

DESIGNING A KNOWLEDGE-BASED SYSTEM TO FACILITATE THE PROCESS OF FALL RISK ASSESSMENT IN CONSTRUCTION

ABSTRACT

Fall from height (FFH) accounts for a large number of fatalities and severe injuries in the construction industry worldwide. Several approaches have been proposed by many researchers to enhance the safety performance of construction industry by preventing falls. However, fall incidents continue to impact the construction sector more in developing regions compared to developed countries. This could be achieved through fall risk assessment (RA) method. The entire safety procedures are likely to fail, if RA fails, as this is one of the critical safety processes in construction industry. But, the traditional method of RA fails to identify safety risks involved in construction activities due to lack of experience and time. To address these safety challenges, some researchers recommended to integrate knowledge management (KM) concept into construction safety management. Unfortunately, there has been few studies that attempts to integrate KM into safety in construction. Hence, this study focused on integrating KM into the safety planning to facilitate the process of RA in the Indian construction industry focusing on preventing falls. This research was presented in the context of traditional vertical formwork because the use of formwork in construction frequently involves working at heights and its operations are associated with a high level of falls incidents and injuries across all construction operations.

In this context, the aim of this research was to design a safety knowledge-based system to facilitate the fall RA process for vertical formwork activities to prevent falls. First, the study has used a qualitative approach to identify how KM strategies are employed in the RA process to prevent falls in construction companies. The results indicated that there was no systematic way of managing safety knowledge in construction during the fall RA process. Further, the challenges that users (who perform RA) face during RA and their viewpoints to facilitate it was gathered through semi-structured interviews and surveys. Through this, the study deduced that the users were looking for a platform where they can access safety knowledge for particular activities during the RA process. Based on the inputs from users, four activities that pose fall risks during formwork operations were identified through observation and surveys and the riskiest activities among them were analyzed using the occupational safety and health administration (OSHA) database. Then the Delphi survey was used to capture the safety knowledge (i.e., activity risk levels, causes of fall, individual at risk, and preventive measures)

of vertical formwork activities from the construction experts. Along with, best safety practices for formwork operations were also captured through thorough document analysis. Based on the framework developed for the knowledge-based system, a prototype was first developed to store and re-used the safety knowledge that was captured. The prototypes' interface design was evaluated through a cognitive walkthrough (CW) with 5 experts from different educational and industrial backgrounds. Based on the feedback given by the experts, the interface design of the prototype was improved and a web-based KM system was developed using PHP language programming. The developed system was evaluated in the real-life construction environment with 20 end-users based on three criteria such as features, benefits, and challenges addressed. Based on the findings, it can be determined that the proposed system offers numerous benefits to builders in (1) ensuring that end-users, regardless of their site location, have easy access to vertical formwork safety knowledge; (2) helping users with job site learning of safety RA skills; (3) effectively sharing safety knowledge; (4) facilitating the fall RA process on-the-job for safety heads; (5) helping to improve safety performance; and (6) saving time that is spent on RA.

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