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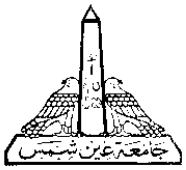

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Structural Engineering

Analyzing BIM Performance In Building Projects Using Lean Concept

Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science In Civil Engineering

(Structural Engineering)

By

Ahmad Fathy Belal

Bachelor of Science In Civil Engineering

(Structural Engineering)

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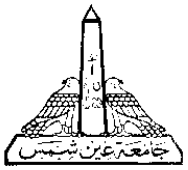

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Statement

This thesis is submitted as a partial fulfilment of Master of Science in Civil Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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IN THE NAME OF ALLAH, THE MOST GRACIOUS AND THE MOST MERCIFUL

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Table of Contents

Page

TABLE OF CONTENTS.....i
LIST OF FIGURES.....iii
LIST OF TABLES.....iv
ABSTRACT.....v
CHAPTER 1: INTRODUCTION.....1
1.1 GENERAL…… ……...…….1
1.2 RESEARCH QUESTIONS……5
1.3 RESEARCH OBJECTIVE…….5
1.4 RESEARCH MOTIVATION…….5
1.5 RESEARCH SCOPE AND LIMITATION...…….6
1.6 RESEARCH METHODOLOGY……...6
1.7 THESIS OUTLINE……7
CHAPTER 2: LITERATURE REVIEW.....8
2.1 BACKGROUND.....8
2.2 BIM TECHNOLOGY……...…9
2.3 LEAN APPROACH…….11
2.4 INTERACTION BETWEEN BIM AND LEAN…….…13
2.5 SUMMARY……..18
CHAPTER 3: BIM PERFORMANCE.....19
3.1 INTRODUCTION.....19
3.2. DATA COLLECTION AND ANALYSIS…….…21
3.2.1 ACTUAL MAN-HOURS WITH RESPECT TO BUDGETED MAN-HOURS……...24
3.2.2 MODEL DEVELOPMENT…….…….25
3.2.3 RELATIONSHIP BETWEEN AREA AND MAN-HOURS…..……..….27
3.3 DISCUSSION……...28
3.3.1 BIM PROJECTS……...28
3.3.2 THE TRADITIONAL WAY PROJECTS.…….…….28
3.3.3 MODEL VALIDATION…….…….29
CHAPTER 4: LEAN WAY IN CONSTRUCTION PROJECTS……31
4.1 INTRODUCTION……...…….31
4.1.1 EVOLUTION FROM CRAFT PRODUCTION TO MASS PRODUCTION…….31

4.1.2 TOYOTA PRODUCTION SYSTEM…….....32
4.1.3 LEAN PRODUCTION AND LEAN PRINCIPLES……33
4.2. LEAN CONSTRUCTION……...34
4.2.1 LEAN CONSTRUCTION ORIGINS……...34
4.2.2 LEAN CONSTRUCTION DEVELOPMENT……..…35
4.2.3 CONSTRUCTION INDUSTRY COMPARED TO THE MANUFACTURING INDUSTRY……...36
4.2.4 TOOLS AND TECHNIQUES OF LEAN CONSTRUCTION……37
4.3 INTERACTION BETWEEN LEAN PRINCIPLES AND BIM…….…38
4.3.1 DATA ANALYSIS…….…..…39
4.3.2 PARETO CHART……..…….…..…46
4.3.3 DELAY CAUSES OF PROJECTS…….…..…47
4.3.4 FMEA ANALYSIS……..50
4.3.5 FISHBONE ANALYSIS…….51
4.4 SUMMARY……..54
CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS……55
5.1 SUMMARY……..……....55
5.2 CONCLUSIONS…….…..55
5.3 FUTURE RESEARCH…….57
REFERENCES

List of Tables

TABLE (3.1): LIST OF PROJECTS.....22
TABLE (3.2): FREQUENCY OF PROJECT TYPES…….23
TABLE (4.1): MANUFACTURING AND CONSTRUCTION INDUSTRY DIFFERENCES....37
TABLE (4.2): PROJECTS DURATION DATA…….44
TABLE (4.3): PROJECTS DELAY DURATION……..….45
TABLE (4.4): DELAY CAUSES DATA…….....47
TABLE (4.5): FMEA ANALYSIS……..51

