

INDICATOR FOR PERFORMANCE MANAGEMENT OF CONSTRUCTION CALS

In-Su Jung¹, Jin-Uk Kim², and Chan-Sik Lee³

¹ Researcher, Korea Institute of Construction Technology, Goyang, Korea

² Research Fellow, Korea Institute of Construction Technology, Goyang, Korea

³ Professor, Incheon University, Incheon, Korea

Correspond to jis@kict.re.kr

ABSTRACT: Ministry of Land, Transportation and Maritime Affairs has implemented Construction CALS project for improving informationization level of construction industry and for making construction production system efficient. Although an importance of evaluation on level and performance of construction informationization projects has been emerged, Construction CALS hasn't been evaluated so far. In this study, the performance indicators of construction CALS as the most important base in creating a performance management system were deduced. For this aim, this study reviewed the former researches on system construction for managing performance, analyzed current status of Construction CALS, arranged the relationship between upper strategies and ISP, developed pools of performance indicators, and this study followed IT BSC methodology. As a result, this study developed performance indicators of Construction CALS through four strategies such as globalization and activation of Construction CALS standards, research & development for reaching to international level in construction informationization technology, stabilization of system operation and distribution by publicizing Construction CALS and improving its functions, and policy implementation for managing and coordinating Construction CALS projects. These indicators will be applied to build a system of performance management.

Keywords: Performance Management, Performance Indicator, Construction CALS

1. INTRODUCTION

Ministry of Land, Transportation and Maritime Affairs(MLTM) has implemented Construction CALS project for improving informationization level of construction industry and for making construction production system efficient. Construction CALS is a strategy of informationization for exchanging and sharing information produced from all steps of construction business between employers and related companies through computer networks. It was started in 1998, and has developed CMS(Construction Management System for construction company & employer), KOROMBUS(KOrea ROad Management BUiness System), CCAS(Construction Civil Affairs Administration System), LCS(Land Compensation System), C-PORTAL(Construction CALS Portal System). Also, as outcomes of studies on construction information standards, there are standards for electronic document, standards for electronic drawing, standards for exchanging drawing information, and construction information classification system. Although an importance of evaluation on level and performance of construction informationization projects has been emerged, Construction CALS hasn't been evaluated so far. Managing performance systematically requires their effective measurement and analysis. In addition, the impacts of the system on the performance of all

Construction IT Programs and IT level of the construction industry should be determined by establishing a management system that enables steady improvement. Finally, the system should be able to contribute to the dissemination of performances across the industry. For measuring performance of projects, a system for managing performance needs to be established by general methodology. The most fundamental thing for building the system for managing performance is to deduce indicator representing the projects. As the performance have to be evaluated by the deduced indicators, general and quantitative performance can be shown. This study aims to develop the most appropriate indicators for Construction CALS to respond to changes of environments by measuring quantitative performance of Construction CALS.

2. METHODOLOGY

This study reviewed the former researches on system construction for managing performance, analyzed current status of Construction CALS, arranged the relationship between upper strategies and ISP(Information Strategy Planning), developed pools of performance indicators. The time range of this study was from 2008 to 2012 or the period of the 3rd Construction CALS Program. Establishing a performance system involved

Table 1. Comparison of Main Features between Mixed-use and Single-use Projects

Researcher	Research Theme	Research Contents
DeLone & Mclean (1992)	Development of Success Model of the Information System	– Factors having impacts on the success of the information system were largely classified into 6 sectors following an examination of approximately 180 studies (taxonomy).
Seddon, P. B. & Kiew, M-Y. (1994)	Partial Complementation of the Model of DeLone and McLean	– Reconstruction of the model of DeLone and McLean by adding a factor, i.e., importance of the system
Pitt, L. F., Watson, R. T. & Kavan, C. B. (1995)	Measurement of Service Quality	– Proposing performance measurement by adding a factor -- service quality -- to the model of DeLone and McLean
Myers, B., Kappelman, L. A. & Prybutok, T. (1997)	Presentation of the quality of the information system and productivity measurement model	– The “Working group impacts” factor was added, and “external environment” and “organizational environment” were introduced.
Seddon, P. B. (1997)	Extension of the model of DeLone and McLean	– Reconstruction of the model of DeLone and McLean by adding a factor, i.e., user involvement
Wixom, B. H. & Watson, H. J. (2001)	Success of the DB system	– Analysis of factors having impacts on information quality and system quality as factors in the model of DeLone and McLean
Molla, A. & Licker, P. S. (2001)	Success of the e-Commerce system	– “Trust” and “support & service” were introduced as factors based on the model of DeLone and McLean.

determining the performance indicators based on IT BSC (Information Technology Balanced Scorecard) for the detailed promotion tasks deduced from the 3rd Basic Plan for Construction CALS. In this study, the indicators were deduced, and the establishment of performance standards, measurement of standard data, performance analysis, and feedback were suggested for future research.

