Alexandria Engineering Journal (2017) xxx, xxx–xxx

HOSTED BY

Alexandria University

Alexandria Engineering Journal

www.elsevier.com/locate/aej
www.sciencedirect.com

ORIGINAL ARTICLE

Design iteration in construction projects – Review and directions

Purva Mujumdar *, **J. Uma Maheswari**

Department of Civil Engineering, Indian Institute of Technology Delhi, India

Received 21 August 2015; revised 21 November 2016; accepted 15 December 2016

KEYWORDS

Design iteration;
Types of iteration;
Causes and impact of iteration;
Models of iteration;
Execution strategies of iteration

Abstract Design phase of any construction project involves several designers who exchange information with each other most often in an unstructured manner throughout the design phase. When these information exchanges happen to occur in cycles/loops, it is termed as design iteration. Iteration is an inherent and unavoidable aspect of any design phase which requires proper planning. Till date, very few researchers have explored the design iteration ("complexity") in construction sector. Hence, the objective of this paper was to document and review the complexities of iteration during design phase of construction projects for efficient design planning. To achieve this objective, exhaustive literature review on design iteration was done for four sectors – construction, manufacturing, aerospace, and software development. In addition, semi-structured interviews and discussions were done with a few design experts to verify the different dimensions of iteration. Finally, a design iteration framework was presented in this study that facilitates successful planning.

1. Introduction

The design phase of any construction project is cyclic, repetitive and evolutionary involving designers from various design groups such as structural, mechanical, electrical and plumbing. Often, these designers perceive their design scope with a unique and independent visualization neglecting the holistic view of the project. This alters the priority and sequence of the complete design process [16]. Moreover, the project manager generally pays due attention to construction phase as compared to the design phase. This demotivates appropriate design interactions and structured planning [5]. In reality, there have been ample project evidences which prove that most of the design and construction failures originate from this ill-structured design plan [5]. Hence, adequate efforts must be taken for planning a design phase.

The basic inputs for planning a design phase include activities and the information relationships among them. Typically, there are four types of information dependencies in any design phase such as independent, semi-independent, dependent and interdependent [19,30] as shown in Fig. 1. Among these, interdependent activities prompt for assumptions. Depending on

Abbreviations: HVAC, Heating, Ventilation and Air Conditioning; ADePT, Analytical Design Planning Technique; DSM, Design Structure Matrix; IDEF0, Integrated Definition for Functional Modeling; DFD, Data Flow Diagrams; BIM, Building Information Modeling; MDM, Multiple Domain Matrix; GUI, Graphical User Interface.

* Corresponding author.
E-mail address: purvamujumdar@gmail.com (P. Mujumdar).

Peer review under responsibility of Faculty of Engineering, Alexandria University.

http://dx.doi.org/10.1016/j.aej.2016.12.004

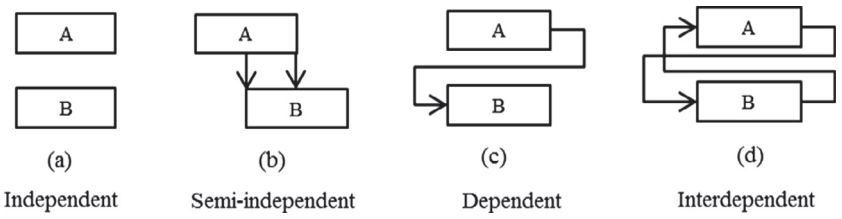

Figure 1 Relationship among design activities.

