LEAN THINKING FOR STRUCTURAL ENGINEERS

Stephen Kwofie and Christine L. Pasquire
INTRODUCTION

LEAN

MANUFACTURING

CONSTRUCTION

STRUCTURAL ENGINEERING & DESIGNS

Value

Lean Thinking

Waste
## Research Method

### Research Phases
- Research Question Formulation
- Location of Study Sources
- Study Selection & Evaluation
- Analysis & Synthesis of Data
- Result Discussion & Reporting

### Activities/Task
- Develop the Research Question to Guide the Study
- Locate, Select & Evaluate Relevant Literature
- Analyse & Synthesize Data
- Report Findings

### Methods
- Define & use electronic databases
- Define search period
- Define inclusion & exclusion criteria
- Define & use search strings
- Data filtration & clean-up
- Selection of method for analysis & synthesis of qualitative research
- Coding & extraction of data

### Tools
- IGLC, Emerald; Elsevier; Taylor & Francis; IEEE; Springer; Wiley; Inderscience; EBSCO; ISI web of Science; Google Scholar; and Research Gate
- 1997 - 2019
- Inclusion - lean terms with design & product development; peer reviewed articles published in journals and proceedings of international conferences
- Exclusion - lean solely referring to manufacturing & production
- Lean thinking, lean design, lean product development, lean product design, lean design management and lean product engineering
- Title review, abstract review, schematic reading
- Thematic synthesis
- Nvivo computer software

### Report
- Section 1
- Section 2
- Section 3
- Section 4
Lean in the general world view has been perceived as “lacking or deficient in flesh; lacking richness, sufficiency or productiveness; containing little or no fat; deficient in an essential quality.”

The concept of value generation and waste reduction appear to be the spine connecting these diverse definitions of lean when applied to the manufacturing and construction industries.

Lean thinking concept has been identified to be mainly founded on philosophy and culture.
DEFINITION OF LEAN STRUCTURAL DESIGN

➢ In construction, lean applied to product development achieves the design management field of work and thus called “lean design” when applied to building projects.

➢ Lean design is an extension of lean thinking in the design phase, which creates the potential for high value in the whole process with well-defined systems, structures and materials to meet customer needs.

➢ Lean design therefore relates to the principles, methods, techniques, practices and tools contemporarily used in managing designs or product development process to generate value for customers.
LEAN PRINCIPLES APPLICABLE TO LSD

➢ Value Principle
➢ Value Stream Principle
➢ Flow Principle
➢ Pull Principle
➢ Perfection Principle
➢ Transformation-Flow-Value Principles
LEAN TECHNIQUES AND METHODS APPLICATION TO LSD

- TVD is a management method for designing and delivering customer value aligned with defined target.
- SBD are characterised by exploration of multiple design options, delays to specifications and commitment, development of extensive prototyping or simulation and convergence upon the optimum design.
- CBA is a technique for consistent good decision making on design options by focusing on the valued advantages, which is followed by actions and subsequently generate an outcome.
LEAN TOOLS FOR LSD

➢ VSM is a core lean tool used to capture the present state of value stream with regards to information and material flows, identify opportunities to improve flow whilst ensuring waste reduction and proposing future state showing plans of development

➢ QFD is one of the lean tools that facilitates identification of customer needs and requirements at the design phase

➢ DSM is a systematic tool for finding the optimal order originally developed by Steward (1981) and applied to represent design information flows such that design tasks are outlined and their interdependencies are assessed to show tasks to be completed both in series and parallel

➢ LPS is a lean tool originally designed to facilitate stabilisation of production work flow where decisions and commitment to tasks are made by the last responsible person known as the ‘last planner’

➢ The 5S is a systematic process tool used in organising a workplace such that it contains only the materials needed and appropriately designated resulting in work efficiency, reduced waste, optimum value and productivity
CONCLUSIONS

• This paper focused on the first part of the study where an understanding of lean was gained with respect to structural designs.
• The research revealed that LSD involved the application of lean thinking concept in structural designs through lean principles, techniques, processes, practices and tools to deliver value for customers.
• This research was mainly based on literature and the practical applicability of the findings to assess the understanding and implementation of lean from SE point of views form part of the second phase of the study.
• Therefore, further research will be carried out focusing on the relationship between structural engineers and lean using case studies.
• Further studies will also be done to discuss possible hindrances to LSD and corresponding solutions.
THANK YOU FOR YOUR TIME
ANY QUESTIONS?