

Contents

Preface

xv

PART 1

Background information of the book

1

1 General introduction

3

Introduction 3

Sustainable construction 5

*Need for information and communication technologies in
construction* 6

Objective of the book 6

Summary 7

References 7

PART 2

Sustainable construction 4.0

9

2 Artificial intelligence for sustainable construction

11

Introduction 11

Concept definitions 12

Benefits of applying artificial intelligence to construction 14

Sustainable construction 15

Benefits of sustainable construction 16

Artificial intelligence for sustainable construction 16

Challenges of artificial intelligence in sustainable construction 19

Solution to the challenges highlighted 19

Conclusion 19

References 20

3	Augmented reality and sustainable construction	21
	<i>Introduction</i>	21
	<i>Sustainable construction (SC)</i>	22
	<i>Working principle of augmented reality</i>	23
	<i>How augmented reality works</i>	23
	<i>Augmented reality in today's world</i>	24
	<i>Augmented reality devices</i>	25
	<i>Devices suitable for augmented reality fall into the following categories</i>	26
	<i>Types of augmented reality</i>	27
	<i>Smart City planning and building: Augmenting the possibilities</i>	28
	<i>Augmented reality in construction</i>	28
	<i>Benefits of augmented reality for construction project</i>	31
	<i>Challenges of augmented reality</i>	34
	<i>Conclusion</i>	35
	<i>References</i>	36
4	Big data and sustainable construction	39
	<i>Introduction</i>	39
	<i>The big data</i>	40
	<i>Big data in construction</i>	40
	<i>Big data engineering and big data analysis</i>	41
	<i>Key principles of sustainable construction</i>	42
	<i>Conclusion</i>	43
	<i>References</i>	43
5	Building information modelling for sustainable construction	44
	<i>Introduction</i>	44
	<i>Building information modelling in the construction industry</i>	44
	<i>The concept of building information modelling promoting sustainability</i>	45
	<i>Building information modelling for sustainable construction</i>	47
	<i>Practical application(s) of BIM techniques as innovation for sustainability achievement</i>	48
	<i>Benefits of building information modelling to the construction industry</i>	48
	<i>Summary of the challenges of BIM in sustainable building design</i>	50
	<i>Conclusion</i>	51
	<i>References</i>	52

6 Biomimicry and sustainable construction

54

Introduction 54*Approach and levels* 56*Biomimetic design considerations* 56*Biomimetic design methodology* 58*Biomimicry to improve sustainability* 58*Conclusion* 59*References* 60**7 Blockchain for sustainable construction**

61

Introduction 61*Pillars of blockchain technology* 62*Challenges of blockchain technology* 64*Problems blockchain solves* 64*Benefits of blockchain technology* 65*Other benefits of blockchain* 65*Sustainable procurement in the construction industry enabled by blockchain* 66*Fostering enhanced efficiency and trust in the supply Chain* 66*Blockchain and sustainability* 66*Opportunities related to blockchain in the construction industry* 68*Conclusion* 68*References* 69**8 Cryptocurrency for sustainable construction**

70

Introduction 70*Definitions* 70*Cryptocurrency fulfilment in the role of money* 71*Advantages and disadvantages of cryptocurrencies* 73*Cryptocurrency for sustainable construction* 74*Application of cryptocurrency as means of payment* 75*Conclusion* 76*References* 76**9 Cyber security for sustainable construction**

77

Introduction 77*The role of cyber security in the construction industry* 77

Some cybercrimes related to construction	79
Basic security protocols	79
Cyber security measures for sustainable construction	80
Causes of incidents in cyber security	82
Contribute to public and professional awareness of security	82
What information could be exposed in a breach of cyber security	82
What you should be doing about it	82
Construction industry instances of cybercrime	83
Sustainable construction	84
Benefits of sustainable construction	85
The effects of sustainable construction	85
Information technology and sustainable construction	86
The role of information technology (IT) in achieving sustainable construction	86
Conclusion	87
References	87

10 Drone and sustainable construction

89

Introduction	89
Definition of terms	89
Application of drone technology in construction	91
Environmental impact	95
Economic impact	95
Social impact	95
Technical impact	95
Drone technology for sustainable construction	95
Conclusion	97
References	97

11 Gamification for sustainable construction

101

Introduction	101
Process of developing gamification	101
Drivers and challenges of applying gamification	103
Advantages of gamification	104
Gamification for construction sustainability	105
Relationship between gamification and sustainability	105
Gamifying construction	106
Construction application	106
Conclusion	107
References	108

12 Internet of things and sustainable construction	110
Introduction	110
Internet of things	111
The IoTs architecture	111
The communication process of IoT	112
Sustainable construction	112
Internet of things for sustainable construction	113
Internet of things' roles in sustainability	117
Roles of internet of things for sustainability	117
Models for business and investment	117
Impact measurement	117
Drawbacks with IoT in the actualization of sustainable construction	118
Conclusion	120
References	120
13 Machine learning for sustainable construction	124
Introduction	124
Sustainable construction	124
Benefits of sustainable construction	125
Machine learning for sustainable construction	125
Limitations to machine learning	131
Conclusion	132
References	132
14 Nanotechnology for sustainable construction	134
Introduction	134
Nanotechnology	136
Nanotechnology for sustainable construction	137
Importance of nanotechnology in sustainable construction	137
Application of nanotechnology to other materials	140
Conclusion	141
References	142
15 Robotics for sustainable construction	144
Introduction	144
Reduction and re-usage	145
Construction firm's role in sustainable construction	145
Government role in sustainable construction	145

Green construction and sustainability	146
New innovations	146
Prefabrication	146
Building information modelling	146
Four pillars of sustainable construction	147
The practice of sustainable construction	148
The future of robotics in construction	149
The meeting Point between humans and robots	149
Robotics engagement in construction processes	149
Disadvantages of using robots in construction	150
Examples of robots that can be used on construction sites	151
Achieving sustainable construction through robotics	153
Conclusion	154
References	155

16 Virtual reality for sustainable construction

156

Introduction	156
Development of VR	156
VR and planning smart cities	157
Impact of virtual reality on Green building construction	158
Benefits of utilizing virtual reality within the construction industry	158
Factors mitigating against the wide use of virtual reality	159
Conclusion	160
References	160

Index

162