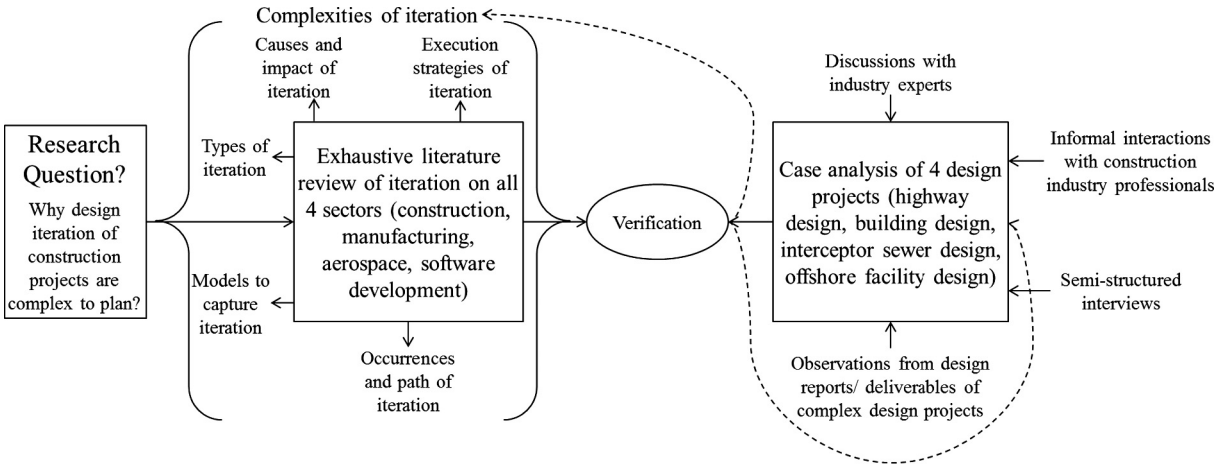

Figure 2 Research methodology.

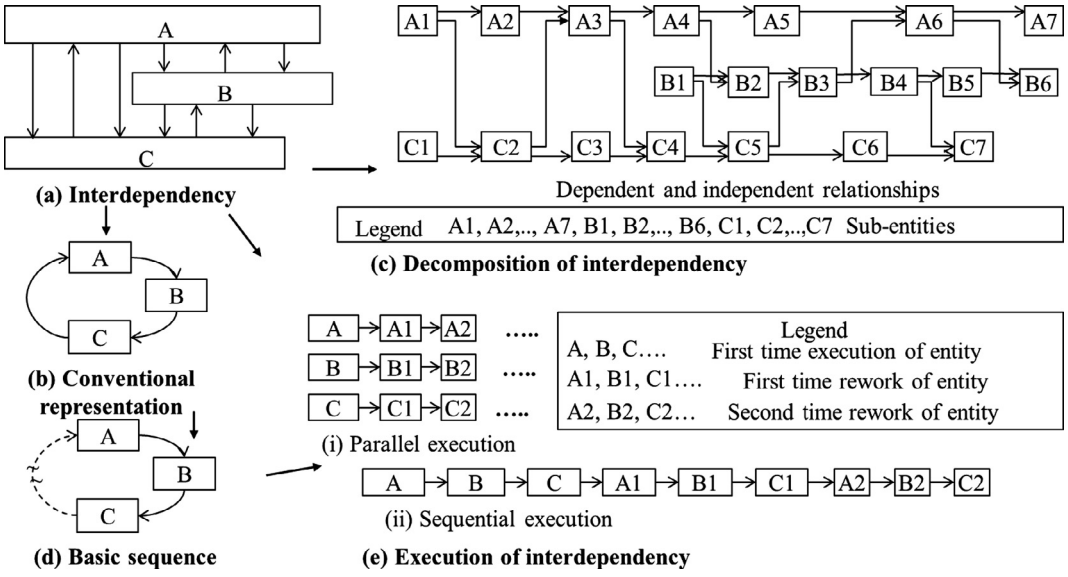

Figure 3 Iteration execution.

the accuracy in the assumptions made, rework, repetition or redesign can occur in varying degrees. This continuous cycle of revisions is generally termed as iteration [25,15].

Iteration is an inherent and unavoidable aspect of any design project and they last until the design process is complete [7]. If these iterations are not anticipated and planned appropriately, rework, repetition and redesign can occur at random resulting in time and cost over-run. Although design iteration is not a new concept in construction projects, very few research investigations have been attempted so far [1,2,27,14]. Thus, the objective of the present study was to explore the iteration and its associated complexity for construction sector both theoretically and practically.

To achieve this objective, exhaustive literature review on design iteration was done for four sectors – construction, manufacturing, aerospace, and software development. Then, the

Please cite this article in press as: P. Mujumdar, J.U. Maheswari, Design iteration in construction projects – Review and directions, Alexandria Eng. J. (2017), http://dx.doi.org/10.1016/j.aej.2016.12.004