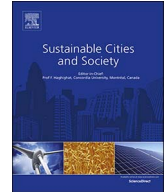




Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs



Effect of lean tools to control external environment risks of construction projects



Richard Hannis Ansah, Shahryar Sorooshian*

Faculty of Industrial Management, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia

ARTICLE INFO

Keywords:
Analytic Hierarchy Process (AHP)
Construction projects
Environmental-based delays
Framework
Lean tools
Prioritization

ABSTRACT

Among the existing management concepts and methods implemented for solving construction project delays is the integration of lean tools in the construction project cycle. While these lean tools are said to minimize delays and improve project delivery processes, most have been conceptualized to assess aspects of the lean tools. However, to ensure suitability and applicability, and thus, the success of lean tools implementation, there is the need for identification and appropriate prioritization of the lean tools. This paper proposes a novel delay control framework based on AHP method for the evaluation of lean tools application in the external environment (political, economic, social, technological, legal, and environmental aspects) of construction projects. To extend the qualitative data, six main delay sources and forty lean tools were extracted from the existing literature for further empirical inquiry. The results of the framework indicated that the most effective lean tools were

control specific delay sources.

