# INTEGRATED PERFORMANCE MANAGEMENT FOR WHOLE PHASES OF URBAN RENEWAL MEGAPROJECTS

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**ABSTRACT:** Construction projects are vulnerable to diverse internal and external factors, requiring systematic and consistent performance management along the entire life cycle of a project. In particular, urban renewal projects have a range of performance measures, including policy reconciliation and permits, project development, project financing, design, construction, and occupancy and maintenance. This requires a program-level megaproject approach, which integrates each stage of a project as well as variety of stakeholders' interests in pursuing a project from different perspectives. However, previous research on performance management has focused especially on the limited scopes of factors, including cost, quality, and schedule at the project level or on financial factors at the firm level. Given the lack of current approaches, this study suggests an integrated and systematic performance management scheme to control urban renewal megaprojects at the broadened perspectives of the program level. To this end, this study adopts the balanced scorecard approach and elicits key performance indices associated with various project configurations. Finally, an algorithm is presented for quantitatively assessing the level of performances along whole life cycle of urban renewal megaprojects.

*Keywords: Performance Management, Urban Renewal, Megaproject, Program Management*

## 1. INTRODUCTION

By year 2015, the size of the Korea urban renewal projects will be more than US$4.2 billion, indebted for continuous growth [10]. Along with the deterioration of aged cities, large-scale urban renewal (hereafter, referred to as UR) is becoming a growing trend in Korea's construction industry. UR is significant not only in Korea but also all over the world today. Many successful UR cases have been reported across the world: Roppongi Hills in Japan, La Defence in France, and Bilbao in Spain, among others [14]. In addition, a number of UR projects are now in progress or under consideration in developed and developing countries such as Korea, Vietnam, and Kazakhstan. UR projects contain diverse functions such as residence, commerce, business, public works, culture, leisure, among others and involve revitalizing current complex spaces vertically and horizontally. UR projects also have a great impact on local society and residences, regional economy, and the nation as a whole. Therefore, UR projects need to be viewed as megaprojects that should be managed not as the sum of single projects but rather as a systematic program.

This study aims to establish performance indicators of UR megaprojects and to support an effective management system from the perspective of public participants. This study systemizes the performance hierarchy from the program level all the way to the activity level. Further, we consider not only construction progress performances but also socio-economic and public perspective such as sustainability and customer satisfaction.

To this end, the derived performance indicators are classified under the life-cycle stages, and, finally, this paper provides an integrated performance assessment framework for UR megaproject management.

## 2. LITERATURE REVIEW

### 2.1 Construction Megaproject

Megaprojects are typically defined as those that cost exceeds more than US$1 billion [2]. However, this is more complex to define with just a numerical threshold. Fiori and Kovaka [2] presented five key characteristics of megaprojects: magnified costs, extreme complexity, increased risk, lofty ideals, and high visibility. These features lead to more complexity and significant challenges to stakeholders than is the case of typical projects. Thus the performance of megaprojects tends to be remarkably poor in terms of cost and time performance. A significant gap occurs in many cases between what is expected from the enormous investment of resources and what is actually obtained [3], [9].

Flyvberg et al. [3] argued that the main cause of those overruns was lack of realism, in other words, delusion of success. In a similar way, Merrow [9] discussed that

megaproject outcomes were strongly affected by cultural, legal, and political factors. In addition, institutional factors related to environmental regulations and innovations also play an important role in megaproject outcomes [9]. Subsequently, unsystematic project planning or failure to properly and effectively manage complex social, legal, political, and environmental uncertainties often produces poor performances and costly consequences during the course of megaproject development.

According to the Korean Urban Renaissance Center [7], the three objectives of UR are (1) to repair and develop existing decayed urban district in a systematic way, (2) to stimulate unique regional socio-cultural characteristics through connecting diverse participants, and (3) to rehabilitate an urban district, including the regional industry and the economy overall. Therefore, UR projects portray the following megaproject perspectives: (1) to require large scale budget investment, (2) to confront complex challenges from social, legal, and political uncertainties, (3) to satisfy public benefits by incorporating a higher standard of public concern, and (4) to create quality landscapes, skylines, and outlooks by harmonizing with the existing surroundings.

### 2.2 Performance Management in Construction

There are a number of studies on measuring and assessing the performance of a construction company or organization, and even particularly for a construction project from several perspectives. As an example, Egan presented the Key Performance Indicators (KPI) to assess the performance of construction projects [1]. The KPI is classified into two categories: project performance and company performance. The Construction Industry Institute also developed the Benchmarking & Metrics (BM&M) that are composed of six categories: cost, schedule, safety, changes, rework, and productivity [15].

