS IN THE EARLY PHASE OF HOUSING REDEVELOPMENT PROJECTS

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ABSTRACT: An important decision-making element for the success of housing redevelopment projects is a prediction of the profitability of redevelopment. Risk factors influencing profitability were deduced through a review of the literature about profitability and a risk analysis developed by a survey of maintenance projects. In addition, a profitability prediction depending on the analysis of risk factors is necessary to judge the business feasibility of a project in the planning stages. A profitability prediction model of management and disposal method, which is calculated by proportional rate and which helps estimate contributions to profitability, is proposed to prevent difficulties in business development. The proposed model has the potential to prevent interruptions, reduce the length of projects, generate cost savings, and enable rational decision-making during the project period by allowing a judgment of profitability at the planning stage.

Keywords: Housing reconstruction project, Risk factors, Early phase profitability prediction, Profitability prediction model, Decision-making

1. INTRODUCTION

1.1 Background and Purpose of the Study

Fluctuations in real estate prices that began during the global financial crisis lead to the suspension of long term maintenance projects or changes in their nature due to issues such as: the increasing volume of unsold real estate in rural areas, the real estate recession, and decreased profitability and sales. As of December 2010, approximately 38%[1)] of total projects in the businesses (reconstruction, redevelopment: 1,508 cases) are delayed or suspended which causes many problems, such as 2,200 cases of civil litigation by residents (Law Firm estimates data in 2008) and dispute cases in the implementation stage[2)]. Therefore, a profitability prediction model, which is possible to implement using the present value evaluation model of management and the disposal method by proportional rate in considering risk factors in the planning stage, should be applied at the implementation stage when making profitability judgment based on the management and disposal plan of a maintenance project which has reached the middle stage.

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2) Ahn, J., "Analysis of the risk factors of the implementation stage of housing redevelopment, Journal of Construction Engineering and Management", Volume 12, Issue 4, 2011.7 edition, 100p, 2011

1.2 The Scope of Research Methodology

This study focuses on problems and risk factors that go into profitability prediction at the planning stage in the housing reconstruction project process. Profitability impact risk factor analysis was conducted to improve the profitability prediction process and method. Therefore, we try to predict the profitability by improving the process to the point of the planning stage (Step 1) at the implementation stage (Step 2), where a profitability determination is made by reorganizing the important impact factors based on survey of the literature and expert advice. It is suggested to estimate profitability at the planning stage using a prediction model of the management and disposal method, which is calculated by proportional rate.

2. THEORETICAL FRAMEWORK AND PREVIOUS RESEARCH

2.1 The Concept of Redevelopment

2.1.1 The Concept of Maintenance Projects

In Article 2 in Urban and residential environments maintenance act, maintenance projects refers to projects that maintain infrastructure in the maintenance section to restore the function of the city and to improve or construct houses or buildings in accordance with the procedures set forth in the Urban and residential environments maintenance act. Therefore, urban

maintenance projects can be called urban planning projects to pursue the efficient use of land and the urban environment and to promote the welfare of the public by making pleasant residential environment and efficient urban environment through maintenance planning as an institutional means.

2.2 Types and Procedures of Housing Redevelopment Projects

2.2.1 Types of Maintenance Projects

Based on the Article 2 in Urban and residential environments maintenance act, maintenance projects are divided into residential environment improvement projects, housing redevelopment projects, housing reconstruction projects, urban environment maintenance projects, residential environment management projects, and horizontal housing maintenance projects as shown in Table 1.

Table 1. Types of Maintenance Projects

Business	Definition
Residential environment Improvement Project	The project is performed in order to improve the residential environment in a residential area of urban low-income residents as a group where the maintenance of infrastructure is extremely poor and excessively dense old and poor buildings are located.
Housing redevelopment project	The project is performed in order to improve residential environment in an area where the maintenance of infrastructure is extremely poor and excessively dense old and poor buildings are located.
Housing Reconstruction Project	The project is performed in order to improve residential environment in the area where the maintenance of infrastructure is acceptable, but excessively dense old and poor buildings are located.
Urban Environment Maintenance projects	The project is performed in a commercial area or an industrial area in the center or sub-center of a city where the recovery of urban functions, such as an efficient use of land, or the activation of a commercial area is needed in order to improve the urban environment.
Residential environment Management project	The project is performed in order to maintain, conserve and manage the residential environment by maintaining infrastructure and expensing of joint-use facilities in areas of dense low-rise housing, including single-family homes.
Horizontal housing Maintenance projects	This project is performed in order to improve residential environment while maintaining the existing system of horizontal buildings and households in dense regions with the low-rise deteriorated buildings.

