CONSTRUCTION ENGINEERING & MANAGEMENT

Malaysian Perspective

CONSTRUCTION ENGINEERING & MANAGEMENT

Malaysian Perspective

Wesam Salah Alaloul
Muhammad Ali Musarat

Universiti Teknologi PETRONAS
Seri Iskandar • 2023

CONSTRUCTION ENGINEERING AND MANAGEMENT
Malaysian Perspective

© Universiti Teknologi PETRONAS 2023
Second Print 2024

All rights reserved. No part of this publication may be reproduced or transmitted in any form or any means, including photocopying and recording, without the written permission of the copyright holder, application for which should be addressed to Universiti Teknologi PETRONAS. Such written permission must also be obtained before any part of this publication is stored in a retrieval system of any nature. The publisher, authors, contributors and endorsers of this publication each excludes liability for loss suffered by any person resulting in any way from the use of, or reliance on this publication.

Published by
UTP Press
Universiti Teknologi PETRONAS
Owned by Institute of Technology PETRONAS Sdn. Bhd.
32610 Seri Iskandar, Perak Darul Ridzuan, Malaysia

Typeset by
IFZAHWORKZ SOLUTIONS SDN BHD
C-20-11, Zetapark, Kompleks Danau Kota
Jalan Taman Ibu Kota, Taman Ibu Kota
53300 Kuala Lumpur, MALAYSIA

Printed in Malaysia by
Reka Cetak Sdn. Bhd.
No. 12 & 14, Jalan Jemuju Empat 16/13D,
Seksyen 16, 40200 Shah Alam,
Selangor Darul Ehsan.
www.rekacetak.com

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Wesam Salah Alaloul
CONSTRUCTION ENGINEERING & MANAGEMENT : Malaysian Perspective /
Wesam Salah Alaloul, Muhammad Ali Musarat.
ISBN 978-967-2880-19-6
1. Engineering--Management--Malaysia.
2. Construction industry--Management--Malaysia.
3. Electronic books.
I. Muhammad Ali Musarat. II. Title.
690.068

Contents

Preface *ix*

Chapter 1: Introduction **1**

1.1 Overview of Construction Industry 1
1.2 Various Sectors of the Construction Industry 2
1.2.1 Residential Construction 3
1.2.2 Industrial Construction 3
1.2.3 Institutional and Commercial Construction 5
1.2.4 Infrastructure and Heavy Construction 5
1.3 Sustainable Development in Construction Industry 5
1.4 Project Development Process 6
1.5 Construction Industry in Malaysia 8
1.6 Codes and Regulations in Malaysia 10
1.6.1 Overview 10
1.6.2 Building Regulations and Enforcement 11
1.7 Construction Projects Stakeholders in Malaysia 12
1.8 Ethics in Construction 13
1.8.1 Overview 13
1.8.2 Unethical Behaviours 15
1.9 Productivity of Malaysian Construction Industry 17

Chapter 2: Contract and Procurement Management **18**

2.1 Contract Definition 18
2.2 Contract Strategies in the Construction Industry 19
2.2.1 Construction Management at Risk Approach 25
2.2.2 Construction Management as Agency Approach 26
2.2.3 Public-Private Partnership (PPP) 27
2.3 Contract Types in Construction Industry 28
2.4 Contract Documents 30
2.5 Tendering Procedures and Evaluation 32