While there have been numerous studies on developing project performance measurement methods and systems, there is no well-defined research as yet of that considers the unique characteristics of complex megaprojects, particularly for the domain of UR. There is thus a need to establish performance indicators and measurement system for successful UR that takes into consideration megaproject features along the entire life-cycle and many diverse functions.

### 2.3 Balanced Scorecard

The Balanced Scorecard (BSC) is one of the most popular performance management frameworks proposed by Kaplan and Norton [4]. This enables establishment of performance indices and application for performance evaluation from both financial and non-financial perspectives. The BSC is composed of three sub-categories: customer, internal process, and learning and growth [4].

Since the BSC provides not only performance indices but also a systematic process to convert strategic business objectives to consistent indices, many researchers have tried to apply the BSC approach to construction domain at corporate or project perspectives [11, 12, and 16]. The BSC is an administrative tool that can assist users to take solid shape against strategies and vision and is also used as a framework for organizational communication and asset management [5]. The BSC thus can help to develop UR mega-projects' strategies and vision into critical success factors (CSFs) and to establish performance indices related to CSFs .

## 3. PERFORMANCE MANAGEMENT SCHEME

Previous performance frameworks are contingent on construction progress data at the single project level [1, 13, and 15]. However, in the case of UR megaprojects where there exist numerous sub-projects and a huge amount of data at a project level, existing approaches are not appropriate to apply. Given the lack of current approaches, thus, UR performance is managed from a synthesized program as well as project level to understand the integrated and coordinated values constituting UR. The Korea Urban Renaissance Center (KURC) [6] proposed the general life-cycle of a UR megaproject consisted of five phases: project conception, planning and feasibility study, preparation, project execution, and operation and maintenance.

Fig. 1 shows the UR performance management scheme; the performance levels are arranged vertically while, the life-cycle is displayed horizontally.

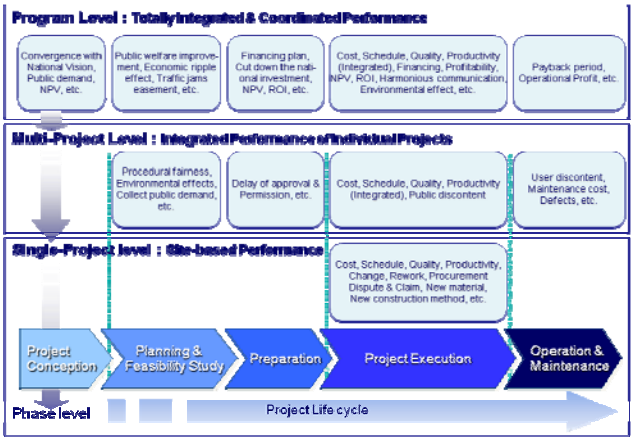


**Figure 1.** UR Performance Management Scheme (revised from KURC [6])

### 3.1 Performance Indices

Since UR megaprojects have a great impact on the local community and national economy; they possess the characteristics of public facilities, not just a private development. In this respect, the general public should be viewed as customer of UR in connection with public agencies and private investors. Project-related factors such as cost, schedule, quality, and others are also considered to be more direct CSFs.

As for the innovation category, there might be material, technological, or methodological innovations for improving the benefits of a megaproject. Lastly, with growing public concerns about the environment and sustainable development, environmental impacts have become more important issues for UR projects. Therefore,

the main performance categories based on critical factors of UR megaprojects can be partitioned into five classes: customer, financial, execution process, innovation, and sustainability perspectives. Figure 2 shows the UR performance categories and relationship with BSC.

In addition, KURC proposed a UR megaprojects' work breakdown system that is composed of eight main categories: (1) general issues (program management), (2) general facilities, (3) transport facilities, (4) sewage and waste disposal sites, (5) resource-supplying facilities, (6) residential and office buildings, (7) public facilities, and (8) health, rest, and religious facilities. Therefore, performance indices and an overall framework were developed to match the work breakdown system. In this paper, only general issues are presented for the sake of brevity (see Table 1).

