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Selecting Optimum Management Practicesin Pre-construction Phase Considering Project Characteristics

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Abstract: ***The importance of project performance management as an alternative for solving problems is rising, which are followed by the hardships of managing construction project in the construction industry. This research classifies and applies the improvements made by the operator's work, in order to apply factors of success on the construction project, as performance management factors. In addition, in order to predict the results reflecting the project characteristic of performance management factor un-improvable by the operator in the initial stage of construction, the effect of project characteristic to the performance was drawn by performance difficulty. Also, in order to improve the predicted performance, researches on setting valid best practices according to the performance territory through a correlation analysis between the best practices improvable through the operator's work, and the performance was made.***

Keywords: Project Performance Management, Performance Improvement, Pre-Construction Phase, Construction Management Method, Project characteristics, Project Performance, Performance level of difficulty

I. INTRODUCTION

With an increase in difficulty of construction project management in the construction industry, the importance of project performance management is being emphasized as an alternative that can solve this problem. Construction companies need to eliminate inefficient aspects of construction projects, understand their current standard and benchmark model projects to establish a rational project management strategy and conduct performance management that can improve project results (Cha, Hee-sung et. al., 2008, Yoo, Il-han, 2004, Shin, Yong-il et. al., 2005).

The U.S. CII (Construction Industry Institute) has made comparison of performance evaluation of projects and benchmarking possible, and is presenting best practices for improvement of results by a project builder. In addition, many existing studies on the elements of success that have an effect on project performance use multidimensional indexes and methodologies to present best practices as benchmarking information to improve performance.

However, although many existing studies have been conducted on the elements that have an effect on the success of a project, the study results are failing to receive wide approval from the construction industry. This is because elements of success are mixed up as independent variables, factors related to the project or project management tools, and there is no specific categorization of each field (Albert, 2004). Thus, the elements that have an effect on the success of a project are not divided into whether they can be improved according to the efforts of the builder and are mixed up, making it difficult to effectively apply the elements for after-project management. Also, despite the fact that the difficulty of performance extraction is different according to the different characteristics of each construction project, there is no reflection of this aspect.

As a result, builders have a tendency to depend on experience when establishing performance management strategies appropriate to the characteristics of each project, and there is the problem of inefficiency when attempting to make strategic decisions on selection and degree of execution for effective benchmarking of best practices to specialized projects. This is why domestic project performance management is currently unable to fulfill the function of performance improvement, and is remaining just as an idea of performance evaluation.

Therefore, this study attempted to make establishment of an effective performance management strategy that reflects the characteristics of a project in the early stages of construction possible. The effects of project characteristics on results were predicted, and a method of selecting specialized optimal best practices that can improve predicted performance was studied.

The aim of this study was to predict the effects of the characteristics of a project on performance and present a method to select specialized optimal best practices that can improve predicted results, to make establishment of an effective performance management strategy that reflect project characteristics in the early stage of construction possible.

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The process of study was divided into 1) analysis of preceding studies and extraction of problems, 2) extraction of elements for project performance management, 3) extraction of a project performance level index, 4) extraction of a construction practice that affects project performance, 5) presenting an algorithm to select the optimal construction practice.

II. Elements Of Performance Management

A. Project Performance Index

The results of the preceding study, "Development of a Field-focused Risk Management Optimization Program through Development of a Construction Project Performance Prediction System" (Cha, Hee-sung et. al., 2007) and the results of other domestic and foreign studies were used to define the range of performance as summarized in Table 1, below.

TABLE I
PROJECT PERFORMANCE INDEX

Field of performance	Definition and method of measurement
Contract management performance	Measured with the cost and time following a conflict. Performance related to project success following effective contract management.
Cost management performance	Measured with the increase rate of the budget in the early stage and the accuracy of predicted cost. Performance related to effectively completing a project within a set budget.
Schedule performance	Measured with the increase rate of the time planned in the early stage and the accuracy of predicted schedule. Performance related to effectively completing the project within the set amount of time.
Quality performance	Measured with the rate of materials passing the quality test and cost and frequency of redone work. Performance related to effectively materializing the quality required by the client.
Risk management performance	Measured with the rate of reserves used and the increase of cost due to a change in design. Performance is related to effective management of various risks that can arise during a project.
Safety and environment performance	Measured with the rate of accidents in the field, the rate of waste that is created, and the number of civil complaints. It is comprehensive performance related to existing safety performance and environmental performance.
Productivity	Measured as productivity per employee and laborer.

The 7 fields as defined in Table 1 were used to measure each type of project performance and apply it to the study.

B. Project Characteristics Index And Construction Practice

Project characteristics and construction practices were collected by literature review (Albert 2004, CII 2001, Chua 1999).

This study divided the elements of project success to project characteristics and construction practice according to whether or not improvements are possible through the efforts of the developer.