	2.6	Claim Management	35
		2.6.1 Claim Management Approach	35
Chapter 3:	**Quantities Taking-off and Cost Estimation**		**37**
	3.1	Taking off for Civil Works	37
	3.2	Costs in Construction Projects	38
	3.3	Cost Estimation	39
		3.3.1 Types of Cost Estimates	41
	3.4	Inflation and Time Value of Money for Investment	42
Chapter 4:	**Project Planning and Scheduling**		**44**
	4.1	Project Planning	44
	4.2	Project Scheduling	46
	4.3	Work Breakdown Structures	46
		4.3.1 Guidance for WBS Development	47
		4.3.2 Types of WBS	48
	4.4	Activities Duration	51
	4.5	Activities Sequences and Dependencies	52
	4.6	Gantt Chart (Bar Chart)	52
	4.7	Arrow Diagram Computation (Activity on Arrow (AoA))	53
	4.8	Precedence Diagram Computation (Activity on Node AoN)	54
	4.9	Floats	56
Chapter 5:	**Resource Allocation**		**59**
	5.1	The Management of Resources	59
	5.2	Resources Allocation	61
		5.2.1 Steps for Resources Allocation	61
		5.2.2 Challenges in Resources Allocation	63
	5.3	Resource Levelling	64
Chapter 6:	**Project Control and Monitoring**		**65**
	6.1	Monitoring Project Status	65
	6.2	Progress Control	66
	6.3	Updating of Schedules	67
	6.4	Evaluating and Forecasting	67
	6.5	Earned Value Analysis	68
	6.6	S-Curve	72
Chapter 7:	**Site Organisation and Management**		**76**
	7.1	On-site Organisation	76
	7.2	Mobilisation and Demobilisation	79
	7.3	Site Office Administration and Reports	80

	7.4	Storage of Materials and Equipment	80
	7.5	Coordination with Suppliers and Sub-Contractors	81
	7.6	Site Supervision and Productivity	82
	7.7	Environmental Management System	83
	7.8	Construction Site Solid Waste	84
Chapter 8:	**Health and Safety in Construction**		**87**
	8.1	Nature and Types of Accidents	87
	8.2	Accident Theories	95
	8.3	Health and Safety Issues on Construction Sites	96
	8.4	CIDB Act and OSH Act	96
	8.5	Main Players of Construction Site Safety	97
	8.6	Safety Management Techniques and Tools	99
Chapter 9:	**Industrialized Building System (IBS)**		**101**
	9.1	Definition of IBS	101
	9.2	History of IBS	102
	9.3	CIDB IBS Grouping	103
	9.4	In-situ Vs IBS, Advantages and Disadvantages	104
		9.4.1 Advantages of IBS	104
		9.4.2 Disadvantage of IBS	105
	9.5	Buildability and Barriers of IBS	106
	9.6	IBS Score	107
Chapter 10:	**Management Tools in Construction Industry**		**112**
	10.1	Quality Assurance and Quality Control	112
	10.2	TQM in the Construction Industry	116
	10.3	Lean Construction	117
	10.4	Value Engineering	120
		10.4.1 Value Analysis Job Plan	120
	10.5	Risk Assessment and Analysis	122
Chapter 11:	**IR 4.0 Applications in Construction Industry**		**125**
	11.1	IR 4.0 Definition	125
	11.2	Building Information Modelling (BIM) and Digitalisation	128
	11.3	3D Printing	128
	11.4	Automated and Cloud Computing	131
	11.5	Physical and Cybersecurity	131
Bibliography			133
Index			139

Preface

Malaysia is moving fast towards expansion and has come up with incredible construction projects that have made a massive impact globally. Although several literatures are available on construction engineering and management practises; however, there was no such specific information under one umbrella from a Malaysian perspective. This unavailability of information is an opportunity for the authors to write a book that covers the attributes of all the construction industry events from a Malaysian perspective.

The authors would like to thank all the Governmental Departments of Malaysia, as most statistics are taken from their websites. Moreover, the authors acknowledge the role of Universiti Teknologi PETRONAS (UTP) for the opportunity and motivation provided in this book write-up.

This book covers all the major aspects of construction engineering and management related to the Industrial Revolution 4.0 that have been implemented or can be further executed in the Malaysian Construction Industry. Detailed information about the laws, procedures, and ways of construction and claim management can be read in this book, which can benefit all beginners and the experienced stakeholders of the industry. The book also covers site management techniques and health and safety in construction. Moreover, the Industrialised Building System (IBS) with the latest management tools in construction are also detailed with discuss.

Wesam Salah Alaloul
Muhammad Ali Musarat
Seri Iskandar, 2022