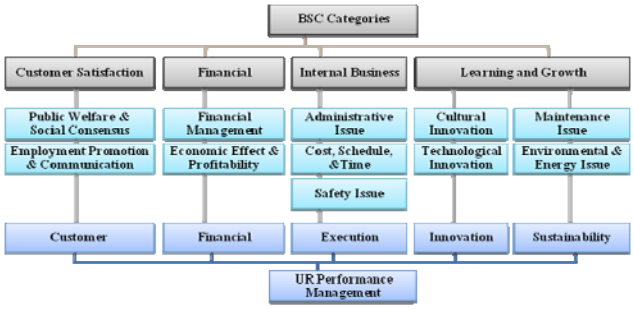


**Figure 2.** Relationship between BSC and UR Performance

### 3.2 Performance Assessment Algorithm

A UR megaproject is composed of multiple projects and there are diverse performance indices. Moreover, depending on the situation, project managers may want to investigate the performance from different level. Therefore, this study proposed a simple performance assessment algorithm.

·*Performance Index Level*: Each performance index is assigned a scoring method through a literature review and expert interviews. For example, the "harmonization with the national plan" is inputted by a program manager on a seven-point Likert scale, and the "revitalization of a lagged old city" is marked from the standard developed by the Korea Development Institute [5]. Input values could be converted to seven-point scores in terms of their mean value and the standard deviation (see Figure 3).

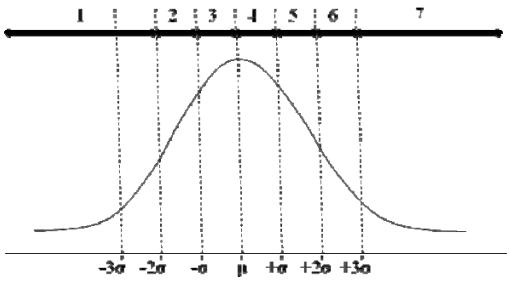


**Figure 3.** Input Normalization for Scoring

·*Performance Category Level*: To sum up the scores of each index, weight assignment is required. This research proposes to develop each weight by Analytical Hierarchy Process (AHP) or by the project manager's perceptions depending on the characteristics of the project. Since this study does not include the weight assignment process, uniform weight is assumed.

As shown in equation (1), the scores of each index are summed up in terms of their relative importance.

$$(s_1*w_1)+(s_2*w_2)+\ldots+(s_n*w_n) = score\ of\ category\ldots..(1)$$

*where* $s_i$ = *score of* $i^{th}$ *index*
$w_i$ = *weight of* $i^{th}$ *index in the category*
$(w_1 + w_2 + \ldots + w_n = 1)$
$n$ = *number of indices in the category*

**Table 1.** Performance Framework and Indices: General (Common) Issues

| Phase | Performance Category | | | | |
|---|---|---|---|---|---|
| | Customer Perspective | Financial Perspective | Execution Perspective | Innovation Perspective | Sustainability Perspective |
| Project Conception | Convergence with national plan<br>… | Financing plan<br>… | Work progress<br>… | | Environmental feasibility<br>… |
| Planning and Feasibility Study | Revitalization of lagging city<br>Reflection of public opinion<br>… | Economic value added through UR<br>Ripple effect<br>… | Work progress<br>… | Innovative conception<br>… | Environmental effect assessment<br>… |
| Preparation | Green tract of land supply<br>… | Sales profit<br>Sales rate<br>… | Work progress<br>Administration<br>… | Effect of design-phased VE<br>… | Energy efficiency<br>… |
| Project Execution | Public discontent<br>Disputes & claims<br>… | Fund raising<br>… | Work progress<br>Cost performance<br>… | Effect of construction-phased VE<br>… | Noise prevention<br>Dust prevention<br>… |
| Operation and Maintenance | Public discontent<br>… | Return on investment<br>… | | | Maintenance cost<br>… |

This is applied to the project level and the program level through a similar process.

*score of a project*
*= ∑(score of category*category weight)……..(2)*
*score of a program*
*= ∑(score of project*project weight)……..(3)*

## 4. ILLUSTRATIVE EXAMPLE

The proposed framework is applied to a sample project that has three phases: project conception, planning and feasibility study, and preparation. First, the input values of the relevant performance indices are collected and converted to the performance score in terms of mean values and standard deviations. However, since A7 and A8 indices represent the present states, the statistics are not applied exceptionally in that case. An individual index's score is summed up as performance categories scores, phase's scores, and the total program score according to equations (1), (2), and (3) as stated above. Table 2 shows the UR megaproject performance index calculation example where a perfect performance reaches a maximum of '7' worth.

## 5. CONCLUSION

As discussed, most studies on performance management in the construction domain have focused on the project or corporate level. However, in the wake of the increasing number of urban renewal projects, a performance management framework at the program level is necessary. Since urban renewal projects portray broader features of performance measures, encompassing policy reconciliation and permits, project development, project financing, design, construction, and occupancy and maintenance, this requires a program-level megaproject approach, which integrates each stage of a project as well as various stakeholders' interests in pursuing a project from different perspectives.