3. BACKGROUND OF CASE STUDIES

3.1 Success Model of the Information System

With regard to the performance analysis of information technology and information system, several studies on the correlation among factors wielding impacts on the success of the information system were compared (Table 1). The studies consistently showed that key factors related to the performances of the information system lay not only in the final effects but also in each factor related to quality and use, which influence the final effects.

In Korea, studies have been conducted to facilitate application to actual work based on cases of existing studies. To identify objectively the effects of IT on the finance, customer, process, and innovation aspects of the organization, some of the studies raised the need for the performance management of the information system wherein BSC as one of management techniques is applied.

3.2 Methodology of IT BSC Analysis

The IT BSC analysis methodology addresses the issues associated with the current information technology and system performance analysis methodology.

First, whereas the existing methodology lacks comprehensive viewpoints since it measures only certain parts of the targets such as IT promotion plan,

promotion environment, utilization level, etc., the IT BSC methodology helps upgrade the level of the organization's value creation by analyzing and managing performances through the introduction and institutionalization of indicators.

Second, in terms of performance indicators, the existing methodology performs analysis through indicators focusing on checking the current level and lacks the unified definition and standardization of indicators and analysis of the causal relationship among them. In contrast, IT BSC analyzes the performances using various indicators ranging from investment effects and financial aspects to customer satisfaction. Based on this, it helps obtain information for decision making through an examination of the feasibility of future investment and ways of rearranging resources distribution.

Third, with regard to the assessment process, the existing methodology usually does not emphasize mutual agreement with departments that are currently promoting the program when developing indicators; its methods of verifying the aggregation of objective performance by indicator and performance are also insufficient; thus possibly causing difficulties in connecting organizational responsibility for the results from IT and establishing measures for utilizing the performance analysis later. On the other hand, IT BSC makes the persons concerned in the department currently promoting the program participate in developing indicators and offers responsibilities for the results to the organization by monitoring the performances from IT investment; this in turn results in the steady improvement of performances.

In sum, the IT BSC analysis methodology can analyze performances from a more comprehensive aspect beyond the single-dimensional analysis used by existing information technology and system studies to verify the

success factors of the system itself or to analyze the economic effects.

4. ESTABLISHMENT OF RELATIONSHIP WITH SUPERIOR STRATEGIES AND ISP

Since transforming the Construction and Traffic Information Strategy into the visions and goals of Construction CALS is not easy, the visions and strategies being promoted aggressively by Construction CALS were connected with key performance indicators by utilizing the performance aspects of IT BSC. At this point, the 4 basic aspects of IT BSC -- finance, customer, internal assignments, innovation, and education -- were utilized by transforming the visions, goals, and strategies of construction CALS into key performance indicators.

Figure 1 defines the visions, goals, and strategies that should be supported by Construction CALS based on the strategic aspects of Construction and Traffic Information, showing the process of deducing key indicators to achieve the goals and to connect them. Based on the connecting process, the mid- and long-term visions and strategies of Construction and Traffic Information -- which covers the period 2008~2012 as the target period for the performance analysis of Construction -- were analyzed.

5. ESTABLISHMENT OF TARGETS FOR THE DEVELOPMENT OF PERFORMANCE INDICATORS

In this chapter, the 3rd Basic Plan for Construction CALS was examined to develop the performance indicators of Construction CALS.

5.1 Activation and globalization of standard development

The basic plan specified 3 goals: (1) pursuit of significant progress in the standardization of construction information through the promotion of the development of basic standards and applied standards for construction information; (2) connection of national construction information standards with international standards and creation of standards for the assumption of the leading position, and; (3) establishment of a system for developing standards for construction information and improving such standards to make them more efficient and useful through the reorganization of the base.

