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A Study on Productivity Analysis of Quality Management System in Construction Site

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Abstract: Quality management work at construction sites requires a lot of time and effort in Excel-based document preparation and approval in addition to conducting quality tests. Because Excel-based quality management tasks are divided into quality test report printing and test progress, test report documentation, test report printout and approval, and management ledger preparation. This divided processes increase work time and reduce efficiency. Accordingly, a cloud-based construction site quality management system (Q-BOX) was developed to improve the productivity of quality management work. The purpose of this study is to analyze the productivity of Q-BOX, which is in the early stages of construction site introduction.
Key words: Construction Site, Quality Management System, Productivity Analysis, Monte-Carlo

1. INTRODUCTION

This study introduced Q-BOX to the road construction site and analyzed changes in the quality management work process before and after the introduction. In addition, a survey was conducted on quality control engineers to collect data on the work time before and after the introduction of Q-BOX. Based on the collected data, the Monte-carlo simulation method was applied to analyze the productivity improvement effect of Q-BOX and the results were presented. The results of this study can be used as basic data for future studies on automation of quality control tasks.

2. METHODOLOGY

This study investigated and analyzed the quality control work process before and after the introduction of Q-BOX in order to analyze the productivity improvement effect resulting from the introduction of Q-BOX at construction sites. Based on this, information of the time required for each quality work process and the degree of process simplification can be systematically collected in a survey, and the differences before and after introduction can be compared. The current quality management process was investigated through several meetings with practitioners, and the quality management process after the introduction of Q-BOX was investigated through interviews with developers and those with experience using Q-BOX.

3. SURVEY AND ANALYSIS

The purpose of survey is to collect data of time that can be saved by applying Q-BOX to quality control work performed at construction sites according to the work process. For this purpose, a non-face-to-face survey was conducted among workers at the “OO Korea Expressway construction site.”

3.1. Selection of quality test items for survey

We analyzed construction site quality management work in 2022 and selected the 9 most frequently performed quality test items. And, a survey on work processing time before and after the introduction of Q-BOX was conducted on 16 quality control practitioners using an online platform and interviews.

3.2. Analysis methodology

Through a survey, we investigated the minimum, average, and maximum time required for each field quality test item and work process. Based on this, Monte Carlo simulation methodology was applied to analyze the time required for all on-site quality control tasks based on probability distribution, and the work time reduction effect resulting from the introduction of Q-BOX was derived.

3.3. Results of analysis

As a result of a simulation of the time required for quality control work before the introduction of Q-BOX, excluded the approval stage where time required is difficult to predict, the data was in the form of a beta distribution and was expected to take 221.18 minutes on average. The standard deviation was 39.09 minutes and the mode was 213.5 minutes. After the introduction of Q-BOX, the simulation data on work time was expected to take the form of a log-normal distribution and take an average of 31.35 minutes. The standard deviation was 10.46 minutes and the mode was 23.2 minutes. The results are summarized in <Table 1>.

Table 1 Summary of simulation results. [Unit: minute]

Classification	Average	Data distribution	Standard deviation	Mode	The Time that can be reduced
Before Q-BOX application	221.18	Beta distribution	39.09	213.5	189.83
After Q-BOX application	31.35	Log-normal distribution	10.46	23.2	

4. CONCLUSION

To analyze the effectiveness of Q-BOX, this study compared work processing times before and after solution introduction and analyzed them using statistical methods. As a result, it was found that there was a time reduction effect of over 85% in pure business processing time that excluded approval waiting time, which is difficult to predict. Since the sample size of the population is very small, there may be argument about the quantified numbers, but it was analyzed that the effect of increasing the efficiency of quality control work at construction sites can be fully expected if the Q-BOX system is introduced.

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