

**LEAN STRATEGIES TO MINIMIZE WASTE IN  
SRI LANKAN QUARRY INDUSTRY**

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Degree of Master of Science in Project Management

Department of Building Economics

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Thesis/ Dissertation submitted in partial fulfilment of the requirements for  
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## DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Date:

The above candidate has carried out research for the Dissertation under my supervision.

Signature of the supervisor:

Date:

## DEDICATION

*This dissertation is gratefully dedicated to my father and mother for making me who I am, and wife for supporting me all the way!*

## **ACKNOWLEDGEMENT**

This dissertation would not have been possible without the support of so many people in so many ways. I owe a debt of gratitude to each and every one who spent their valuable time and effort and to all who shared their knowledge and professional experience.

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Finally, I take this opportunity to thank my family and batch mates for their emotional and moral support.

## **ABSTRACT**

### **Lean strategies to minimize waste in Sri Lankan quarry industry**

Aggregates product is one of the main contributors to the construction industry. According to the GSMB records, the total annual production of crushed and broken rock is about 10 million cubic meters. Due to the rapid increase of construction industry, the demand for the rock is also increasing and it will help to increase the number of metal quarries in the country. Therefore, there is a need to enhance quantity and productivity of process in industrial quarry projects.

It is very difficult to find a systematically well-developed quarry although there is a high demand for aggregate product in Sri Lanka. It is observed that there are many non – value adding activities (waste) in their processes which hinder the quarry performance. Therefore, there is a need to implement concept such as lean philosophy in order to eliminate or minimize waste and to optimize quarry operation.

Accordingly, aim of this research is to identify lean strategies to minimize waste in Sri Lankan quarry industry. One of the objectives of this study was to identify lean concept and main industrial waste. This objective was successfully achieved through a comprehensive literature survey and end of the literature review the conceptual model for the study was developed.

Multiple case study method under qualitative research approach was selected as the most suitable research method for this study. Three industrial quarry sites were selected under the multiple case study design. Data collection for the case study was based on semi structured interviews based on the open ended questions to enhance the richness of the information collected. Data were analyzed adopting content analysis, tables and cognitive mapping techniques.

Cognitive map was developed for all identified factors affecting waste in Sri Lankan aggregate mining industry under main eight waste which are Over Production, Waiting/ Delay, Unnecessary Transportation, Unnecessary Processing, Excess Inventories, Unnecessary Movement/ Motion, Defects, Underutilised People . The proposed strategies for each factor were linked to relevant lean strategy by considering literature review and desk study. Finally, initially developed conceptual model was modified to prepare a framework to minimize waste (non-value adding activities) in Sri Lankan quarry industry by using lean strategies as the final outcome of the research. Accordingly TPM, JIT, Bottleneck Analysis, PDCA, 5S, Kaizen, TQM, Poka-Yoke, Jidoka were identified as key lean strategies to minimize main eight waste in quarry industry.

Key words: Aggregate mining Industry/ Quarry Industry, Lean Concept, Waste

## TABLE OF CONTENT

Declaration .....	i
Dedication .....	ii
Acknowledgement .....	iii
Abstract .....	iv
Table of Content .....	v
List of Figures .....	x
List of Tables .....	xii
List of Abbreviations .....	xiii
CHAPTER 01 .....	1
1. Introduction .....	1
1.1 Background .....	1
1.2 Problem Statement .....	4
1.3 Aim and Objectives .....	5
1.4 Methodology .....	6
1.5 Scope and Limitation .....	6
1.6 Chapter Breakdown .....	7
1.7 Summary .....	8
CHAPTER 02 .....	9
2. Literature Review .....	9
2.1 Mining Industry .....	9
2.1.1 World Mining Industry .....	10
2.1.2 Sri Lankan Mining Industry .....	13
2.1.3 Underground and Open Cast Mining .....	16
2.1.3.1 Underground Mining .....	16
2.1.3.2 Open Cast / Surface Mining .....	17

