UNIVERSITY OF CAMBRIDGE
Department of Engineering

CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

Managing decision dependencies to improve design process efficiency in nuclear construction projects: a case study on precast module design

Background

Nuclear construction projects (NCPs) are criticised by delays and cost overruns. Design-related issues played a role in poor quality and delivery performance. Current design practices are insufficient to handle the interdependency in design processes. Advanced design management tools are required to improve design process efficiency and knowledge integration.

Purpose

This research aims to apply network-based instruments, social network analysis (SNA) and design structure matrix (DSM), to understand the design process in terms of decision dependencies. The analysis results could help to formulate process improvements.

Research design and methods

A mixed-method case study was carried out. The case is the precast module design in a real NCP - Hinkley Point C (HPC). Quantitative document analysis was conducted to extract the decision dependencies. Eigenvector centralities (EVCs) were calculated to analyse the influence of decisions. DSM operations, partitioning and tearing, were used to optimse the design process. The benefits and practicality of the applications of network-based instruments were assessed by project participants through semi-structured interviews.

Findings

This research demonstrated the complexity of the design process in the setting of NCP. The constraints from decision dependencies imposed challenges in process improvement. However, this research also tested the effectiveness of the instruments. Although tearing was ineffective, partitioning were effective in internal coordination. To extend the use of DSM operations to the entire design organisation, design managers still overcome practical problems with the effort of clients and stakeholders.

Practical implications

This single case study explored the design inefficiencies in the design process in NCPs. The results help clients and stakeholders to understand the design complexity and to propose process improvement. HPC is the first NCP in the UK that deliver the EPR design. The lessons learnt from this study can be implemented in future NCPs that deliver the same design.

Originality / value

Actual design process was captured from qualitative data in previous studies. An extract protocol had been developed to extract decisions and dependencies from retrospective

data. Construction operational requirements were considered as one of design decisions. This consideration improved the integration of design and construction knowledge. Network-based instruments, EVC and DSM, were used and supplemented in the analysis of the design process.

Ka Ming Lie
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