Source: Urban and residential environment maintenance act

2.2.2 The Process of Housing Reconstruction

Based on the Article 3 in Urban and residential environments maintenance act, the general process of housing maintenance and redevelopment projects is shown in Figure 1. The maintenance plan is established by mayors and governors of areas which have a population of more than 500,000 people per each 5-year unit of the10-year plan and where the maintenance of infrastructure is extremely poor and where excessively dense old and poor buildings are located in order to improve the residential environment.

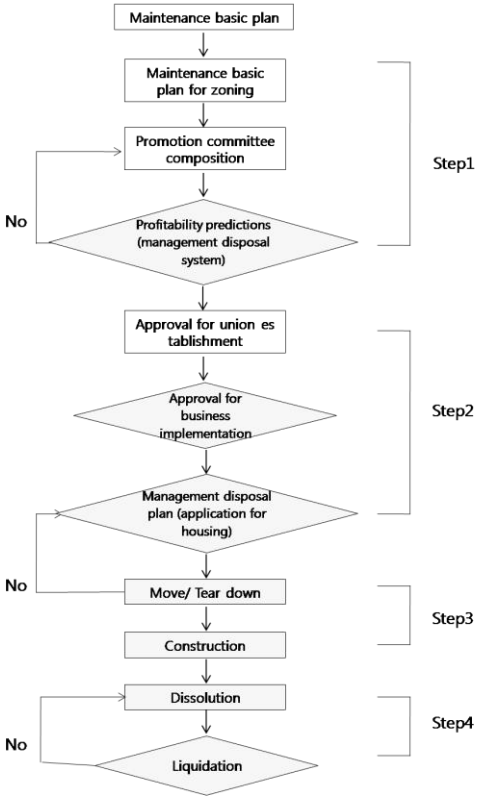

Figure 1. Housing Redevelopment Maintenance Procedures

2.3 The Problem with Housing Reconstruction Projects

2.3.1 The Main Problem of Housing Reconstruction Projects

The decision making of the promotion committee, a decision-making body in the early stages of the redevelopment project, acts as the determinants of total profit. Thus, the committee should provide opportunities to the companies to make decisions selectively by reviewing and deliberating the constraints on the projects and by providing reasonable direction through participation of experts in the field for preparation and planning related to profitability prediction. In addition, it is necessary to disclose and explain the decision-making process so that all stakeholders have all necessary information.

Table 2. The Main Problems and the Steps of Cost Variation

Step	Existing Calculation Point	The Main Problem
		Expenses Fluctuation Factor
Step 1 design	Promotion Committee Maintenance plan	Lack of due prediction
		Absence of profitability prediction
Step 2 plan	Unions, Enforcement Management, disposal plan	Lack of cost plan, conflict during the construction agreement
		lack of union's profitability prediction maintenance, changes of the contractor's proposal cost
Step 3 execution	Construction, completion	Increase in the cost due to design changes
		Design, construction, separation, fluctuations in the housing market
Step 4 Settlement	Permission of dissolution	Additional burden of cost
		Liquidation prediction

Source: Architectural Institute in 2012. 01 Volume 28, Issue 1 135p Table 6

2.5 Previous Studies

Previous studies are general studies[3] consisting of general investment and economic analysis and are mostly focused on the research presented on common problems and improvements of maintenance projects. Profitability prediction is made with the common development profit method at the planning stage for housing reconstruction projects. Studies on profitability prediction model at the planning stage are insufficient. Previous studies are shown in Table 3.