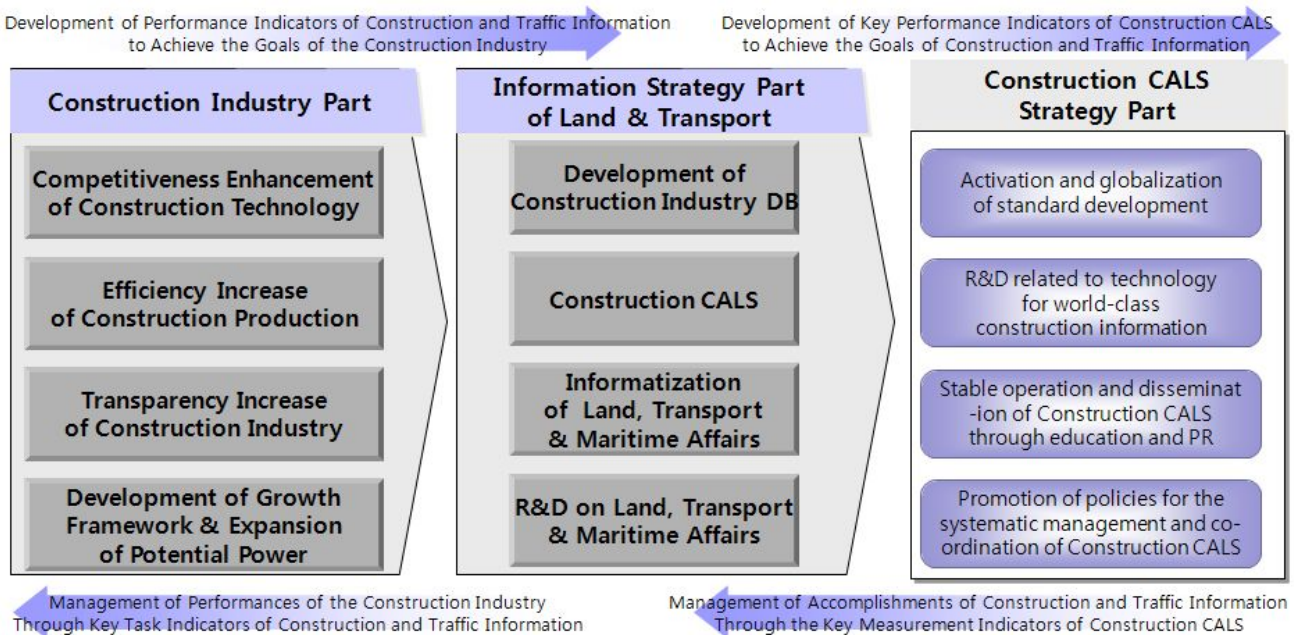
Key tasks to be promoted by the basic plan included the “establishment of standards for each field for the actual utilization of basic standards,” “creation of reference standards and applied standards for significant progress in the distribution and utilization of construction information,” and “establishment of foundation for the world’s best construction information standards.”

5.2 R&D related to technology for world-class construction information

The basic plan included 4 goals: (1) steady R&D for the innovation of process for construction programs; (2) expansion of research on application technology for the development of construction information; (3) advancement of application technology for world-class construction information, and; (4) generation of global construction information through the creation of information architecture, application technology, and application model of ubiquitous next-generation construction programs.

Key tasks to be promoted by the basic plan included “research on the innovation of the work system to create efficient construction programs,” “technology research for the steady development of the Construction CALS system,” and “creation of ubiquitous real-time construction information service system.”

Fig 1. Process of Connecting Work BSC with IT BSC



5.3 Stable operation and dissemination of Construction CALS through education and PR

The basic plan indicated 4 goals: (1) creation of a well-organized system that can generate all sorts of construction information; (2) provision of synergistic effects to existing systems by expanding the construction information system to public institutions and private corporations; (3) establishment of education foundation for the utilization of the already established systems, and; (4) increase in efficiency of operation and dissemination through portal systems.

Key tasks to be promoted by the basic plan included the “stable operation of the construction CALS system and development of its functions,” “expansion of application of Construction CALS in public and private sectors at home and abroad,” and “creation of education and PR support system to improve perception on construction information.”

5.4 Promotion of policies for the systematic management and coordination of Construction CALS

The basic plan specified 3 goals: (1) promotion of measures for the steady and smooth operation of the Construction CALS Program; (2) expansion of use of Construction CALS to private sectors aside from public sectors, and; (3) generation of the world’s top 10 construction information through a stable legal foundation.

Key tasks to be promoted by the basic plan included “securing connection with similar programs through strengthened legal foundation,” “creating a performance management system for concrete management,” and “establishing legal institutions to support construction information.”

6. SELECTION METHODS FOR PERFORMANCE INDICATORS

Since examining the Performances of the 3rd Basic Plan for Construction CALS in this study involved measuring the effectiveness of the basic plan through a check of its key factors, the use of a deductive approach seemed feasible. In other words, a deductive indicator deduction method wherein the assessment ranges are decided first, tasks by stage to identify the key factors are repeated, and detailed indicators are finally deduced was utilized.

Since the ultimate measure of performance indicators is effectiveness, an effectiveness model was used in this study. Among the effectiveness models, a goal achievement model that has traditionally been used was utilized for the development of performance indicators. In particular, for the development of performance indicators, a deductive approach wherein the goals for each field are identified and indicators appropriate for each goal and assessment elements for each model are deduced was adopted. Performance indicators were developed by identifying the factors making up the goals and referring to previous studies tackling each factor.

7. DEVELOPMENT OF PERFORMANCE INDICATORS

Performance indicators for each sector of Construction CALS were developed based on the methodology presented in Chapter 6. This chapter presents the results. To develop effective indicators by excluding the subjective judgment of researchers as much as possible in the development process, consultation meetings attended by persons in charge in Korea’s MLMT and Korea Institute of Construction Technology(KICT) as well as Construction CALS experts were held, and surveys, conducted.