2.1.4	Industrial Quarry Project.....	18
2.1.5	Process in Quarry Industry.....	21
2.1.5.1	Drilling.....	21
2.1.5.2	Blasting.....	22
2.1.5.3	Mucking and Scaling.....	24
2.1.5.4	Breaking.....	25
2.1.5.5	Loading and Transporting.....	25
2.1.5.6	Processing/ Crushing.....	26
2.2	Lean Philosophy.....	29
2.2.1	History of Lean Philosophy.....	32
2.2.2	Lean Principles.....	33
2.2.2.1	Womack and Jones’s Principles.....	33
2.2.2.2	Koskela’s Lean Principles.....	36
2.2.2.3	Henderson and Larco’s Lean Principles.....	38
2.2.2.4	Chinh and Nhon’s Principles.....	38
2.2.3	Types of Waste.....	39
2.2.4	Lean Strategies.....	42
2.2.4.1	5S Concept.....	42
2.2.4.2	Just-In-Time (JIT).....	42
2.2.4.3	Kaizen.....	43
2.2.4.4	Kanban (Pull System).....	43
2.2.4.5	Value Stream Mapping.....	44
2.2.4.6	Poka-Yoke.....	44
2.2.4.7	Takt Time.....	45
2.2.4.8	Total Productive Maintenance (TPM).....	45
2.2.4.9	Continues Flow.....	46

2.2.4.10 Bottleneck Analysis .....	46
2.2.4.11 Total Quality Management (TQM) .....	46
2.2.4.12 Visual Controls / Visual Management.....	47
2.2.4.13 Daily Huddle Meeting .....	47
2.2.4.14 Plan Do Check Act (PDCA).....	47
2.2.4.15 Cellular Manufacturing/ Manufacturing Cells.....	48
2.2.4.16 Jidoka (Autonomation) .....	48
2.2.4.17 Work Standardization .....	48
2.2 Waste in Quarry Industry .....	49
2.3 Application of Lean Concept in Mining Industry .....	50
2.4 Conceptual Model of the Research .....	52
CHAPTER 03 .....	54
3. Research Methodology .....	54
3.1 Introduction .....	54
3.2 Research Approach .....	54
3.3 Case Study Design .....	55
3.3.1 Identification of Unit of Analysis .....	55
3.3.2 Case Selection .....	56
3.4 Data Collection.....	56
3.4.1 Interviews.....	56
3.4.1.1 Interview Structure .....	57
3.4.1.2 Interview Process .....	57
3.5 Data Analysis .....	58
3.6 Summary .....	59
CHAPTER 04 .....	60
4. Data Analysis and Findings .....	60

4.1	Introduction .....	60
4.2	Overview of the Cases.....	60
4.3	Profile of Interviews.....	62
4.4	Cross Case Analysis .....	62
4.4.1	Waste in Sri Lankan Quarry Industry .....	63
4.4.1.1	Over Production Waste.....	66
4.4.1.2	Waiting / Delay Waste .....	69
4.4.1.3	Unnecessary Transportation Waste.....	72
4.4.1.4	Unnecessary Processing Waste.....	75
4.4.1.5	Excess Inventory Waste.....	78
4.4.1.6	Unnecessary movement/ motion waste .....	80
4.4.1.7	Defects .....	83
4.4.1.8	Underutilized People Waste .....	87
4.4.2	Lean Strategies to Minimize Waste.....	95
4.4.2.1	Lean Strategies to Minimize Over Production Waste .....	99
4.4.2.2	Lean Strategies to Minimize Waiting /Delay Waste .....	100
4.4.2.3	Lean Strategies to Minimize Unnecessary Transportation Waste .....	101
4.4.2.4	Lean Strategies to Minimize Unnecessary Processing Waste .....	101
4.4.2.5	Lean Strategies to Minimize Excess Inventories Waste.....	102
4.4.2.6	Lean Strategies to Minimize Unnecessary Movement/ Motion waste .	103
4.4.2.7	Lean Strategies to Minimize Defects Waste.....	104
4.4.2.8	Lean Strategies to Minimize Underutilized People Waste.....	106
4.4	Framework to Minimize Waste in Sri Lankan Quarry Industry .....	108
4.5	Summary .....	110
CHAPTER 05.....		111

5. CONCLUSIONS AND RECOMMENDATIONS .....	111
5.1 Introduction .....	111
5.2 Conclusions .....	111
5.3 Recommendations to the Mining Industry .....	114
5.4 Recommendations for Further Research .....	115
References .....	116
Annexes .....	122