Table 3. Previous Research for Profitability Model

Research-ers	Object of Study	Research Contents	Analytical Methods
Song, S., (2001)	Reconstr-uction	Income-expenditure = development profit Profitability=A/B+C+D< Profitability exist 1> Profitability non-exist	General revenue analysis
Han, S., (2001)	Reconstr-uction	Old high-rise apartment reconstruction Study on the economic analysis of business	General revenue analysis
Jang, Y., (2006)	Reconstr-uction	Study on analysis of the determinants of low-density apartment district reconstruction profitability	Free ownership
Woo, K., (2007)	Reconstr-uction	Free ownership calculation risk variables of evaluation indicators, Probability distribution	Factor analysis Sensitivity analysis
Kim, D.	Overseas Construc-tion	Deduction of profitability influential factors a universal model of regression analysis	Factor analysis Discriminant analysis
Jang,W., (2011)	Housing Redevelop-ment	Location and comparing plan elements and business profitability analysis of housing redevelopment project	Discriminant analysis

3. MAINTENANCE PROJECT STATUS OF HOUSING REDEVELOPMENT

3.1 The Seoul Metropolis Housing Redevelopment Status

The status of the housing redevelopment is shown in Table 4. 20 “Gu” (district) are listed among the 25 Seoul metropolitan boroughs and there are 269 projects in total. The first place is Seongbuk-gu with 47 projects and the second place is Eunpyeong-gu with 29 projects, and the third place is Seongdong-gu with 26 projects. Housing redevelopment projects contain many potential problems in each step so that it was necessary for a significant profitability prediction to perform targeted surveys of housing redevelopment owners to find out how many projects were in progress and to disclose information about profitability prediction at the planning stage**.**

3) Hahn, S., “Study on the economic analysis of aging high-rise apartment reconstruction projects”, Master's thesis, Konkuk University, pp. 49~56, 2001

Table 4. Seoul Housing Redevelopment Maintenance Projects

Administrative Area	Redevelopment Business Number	Administrative Area	Redevelopment Business Number
Yangcheon-gu	8	Jongno-gu,	9
Guro-gu	3	Jung-gu	7
Geumcheon-gu	2	Seongdong-gu	26
Mapo-gu	17	Songpa-gu	2
Yeongdeungpo-gu	15	Jungnang-gu	3
Dongjak-gu	22	Dobong-gu	3
Gwanak-gu	7	Nowon-gu	7
Eunpyeong-gu	29	Gangbuk-gu	10
Seodaemun-gu	18	Seongbuk-gu	47
Yongsan-gu	11	Dongdaemun-gu	23
Total		269	

Source: Seoul Metropolitan Government cleanup system

4. SURVEY

4.1 Overview of the Survey and Analysis of Methods

4.1.1 Overview of the Survey

In this study, factors influencing profitability were investigated and analyzed. The survey was conducted by visiting and making a personal interview with a structured questionnaire. Its period was five months from September 2011 to January 2012, during which time a total of 600 surveys were distributed and 421 surveys were recollected out of which a total of 393 surveys were used.

An empirical analysis was performed and all surveys were tested at a significance level of 0.05. 393 surveys used in this study are statistically significant ($p = 0.0493$).

The survey contents went through statistical process control in order to perform this study. First, frequency analysis was conducted to learn the profitability prediction of respondents. Second, predictability and accuracy were examined by measuring confidence between items for profitability prediction, as determined with Cronbach's α coefficient. Third, T-test, one-way ANOVA, and chi-square test (x2) were conducted to find out the difference between profitability predictions according to the general characteristics of the respondents. Significant differences were examined by Scheffe's multiple range tests.

Table 5. Step-by-step the Importance of Reliability, the Profitability Factor

Division		Question Numbers	Reliability
Profita-bility Factors	Legal Institutional Environment	13	.812
	Bidding Information	3	.852
	Project Characteristics and Environment	12	.817
	Relationship between Organizational Members	6	.798
	Construction Management Skills	5	.809
Profitability Factors, the Importance in each Step		39	.926

4.3 The Analysis of the Factors Affecting Profitability

4.3.1 The Analysis of the Factors Affecting Profitability

Among the factors affecting profitability, 'real estate policies and institutions' are the most common factors (40.2%) and owners were never informed about profitability in 76.8%. This shows that the demand of profitability prediction at the planning stage is absolutely necessary.

