PERFORMANCE INDICATORS BASED ON TFV THEORY

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ABSTRACT

In order to obtain good project performance, the performance of construction work processes should be improved. Traditionally, good project performance means a project is on budget and on time with expected quality. Thus, most project managers have used project performance indicators concerning time, cost, quality, safety, profitability, etc. However, these performance indicators are result-oriented and they cannot measure the performance of construction work processes, which we call as process-oriented performance. As process-oriented performance indicators for construction works, this paper suggests the use of three concepts: reliability, efficiency and effectiveness. These are derived from the TFV theory. The following three statements are the basis for establishing indicators related to those three TFV concepts: a "Transformation should be efficient", "flow should be reliable", and "value of a work relies on the effective completion of the preceding work". This paper proposes three TFV based indicators, establishes a logical relation model between the indicators and other traditional indicators, and tests the validity of those indicators. Finally, this paper suggests how to use these indicators to build a process-oriented performance measurement system for construction projects

KEY WORDS

Performance measurement, TFV, reliability, effectiveness, efficiency

INTRODUCTION

Based on a survey with more than two hundred executives, Schieman and Lingle(1999) concluded that measurement-managed companies exhibit better performance compared to their non measurement-managed counterparts. This is because performance measurement provides the necessary information for process control, and makes it possible to establish challenging and feasible goals. Also the use of performance measures is strongly related to the necessity of improving process transparency in production management. By using indicators, some of the invisible attributes of the process are made visible (Koskela, 1992).

In construction industry, a good project performance traditionally means a project is on budget, on time, and with the expected quality. Thus, most project managers have used project performance indicators concerning time, cost, quality, safety, profitability, etc. that is result-oriented. And, for the most part, recent researches on performance

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measurement have tended to centre around the question of result- oriented performance indicators.

However, project managers do not know the status of ongoing works with the information provided by these result-oriented indicators because project performance indicators concerning time, cost, etc. are not be measured until project is complete.

Many of these indicators are focused on the result of project and not on processes. It is difficult for participants to know how well their project is doing and to control the production process when it is in progress. And, result-oriented performance indicators are difficult for participants to know how well their project is doing and to control the production process when it is in progress.

Therefore, this paper proposes a set of process-oriented performance indicators for construction works. Three concepts that derived from the TFV (Transformation-Flow-Value) theory (Koskela, 2000) were chosen for establishing those indicators : reliability, efficiency and effectiveness.

PERFORMANCE MEASUREMENT: DEFINITION

Performance measurement describes the feedback of information on actives with respect to meeting customer expectations and strategic objective. Performance measurement systems should answer two simple questions (Lynch 1991):

- Are functions and departments doing the right things?
- Are they doing them well?

We will limit ourselves to the performance measurement focused on a task that is a basic production unit, because we should control the individual task in order to continuously improve the whole production process. By measuring the daily work assignments, indicators of performance suggested are used to measure and improve the efficiency and the quality of the project processes, and identify opportunities for progressive improvements of process performance.

TFV(TRANSFORMATION-FLOW-VALUE) THEORY

Koskela(1999) argued that we are suffering from deficiencies of theory in construction; he thinks that there are three broad impacts. Firstly, the chronic performance problems can more or less directly be associated to problems of theory. Secondly, in lack of explicit theory, it has been difficult to implement methods of flow management and value management in construction. Thirdly, our efforts to develop construction, say through industrialization or information technology, have been hindered by the lack of a theory. Koskela et al. (2002) define the TFV theory as a theory-based methodology for construction that strives to enhance understanding and practice in the industry. However, the scope of the TFV-theory is not limited to the construction industry; it embraces the domain of project-based production management, which concerns with the delivery of “one-off” products. According to the TFV theory, the design, control, and improvement of production should be conducted as an integration of transformation, flow, and value concepts and not as alternative concepts (Koskela 2000). These three concepts are presented bellow

- In the first concept, production is viewed as a transformation of inputs to outputs. Production management equates to decomposing the total transformation

into elementary transformations and tasks, and goal is to make the transformation as efficient as possible.

- The second concept views production as a flow, where, in addition to transformation, there are waiting, inspection and moving stages. Queuing theory, which applies to such flows, teaches that variability is the crucial determinant of the behaviour of flows. Production management equates to minimizing the share of non-transformation stages of the production flow, especially by reducing variability.
- The third concept views production as means for the fulfilment of customer needs. Production management equates to translating these needs accurately into a design solution, and the producing products that conform to the specified design.

Customer may be recognized as it of production processes and in this case, customer of the work of predecessor may be able to be the work of successor. From this point of view, value of a work relies on the effective completion of the preceding work, which means to improve the stability of production process by reducing variability of start point of following work, and then to achieve eliminate non-value-adding phenomena from production.

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EFFECTIVENESS

Effectiveness is the degree to how much the proceeding work has influence on succeeding work. Effectiveness of work is measured when pertinent tasks are completed. Method of Effectiveness measurement is depicted in Figure. 2.

A2 depicted as a dotted line box indicates the daily work planned of a subcontractor, which is performed for 4days from D1 to D4. In the case of A2, one delayed day resulting from uncompleted work of D2 of A2 is recorded, and then Effectiveness becomes 75% to B23.