TABLE II
CONSTRUCTION PRACTICES

Construction practices	Definition
Establish goal	Setting and sharing of performance goals
Establish cooperative relationships	Degree of cooperation between participants for successful project operation. (attitudes towards each other)
Create team	Project operation structure
Benchmarking	Feedback on similar performance (analysis and level of application)
Value engineering	Value engineering, review of constructability and other degrees of operation (VE operation standard)
Construction plan	Planning for start-up, temporary plan, division of work, solution to delay of construction (write up construction plan)
Risk management	Awareness, evaluation, establishment and degree of execution of alternative process
Award system	Incentive, penalty [Clearness of award evaluation standard (specific standard)]
Change control	Convenience of document management, plan updates
Quality control	Education, materials auditing, checking for defects
Cost, process management	Comparative analysis of execution in comparison to plan (measurement, analysis, update)
Materials management	Execution of materials management
Cooperating companies management	Whether there is feedback on evaluation of subcontractors (whether there is a tool of evaluation and the results are later reflected to construction)
Information system	Whether construction is managed through informatization and electronification like PMIS
Application of cutting-edge technology	How much cutting-edge technology such as RFID, 3DCAD, ROBOT, GPS (Global Positioning System), PDA, USN (Ubiquitous Sensor Network) are applied to the field and used

Documentary research was conducted on the elements of project success and whether or not they should be improved were considered to divide them according to project characteristics and pools of construction practice, and extract indexes. The pools with similar significance were combined, and categories with an upper and lower relationship were given levels and grouped to create a pre-index. The pre-index extracted was verified to see whether it was appropriate for the domestic project field through advice from the field, and elements that defined the characteristics of current project and construction practices used were additionally extracted and applied. The indexes extracted through this process are shown in Tables 2 and 3. The indexes were used for the study as elements of performance management.

TABLE III
PROJECT CHARACTERISTICS INDEX

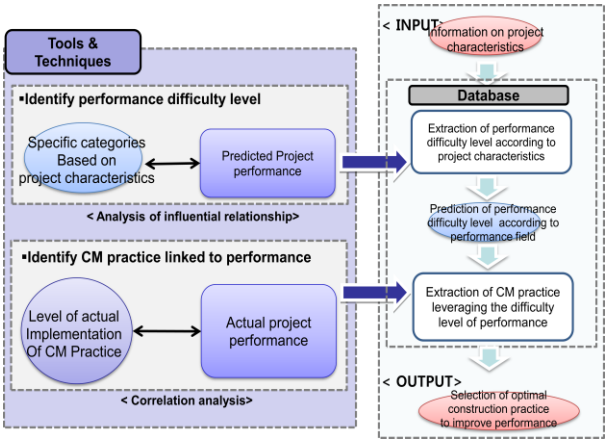
Field of characteristics	Characteristics index	Specific fields and definition
General characteristics	Project type	Divided into residences, commercial, industrial, education, culture and combined facilities.

	Project scale	Characteristics defined by standards such as contract amount, above land and below land scale, surface area.
	Bidding method	Project contract method defined by divided design and construction orders, turn-key, CM order, etc.
	Method of deciding contract amount	Amount deciding method defined by total amount contract, contract based on quote, actual cost calculation contract, etc.
	Land conditions	Condition of surrounding land such as inner city constructions, new city development, etc.
	Ground conditions	Condition of ground decided by complexity of foundation and difficulty level of construction.
Characteristics of participants	Characteristics of client structure	Whether the client is a public facility or private facility.
	Scale of client structure	Characteristics according to scale of client structure.
	Experience of client conducting similar projects	Index of whether the client has experience conducting similar projects -- defined as none, 1-2 times, 3 times or more.
	Clearness of requirements of client	How specifically the requirements of the client are defined in the specs sheet and plan.
	Cooperating attitude of designer	How much aid the designer offers in the early stage of construction, including constructability review and VE.
	Scale of designing company structure	Number of employees of designing company -- defined as over 500, 50-500 and under 50 people.
	Experience of the designer conducting similar projects	Index on experience of designer conducting similar projects.
	Number of similar projects conducted by builder, performance	Average performance according to whether the builder has experience conducting similar projects.
System and environment characteristics	Conditions of system	Level of difficulty of applied system when conducting project.
	Financial conditions	Stability of financial market while conducting project -- defined as increase rate of raw materials cost, etc.
	Social conditions	Ease of supply and demand of labor workers when conducting project.