Table 6. Profitability Step-by-Step Importance Factor

Division		Minimum value	Maximum value	Average	Standard deviation
Profitability Factors	Legal Institutional Environment	1.00	5.00	3.52	.54
	Bidding Information	1.00	5.00	3.75	.83
	Project Characteristics and Environment	1.00	4.92	3.60	.52
	Relationship between Organizational Members	1.00	5.00	3.76	.64
	Construction Management Skills	1.00	5.00	3.70	.70

4.3.2 The Need to Build a Prediction Model

A profitability prediction model is necessary at the planning stage in order to solve the problems of business interruption and delay due to the lack of providing profitability prediction which can be the cause of conflicts between the organizational members as shown in the survey results. Therefore, profitability prediction model for the current value and future value are proposed by applying proportional rate equation at the step for management and disposal.

5. PROFITABILITY PREDICTION MODEL

5.1 Profitability Prediction Model of the Present Value

Profitability prediction of the model based on the proportional rate of management and disposal method are the same as the development profit after deducting sales income and expenses as shown in existing models of free shares. The model is used generally at the step for management and disposal. Thus, the profitability prediction model was brought to the planning stage as shown in Table 9 based on the proportional rate of management disposal, which is applied at the management and disposal step, so that this allows contributions to the present value to be calculated. In order to calculate the right value, the previous price is supposed to be calculated. However, it is difficult to estimate the correct value when applying the profitability prediction by the proportional rate of the current value at the planning stage because the time to evaluate is after project implementation. The outline right value can be calculated on average when multiplying the individual official land price and multiples of the difference between current price and the official land price. The current value of the model is shown in Table 7.

Table 7. Profitability Projections for the Present Value Model

Item	Calculation Standard
Sale Gross Income	Apartment sales income + Facilities sale income
Total Expenditure Expenses	Construction cost + Project costs
Development Profit	Sale total revenue - Total expenditure expenses
1) Proportional Rate	Development profit ÷ Added information valuation
2) Right Value	Individual equity × Proportional rate
3) Contributions	Applying equilibrium price - Right value
Profitability Standard	Proportional rate 100% > Profitability exist

1) Proportional rate: This shall be calculated by calculating estimated appraised value by applying the multiple prices (compensation rate) to the official land price with the market price. Typically, 100% proportional rate is a rate close to the market price based on whether to have profitability. Proportional rate 4) can be calculated at the step for management and disposal by using the equation shown below.

$$P = A - \frac{B}{C} \times 100 \quad (1)$$

P: Proportional rate (%), A: Total income amount, B: Total expenditure amount, C: Previously appraised value.

With the proposed formula of the present value for estimating proportional rate at the planning stage, the total incomes and disbursements can be calculated. Since the previous appraised value is evaluated at the point of project implementation, current official value can be calculated by the following equation (2) and estimated appraised value can be derived by multiplying official land price and the multiple of the difference of current market price and official land price for the profitability prediction at the planning stage.

$$P = A - \frac{B}{C1} \times 100 \quad (2)$$

P: Proportional rate (%), A: Total amount income, B: Total expenditure amount, C1: Estimated appraised value

※ Compensation rate: Estimated method of previously appraised value and the difference between the market price and the official land price shall be applied as a percentage against official land price.

2) Estimated appraised value: The previously appraised value point is calculated by multiplying multiples of the official land price and the market price against official land price. It uses calculation method at the planning stage due to the point of project implementation.

5.3 Implications

In the case of the profitability prediction model of management and disposal method proposed based on the present value, a model calculated by applying the fluctuation rate to the present value considering the future value for each progression point can make a contribution to solving problems with maintenance projects such as delays and conflicts by applying profitability prediction models at the planning stage.

6. CONCLUSIONS

This study proposed ways to improve the existing housing reconstruction project process with the profitability prediction in the planning stage by analyzing the main problems in profitability prediction management. In this process, the analysis of the factors affecting profitability, the improvement of the process, and current value and future value of the model for the profitability prediction are presented.

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