

CONTENTS

1	Introduction to This Book	1
2	Definition, Current Issues and Areas for Improvement in Agricultural Supply Chains	3
2.1	<i>Definition of Agricultural Supply Chain (ASC)</i>	3
2.2	<i>The Need for Value-Addition in ASC</i>	4
2.3	<i>Key Issues in Agricultural Supply Chains</i>	5
2.4	<i>Summary</i>	10
	<i>References</i>	10
3	From Industry 4.0 to Agriculture 4.0	13
3.1	<i>The Evolution of Industry 4.0</i>	13
3.1.1	<i>Definition of Industry 4.0</i>	13
3.1.2	<i>The Evolution to Industry 4.0</i>	14
3.1.3	<i>Technological Applications of Industry 4.0</i>	16
3.1.4	<i>Big Data and Analytics</i>	17
3.1.5	<i>Autonomous Robots</i>	17
3.1.6	<i>Simulation</i>	18
3.1.7	<i>Horizontal and Vertical System Integration</i>	18
3.1.8	<i>The Industrial Internet of Things (IoT)</i>	18
3.1.9	<i>Cyber Security and Cyber Physical Systems</i>	19
3.1.10	<i>The Cloud</i>	19
3.1.11	<i>Additive Manufacturing</i>	20
3.1.12	<i>Augmented Reality</i>	20

3.2	<i>The Emergence of the Agriculture 4.0 Concept</i>	20
3.2.1	<i>Agriculture 4.0</i>	20
3.2.2	<i>The Evolution of Agricultural 4.0 Technology</i>	24
3.3	<i>Summary</i>	26
	<i>References</i>	26
4	Technological Applications of Agricultural 4.0 Supply Chains	29
4.1	<i>Smart Farming</i>	29
4.2	<i>Smart Devices and Platforms</i>	31
4.3	<i>IoT</i>	31
4.4	<i>Temperature Control Applications</i>	32
4.5	<i>Blockchain Applications</i>	32
4.6	<i>Tracking and Tracing Technologies</i>	33
4.7	<i>Autonomous Land Farming Robots</i>	33
4.8	<i>Autonomous Aerial Farming Robots</i>	34
4.9	<i>Smart Monitors</i>	34
4.10	<i>Summary</i>	34
	<i>References</i>	35
5	Data Sharing and the Transformation Agricultural 4.0 Supply Chain Operations	37
5.1	<i>Data Sharing in Agriculture 4.0</i>	37
5.2	<i>The Transformation of the Agricultural 4.0 Supply Chain Operations</i>	39
5.2.1	<i>Farmers Operations</i>	39
5.2.2	<i>Processors Operations</i>	40
5.2.3	<i>Distributors Operations</i>	41
5.2.4	<i>Retailers Operations</i>	42
5.2.5	<i>Consumers</i>	44
5.3	<i>Summary</i>	44
	<i>References</i>	44
6	Sustainability in Agricultural 4.0 Supply Chains	47
6.1	<i>Sustainability Definition</i>	47
6.2	<i>The Triple Bottom Line Concept</i>	48

6.3	<i>Sustainability in Agricultural Supply Chains</i>	49
6.4	<i>Sustainable Performance</i>	50
6.5	<i>Summary</i>	51
	<i>References</i>	51
7	Circular Economy in Agricultural Supply Chains	53
7.1	<i>Definition of Circular Economy</i>	53
7.2	<i>The Need for Circular Economy in Agricultural Supply Chains</i>	55
7.3	<i>Towards Sustainable and Circular Agricultural 4.0 Supply Chains Through Agriculture 4.0</i>	57
7.3.1	<i>The Relationship Between CSR, Sustainability, CE, and Agriculture 4.0</i>	57
7.3.2	<i>Circular Economy Practices</i>	58
7.3.3	<i>Circular Economy and Agriculture 4.0</i>	61
7.4	<i>Summary</i>	62
	<i>References</i>	62
8	Opportunities of Agricultural 4.0 Supply Chains	65
8.1	<i>Real-Time Data Analysis and Decrease of Operational Costs</i>	65
8.2	<i>Increase in Revenue and Production Flexibility</i>	66
8.3	<i>Improves Sustainability and Enables Circular Economy</i>	67
8.4	<i>Enhances Reliability and Uptime</i>	67
8.5	<i>Self-Optimisation and Quality of Service</i>	68
8.6	<i>Improves Infrastructure</i>	69
8.7	<i>Summary</i>	70
	<i>References</i>	70
9	Challenges of Agricultural 4.0 Supply Chains	73
9.1	<i>Sector Heterogeneity</i>	73
9.2	<i>Farm Size</i>	74
9.3	<i>Validation and Collaboration</i>	74
9.4	<i>Safety and Security</i>	75
9.5	<i>Investment Costs</i>	76
9.6	<i>Design and Compatibility</i>	77
9.7	<i>Concluding Remarks</i>	77
9.8	<i>Summary</i>	78
	<i>References</i>	78

x CONTENTS

10 Conclusion and the Way Forward	81
<i>10.1 Summary</i>	<i>84</i>
 References	 85
 Index	 99