Goals were set by separating them according to the key promotion strategies for achieving strategy goals; performance indicators that can best measure objectively the established goals were developed. According to the 3rd Basic Plan for Construction CALS, the strategy goals of the Construction CALS Program include “taking the lead in the global standards for construction information,” “securing international competitiveness in Construction CALS,” “disseminating the support system for construction programs,” and “establishing an integrated national construction information system.” The following are the key promotion strategies for achieving such strategy goals: “activation and globalization of standard development,” “R&D related to technology for world-class construction information,” “stable operation and dissemination of Construction CALS through education and PR,” and “promotion of policies for the systematic management and coordination of Construction CALS.” Accordingly, performance goals and indicators were developed for each of the key promotion strategies.

With the 32 performance indicators that were first deduced to measure the performance of the Construction CALS Program, 24 performance indicators were selected by comprehensively examining the opinions of the staff in charge in the MLTM and KICT (see Table 2).

8. CONCLUSIONS

Although an importance of evaluation on level and performance of construction informationization projects has been emerged, Construction CALS hasn’t been evaluated so far. In this study, the performance indicators of construction CALS as the most important base in creating a performance management system were deduced. For this aim, this study reviewed the former researches on system construction for managing performance, analyzed current status of Construction CALS, arranged the relationship between upper strategies and ISP, developed pools of performance indicators, and this study followed IT BSC methodology. As a result, this study developed performance indicators of Construction CALS through four strategies such as globalization and activation of Construction CALS standards, research & development for reaching to international level in construction informationization technology, stabilization of system operation and distribution by publicizing Construction CALS and improving its functions, and policy implementation for managing and coordinating

Construction CALS projects. These indicators will be applied to build a system of performance management. In the future, studies on the identification of key performance indicators for intensive management among

the 24 performance management indicators and measurement of performances through the development of formulas for each indicator should be conducted.

Table 2. Performance Indicators for the Performance Management of Construction

Strategy	Performance Goal	Performance Indicator
Activation and globalization of standard development	Development of Basic Standards	National Standardization Rate for Construction CALS Standards
		Development of a Construction Information Standard Model Based on International Standards
	Development of Application and Reference Standards	Sharing and Activation of the Distribution of Construction Information
	Dissemination of Standards and Strengthening of International Cooperation	Rate of Diffusion of Standards
Rate of Globalization of Construction CALS Standards		
R&D related to technology for world-class construction information	Improvement of the Working System for Efficient Construction Programs	Application of an Improved Working System to Construction Programs
		Information Sharing/Application of Connection and Reflection on Policies
		Evaluation Marks on the Level of Construction Information
	Technology Development for the Steady Progress of the Construction CALS System	Development of Application Research and Application to the Construction CALS System
Creation of Ubiquitous Real-Time Construction Information System	R&D for Ubiquitous Construction Information Service	
operation and dissemination of Construction CALS through education and PR	Stable Operation and Progress in Functions	Stability of the System
		Rate of Improved Function Reflection
		Rate of Civil Application Processing
		System Utilization Rate
	Expansion of Application of Construction CALS	Rate of Construction CALS Dissemination (supply and integration)
		Location of Construction Information Distribution/Certification Center
		Overseas Exchange and Supply Rate
	Education and PR	PR/Education Activity Performance Rate
Contents Development/Utilization Rates		
Rate of Information Forum Operation		
Promotion of policies for the systematic management and coordination of Construction CALS	Management of Tangible Performances	Rate of Establishment of Performance Measurement Systems
		Rate of Reduction of Construction Program Management Costs
	Development of Supporting Policies	Rate of Development of Private Sector Support Policy
		User Satisfaction Level

REFERENCES

- [1] DeLone, W.H. and E.R. McLean, "Information System Success: The Quest for the Dependent Variable", *Information Systems Research*, March 3(1), pp. 60-95, 1992
- [2] Seddon, P.B. and Kiew, M-Y, "A Partial Test and Development of DeLone and McLean's Model of IS Success", *Proceedings of the International Conference on Information Systems*, Vancouver, Canada, pp. 99-110, 1994
- [3] Ministry of Land, Transport and Maritime Affairs(MLTM), "Establishment of the 3rd Construction CALS Master Plan", 2007
- [4] Myers, B.L., Kappelman, L.A., Prybutok, V.R., "A comprehensive model for assessing the quality and productivity of the information systems function: toward a theory for information systems assessment", *Information Resources Management Journal*, Vol. 10 No.1, pp. 6-25, 1997
- [5] Pitt. L.F., Watson, R.T., Kavan, C.B., "Service quality: a measure of information systems effectiveness", *MIS Quarterly*, Vol. 9 No.2, pp.173-87, 1995