ABSTRACT

Wang, Shih-Yi. Ph.D., Purdue University, May, 2005. Computer Experiment for Improving Construction Processes (First Draft). Major Professor: Daniel W. Halpin.

From the perspective of flow analysis, the more complex the project, the more wastes are prone to build up, due to the increasing number of interfaces between activities. When processes are further expanded beyond the jobsite to the scale of a supply chain, the complexity is usually beyond human perception. Lean thinking and supply chain management were introduced to the construction industry in hopes of resolving the well-known waste and fragmentation problems. However, the lack of a quantitative approach to analyze the construction processes and to assess the effectiveness of the production strategies before implementation impedes the acceptance of these new production philosophies in construction industry. In order to provide a systematic approach to help management make correct and timely decisions, an analytical method capable of efficiently and economically modeling complicated processes and addressing various managerial questions is necessary.

An analytical framework combining simulation, design of experiment, regression analysis, and mathematical programming is proposed to facilitate the optimal design of construction processes under various constraints. The research first uses a simplified concrete delivery process to illustrate how the framework is implemented. The proposed framework is then implemented in two real-world cases (i.e., the concrete column pouring process and the concrete slab pouring process) to test its validity. The application of this framework to study various lean concepts (such as work flow variability and continuous improvement) is also discussed.