## LIST OF FIGURES

Figure 1.1: Chapter breakdown.....	7
Figure 2.1 Left: Bingham Canyon mine in US; Right: Chuquicamata Copper Mine in Chile.....	12
Figure 2.2: Global Mining Activities in 2011.....	13
Figure 2.3: Mineral Resource Map of Sri Lanka.....	15
Figure 2.4: Picture of Quarry Site.....	19
Figure 2.5: Process in Quarry Operation.....	20
Figure 2.6 Left: Manual Drilling Using Pneumatic Hand Drill Machine; Right: Mechanized Drilling Using Track Drill Machine.....	21
Figure 2.7: Blast Design Terminology.....	23
Figure 2.8 Left: Charging of Dynamite with ED (Primer); Right: Filling of ANFO (Main Blasting Agent).....	23
Figure 2.9 Left: Doing Stemming; Right: Making of Circuits (Wiring).....	24
Figure 2.10: Mucking Using an Excavator.....	24
Figure 2.11: Rock Breaking.....	25
Figure 2.12 Left: Loading to Dump Trucks; Right: Material Transportation to Processing or Direct Customers.....	26
Figure 2.13: Crusher Plant Diagram.....	27
Figure 2.14: Commonly use Crusher Plant Flow Sheet.....	28
Figure 2.15: The Deming Chain Illustrating how Quality Improvements Reach the Bottom Line.....	30
Figure 2.16: The Lean Production Value Stream.....	39

Figure 2.17: Continues Cycle of Five Lean Principles .....	35
Figure 2.18: Lean production – Eleven Sub Principles .....	37
Figure 2.19: The Lean Production Principles .....	38
Figure 2.20: Conceptual Model.....	53
Figure 4.1: Factors affecting Over Production .....	66
Figure 4.2: Factors affecting Waiting/ Delay Waste.....	69
Figure 4.3: Factors affecting Unnecessary Transportation .....	73
Figure 4.4: Factors affecting Unnecessary Processing .....	75
Figure 4.5: Factors affecting Waste on Excess Inventories .....	79
Figure 4.6: Factors affecting Waste under Unnecessary Movement / Motion .....	80
Figure 4.7: Factors affecting Defects .....	83
Figure 4.8: Factors affecting Waste on Underutilized People .....	88
Figure 4.9: Cognative map of factors affecting waste in Sri Lankan quarry industry.....	94
Figure 4.10: Framework to minimize waste in Sri Lankan quarry industry by applying lean strategies .....	109

## LIST OF TABLES

Table 2.1: Literature Summary on different type of waste .....	40
Table 2.2: Waste types with their descriptions .....	41
Table 2.3: Simple illustration of 5s.....	42
Table 4.1: Case description.....	61
Table 4.2: Profile of Interviews .....	62
Table 4.3: Identified factors affecting waste in industrial aggregate mining project in Sri Lanka.....	63
Table 4.4: Respondents' responses on factors affecting over production.....	67
Table 4.5: Respondents' responses on factors affecting waiting/ delay waste .....	70
Table 4.6: Respondents' responses on factors affecting unnecessary transportation	74
Table 4.7: Factors affecting unnecessary processing.....	76
Table 4.8: Respondents' responses on factors affecting waste under excess inventories.....	79
Table 4.9: Respondents' responses on factors affecting waste under unnecessary movement / motion .....	81
Table 4.10: Respondents' responses on factors affecting defects.....	84
Table 4.11: Respondents' responses on factors affecting waste under Underutilized People.....	89
Table 4.12: Proposed lean strategies to minimise waste in Sri Lankan quarry industry .....	96

## LIST OF ABBREVIATIONS

<b>Abbreviation</b>	<b>Description</b>
ABC	Aggregate Base Course
AIV	Aggregate Impact Value
AML	Artisanal Mining Licence
ANFO	Ammonium-Nitrate with Fuel Oil
FI	Flakiness Index
FPS	Ford Production System
GSMB	Geological Survey and Mines Bureau
IML	Industrial Mining Licence
ISEE	International Society of Explosive Engineers
JIT	Just in Time
LAAB	Loss Angeles Abrasion Value
NVAA	Non Value Added Activities
PDCA	Plan-Do-Check-Act
PPE	personal protective equipment
SG	Specific Gravity
TPM	Total Productive Maintenance
TPS	Toyota Production System
TPSBH	Toyota Production System Basic Handbook
TQM	Total Quality Management
VSM	Value Stream Mapping