List of Figures

FIGURE (2.1): FRAMEWORK MATRIX BETWEEN BIM FUNCTIONALITY AND LEAN PRINCIPLES…..…….14
FIGURE (2.2): VARIATION IN FREQUENCY OF COORDINATION-BASED ROOT CAUSES……..…15
FIGURE (2.3): PROTOTYPE 1……..….17
FIGURE (2.4): PROTOTYPE 2……..….18
FIGURE (3.1): LEVEL OF DEVELOPMENT DURING PROJECT LIFECYCLE…….…..…20
FIGURE (3.2): NO. OF HOURS PER SQUARE METER FOR DIFFERENT TYPES OF PROJECTS……..….24
FIGURE (3.3): NUMBER OF ACTUAL MAN-HOURS WITH RESPECT TO BUDGETED MAN-HOURS FOR PROJECTS DONE USING THE TRADITIONAL WAY...…….....….24
FIGURE (3.4): NUMBER OF ACTUAL MAN-HOURS WITH RESPECT TO BUDGETED MAN-HOURS IN BIM PROJECTS……...25
FIGURE (3.5): RELATIONSHIP BETWEEN PROJECT AREA (m^2) AND MAN-HOURS (HR) FOR RESIDENTIAL BUILDINGS TYPE…….26
FIGURE (3.6): RELATIONSHIP BETWEEN PROJECT AREA (m^2) AND MAN-HOURS (HR) FOR COMMERCIAL BUILDINGS TYPE……26
FIGURE (3.7): EXCEL SYSTEM INPUT DATA EXAMPLE……..….27
FIGURE (4.1-1): DESIGN PROCESS-PHASE (1)…… ……...41
FIGURE (4.1-2): DESIGN PROCESS-PHASE (2)…… ……...42
FIGURE (4.1-3): DESIGN PROCESS-PHASE (3)…… ……...43
FIGURE (4.2): PROJECTS DELAY BY PHASE……..….46
FIGURE (4.3): PARETO CHART USING FREQUENCY OF OCCURRENCE……..….48
FIGURE (4.4): PARETO CHART USING DURATION OF DELAY……..….49
FIGURE (4.5): FISHBONE DIAGRAM……53

ABSTRACT

Building Information Modeling (BIM) is defined as the process of design, construction and use of the building or facility infrastructure using information about virtual objects.

Previous studies concluded that BIM implementation resulted in increasing the design cost by 6.5%,11% and 17% for Schematic Design phase, Design Development phase, and Construction Documentation phase, respectively. However, there is still a need to compare between BIM and CAD technologies relative to budgeted and actual man-hours.

On the other hand, Lean construction refers to the application of lean thinking or lean principles on projects in the construction industry. The Construction industry is different in many ways from the Manufacturing industry. The unique and complex nature of the construction industry presents an immense challenge for the application of production management, as it would not be easy to simply transfer management practices from production to construction unless modifying construction management methods and culture.

BIM and Lean are quite in concept. However, it has been established that a synergy exists. The objective of this study is to compare between BIM and CAD technologies in different kinds of projects, relative to budgeted and actual man-hours, to develop a Design Estimate that could predict the estimated man-hours for BIM based projects. The significance of this study is the value of the comparison and its reflection in estimating man-hours with an acceptable accuracy based on data collected from BIM projects, which could affect the bidding process. Another objective of this study is

to attempt to apply Lean Approach to the design phase of the construction projects to enhance its performance.

Data of 40 projects designed in the last 10 years were analyzed in order to develop the Design Estimate. The results showed that there was a 4.6% and +7.0% difference between the estimated and the actual man-hours for Residential buildings type, and a +7.6% and -5.0% difference between the estimated and the actual man-hours for commercial buildings type, with a reasonable error rate considering the limited number of collected BIM projects.

Meanwhile, Delays have become a universal phenomenon, resulting in time and cost overruns in most cases, although schedule delays seem to be embedded in all projects, identifying the main causes and preventing these problems from occurring are better than resolving subsequent delay-related disputes. Lean approach provides an informative guidelines to waste reduction or even elimination if properly adopted. In this study, the Pareto chart was used in order to highlight the main causes of delay in the design process, and the results of the Lean Approach implementation indicated that about 28% of the total number of delay causes resulted in about 73% of the causes of delay of the projects when using the frequency of occurrence as the Defects, also, about 23% of the total number of delay causes resulted in about 77% of the causes of delay of the projects when using the delay duration as the Defects. Finally, the overall performance improvement ranges between 3% and 34% by solving about 23% of the total number of delays.

Keywords: BIM, Lean Construction, man-hours, Design Phase.