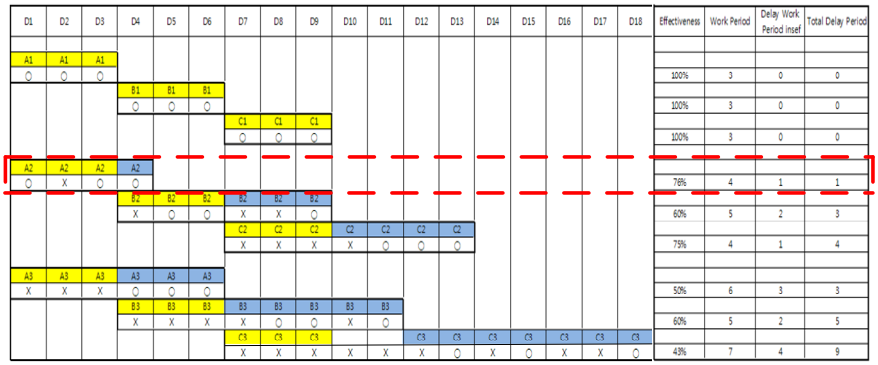

Figure 2 : An example of method of Effectiveness measurement

RELIABILITY

Reliability represents percentage of plan completed of some subcontractors. The process of measurement is so simple that managers may be able easily to use it in construction site. Reliability should be measured day-by-day. Method of Reliability measurement is depicted in Figure. 3. D3 depicted as a dotted line box indicates a work day, and A1, A2 and A3 show the daily work planned of a subcontractor. For example, A1 is performed during 3days (from D1 to D3), and then Reliability of a subcontractor becomes 67% on D3 and cumulative Reliability from D1 to D3comes to 56%

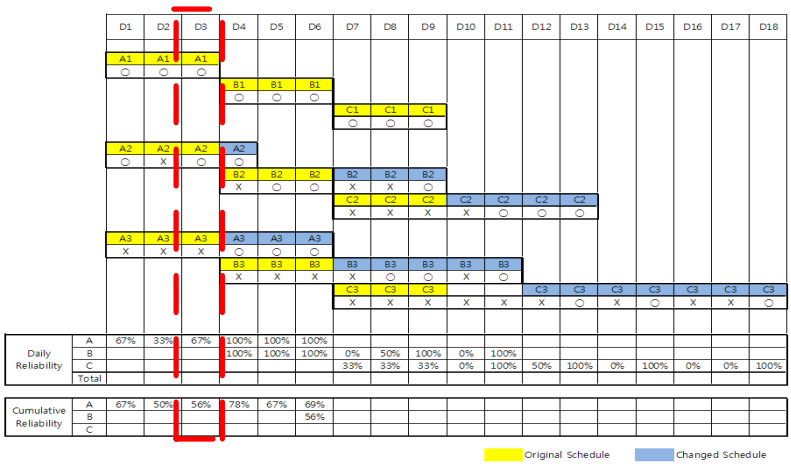

Figure 3 : An example of method of Reliability measurement

EFFICIENCY

Efficiency means amount of inputs required for planned work. Measuring inputs of planned work over amount of planned work provide site managers information about optimum amount of inputs.

LOGICAL RELATION MODEL

These indicators suggested in this paper are able to support to estimate cost, time and etc. in advance. For example, the high Reliability of work means a high ratio of planned workload over performed workload and a low variability of the processing load. As presented in Figure 6.(-) is marked due to relation of Reliability of work and variability of the processing load is in inverse proportion.) And, much of the Processing load means a high variability of inputs, so a cost rises finally. In the end, it is possible to control the cost that is result- performance of project by measuring and controlling the indicators of Reliability from production process on construction projects.

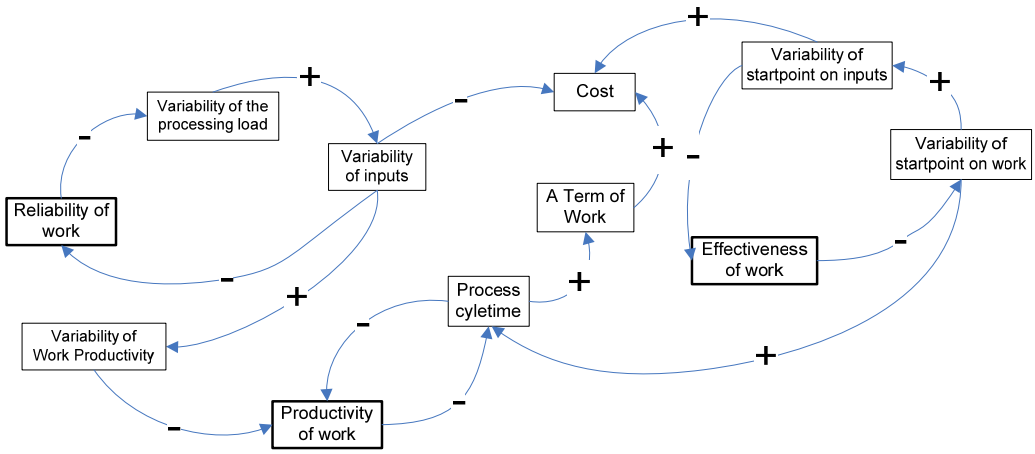

Figure 4: An example of method of Effectiveness measurement

CONCLUSION

Like the slogan in business community that is “If you want to improve something, measure it”, to perform the ongoing construction projects efficiently, we need the ability to know the current status of project and quantify the improved performance.

Also, it is important to what to measure and how to measure. Traditionally performance in construction is measured based on “result-oriented” - time, cost and safety, etc.. But, the main defect of these indicators is that most of them do not reflect to improve and control the performance during the projects. This paper has suggested process-oriented indicators of performance; Reliability, Effectiveness, Productivity which can be used as a basis for progressive improvement of ongoing construction projects, and by modelling the logical relation among several indicators; cost, variability of work productivity, process cycle time etc… , it has ensured that Reliability, Effectiveness and Productivity are validity.

In order to perform the further research, the framework of performance measurements necessary to apply to the construction site, and then this study can be based on the development of a system of performance measurement for construction industry in Korea though the framework.

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