III. Selection Of A Construction Practice That Reflects Project Characteristics

A. System for selection of a construction practice that reflects project characteristics

The ultimate goal of this study is to improve performance through performance management. In order to reach this goal, this study aims to propose the optimal construction practice that reflects project characteristics in the early stage of construction, and improve performance. As examined above, for effective performance management, performance needs to be measured objectively for comparative analysis of the project results with the standard performance of the construction industry, and performance needs to be managed to make improvements possible through benchmarking. In addition, project characteristics that affect project performance and cannot be improved should be reflected, and multidimensional performance management through which construction practices that can be improved and benchmarked is needed. Therefore, this study proposed the optimal construction practice selection system that reflects project characteristics for construction project performance management, as shown in Figure 1.



FIGUREI
Optimal Construction Practice Selection System

The structure for selecting optimum management practice was combined by two relationships. The first relationship is between project characteristics and performance. Another one is between performance and management practice. First of all, the relationships between the project characteristics and performance were clarified for selecting optimum management practices. The project characteristics about the impact on each category of performance were quantified through the expert survey. It was surveyed by experts that the value of project type (residential building, commercial building, industrial building, etc.) affects on the performance (cost, schedule, quality, etc) from -3 to +3 scale. The higher value means that easy to improve performance. The difficulty level of performance was derived by combining survey result. Causal relationship between performance

and difficulty level was estimated using regression analysis. It is possible to predict performance using project characteristics in the early stage. And then, it was performed to correlation analysis between project performance and management practice to find the correlation coefficients. The correlation coefficients are used to find optimum management practice for improving the performance level. It is able to predict performance level using project characteristics in the early project stage. And it is also able to select optimum management practice to improve their performance level.

B. Management Method Selection Algorithm That Reflects Project Characteristics

Based on the theories presented above, the process shown in Figure 2 was created and applied to select the optimal construction practice. The optimal construction practice is selected by the group of rules that select the best construction practices based on the entered data. The relationship of influence on performance of project characteristics was calculated as performance difficulty level according to the system and ideas presented in 3.1, and the correlation according to performance was analyzed. Based on the analysis results, when information on the project characteristics was provided performance difficulty level is predicted, and construction practices that can be benchmarked for areas that have difficulty with performance are presented.

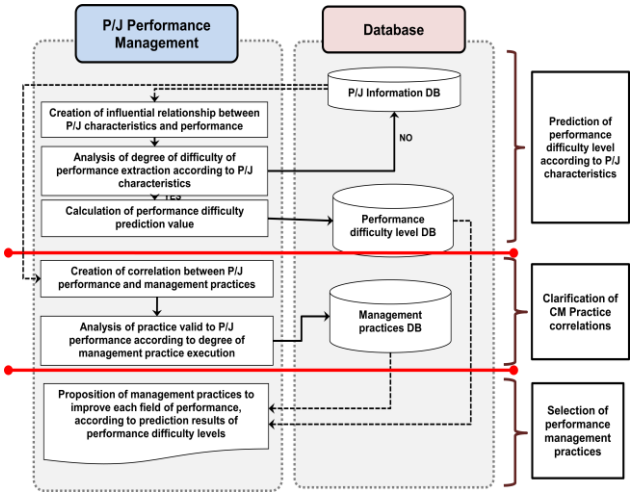


FIGURE II.
OPTIMAL CONSTRUCTION PRACTICE SELECTION ALGORITHM

IV. CONCLUSION

This study divided elements of project success according to whether there could be improvements through efforts of the builder, and applied them as project performance management elements. An algorithm for performance management was presented based on this. The algorithm presented makes performance prediction in the early stage of a construction project possible, and is a foundation for presenting the optimal construction management method to improve project performance. This can be used to quantify the degree of difficulty of construction project performance extraction, and quantitatively analyze the relationship between performance and elements of success. It is hoped the results of this study will be strategically used for selection of optimal construction practices needed for project managers to improve performance.

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REFERENCES

[1] A.P.C. Chan, D. Scott, A.P.L. Chan, "Factors Affecting the Success of a Construction Project", *Journal of Construction Engineering and Management*, ASCE, vol. 130, no. 1, pp. 153-155, January 2004.

[2] A.D. Songer, K.R. Molenaar, "Project Characteristics for successful public-sector design-build", *Journal of Construction Engineering and Management*, ASCE, vol. 123, no. 1, pp. 34-.40, March 1997.

[3] M. Armstrong, and A. Baron, "Managing performance: performance management in action", London: Chartered Institute of Personnel and Development, 2004.

[4] Construction Industry Institute(CII), Bench marking Data Report 2001, CII, Austin, TX, 2001.

[5] D.K.H. Chua, Y.C. Kog, P.K. Loh, "Critical Success Factros for Different Project Objectives", *Journal of Construction Engineering & Management*, ASCE, vol. 125, no. 3, pp.142-150, May/June 1999.

[6] K. Evangelidis, "Performance measured performance gained", the Treasurer, no. February, pp.45-47, 1992.

[7] Gena L. Abraham, "Critical Success Factors for the Construction Industry", Proceedings of Construction Research Congress 2003