This study suggested a preliminary integrated and systematic performance management scheme to control urban renewal megaprojects at the broadened perspectives of the program level. This study also developed performance indices based on the balanced scorecard approach. Then, an illustrative example was presented to demonstrate the assessment algorithm in further detail.

**Table 2.** Performance Indices Calculation Example: General Issues

| Phase (w) | Performance Category (w) | Index Code | Weight | Mean | Standard Deviation | Input | Score |
|---|---|---|---|---|---|---|---|
| Project Conception (0.33) | Customer (0.2) | A1 | 1.0 | 4 | 1 | 5 | 5 |
| | Financial (0.2) | A9 | 1.0 | 4 | 1 | 7 | 7 |
| | Execution (0.2) | A15 | 1.0 | 1 | 0.5 | 0.8 | 7 |
| | Innovation (0.2) | A7 | 1.0 | O/X | - | O | 7 |
| | Sustainability (0.2) | A8 | 1.0 | O/X | - | O | 7 |
| | *Project conception score = (5*0.2)+(7*0.2) +(7*0.2) +(7*0.2) +(7*0.2) = 6.6* | | | | | | |
| Planning and Feasibility Study (0.33) | Customer (0.2) | A2 | 0.5 | 4 | 1 | 6 | 6 |
| | | A3 | 0.5 | 0.5 | 0.1 | 0.3 | 2 |
| | | *Customer score = (6*0.5)+(2*0.5) = 4.0* | | | | | |
| | Financial (0.2) | A10 | 0.33 | 4 | 1 | 7 | 7 |
| | | A11 | 0.33 | 4 | 1 | 4 | 4 |
| | | A12 | 0.33 | 4 | 1 | 5 | 5 |
| | | *Financial score = (7*0.33)+(4*0.33)+(5*0.33) = 5.28* | | | | | |
| | Execution (0.2) | A16 | 1.0 | 0.5 | 0.1 | 0.8 | 7 |
| | Innovation (0.2) | A20 | 1.0 | 0 | 1 | 0 | 4 |
| | Sustainability (0.2) | A23 | 1.0 | 4 | 1 | 4 | 4 |
| | *Planning and feasibility score = (4.0*0.2)+(5.28*0.2)+(7*0.2)+(4*0.2)+(4*0.2) = 4.85* | | | | | | |
| Preparation (0.33) | Customer (0.2) | A4 | 0.33 | 0.5 | 0.1 | 0.4 | 3 |
| | | A5 | 0.33 | 4 | 1 | 4 | 4 |
| | | A6 | 0.33 | 0 | 1 | 3 | 3 |
| | | *Customer score = (3*0.33)+(4*0.33)+(3*0.33) = 3.3* | | | | | |
| | Financial (0.2) | A13 | 0.5 | 4 | 1 | 6 | 6 |
| | | A14 | 0.5 | 0.5 | 0.1 | 0.6 | 5 |
| | | *Financial score = (6*0.5)+(5*0.5) = 5.5* | | | | | |
| | Execution (0.2) | A17 | 1.0 | 0.5 | 0.1 | 0.9 | 7 |
| | Innovation (0.2) | A18 | 0.5 | 0 | 1 | 3 | 7 |
| | | A19 | 0.5 | 0 | 1 | 0 | 4 |
| | | *Innovation score = (7*0.5)+(4*0.5) = 5.5* | | | | | |
| | Sustainability (0.2) | A24 | 0.5 | 4 | 1 | 4 | 4 |
| | | A25 | 0.5 | 4 | 1 | 5 | 5 |
| | | *Sustainability score = (4*0.5)+(5*0.5) = 4.5* | | | | | |
| | *Preparation score = (3.3*0.2)+(5.5*0.2)+(7*0.2)+(5.5*0.2)+(4.5*0.2) = 5.16* | | | | | | |
| *Total program score (project conception to preparation) = (6.6*0.33)+(4.85*0.33)+(5.16*0.33) = 5.48* | | | | | | | |

However, this study requires future study for improvement: (1) since the relative importance weights used in this study were assumed to be uniform, further verification is required, and (2) validation of the proposed framework is required through data collection from real UR cases. Then more advanced performance management by comparison with other projects will be also possible. With all the modifications/improvements so far, the proposed performance framework is expected to assist UR project managers in objectively understanding the current situation and identifying areas that require more administration.

## 6. ACKNOWLEDGEMENTS

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