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Industry 4.0

Sustainable Industrial Approach

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INDUSTRY 4.0

Sustainable Industrial Approach

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Preface

In the current era of rapid technological advancement, Industry 4.0 stands at the forefront, revolutionizing the landscape of business operations, manufacturing, and consumer engagement. The integration of digital technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and big data analytics is reshaping industries, creating unprecedented opportunities for efficiency and innovation. However, as we embrace these technological advancements, it becomes imperative to consider their impact on sustainability.

“Industry 4.0: Sustainable Industrial Approach” delves into the intersection of advanced industrial technologies and sustainable practices. This book aims to provide a comprehensive understanding of how businesses can leverage Industry 4.0 technologies to drive not only economic growth but also environmental and social sustainability. Through a series of in-depth analyses, case studies, and expert insights, we explore how digital transformation can be aligned with sustainable development goals.

The concept of sustainability in industry is no longer a mere option but a necessity. As the global community grapples with climate change, resource depletion, and social inequalities, businesses are uniquely positioned to lead the charge towards a more sustainable future. Industry 4.0 offers a powerful toolkit to address these challenges. From optimizing resource utilization and minimizing waste to enhancing supply chain transparency and fostering circular economy models, the potential for positive impact is immense.

This book is structured to guide readers through the theoretical foundations of Industry 4.0, followed by practical applications and strategies for implementing sustainable practices. Each chapter is designed to equip business leaders, policymakers, and scholars with the knowledge and tools needed to navigate the complexities of this transformative era. We highlight real-world examples of companies that have successfully integrated Industry 4.0 technologies with sustainability initiatives, providing a roadmap for others to follow.

In writing this book, our goal is to inspire a paradigm shift in how businesses operate and innovate. We envision a future where technological progress and sustainability go hand in hand, creating value not just for shareholders but for society at large. By embracing a sustainable business approach, we can ensure that the benefits of Industry 4.0 extend beyond economic gains, fostering a resilient and equitable world for generations to come.

We extend our gratitude to the experts, researchers, and practitioners who have contributed their knowledge and experience to this book. Their insights have been invaluable in shaping a comprehensive and forward-thinking perspective on Industry 4.0 and sustainability.

We hope this book serves as a valuable resource and a source of inspiration for all those committed to driving sustainable innovation in the age of Industry 4.0.

Feel free to suggest any changes or specific elements you'd like to include!

Dr. Vikram Bansal
Mrs. Deepthi. B.



Acknowledgments

Writing this book has been an incredible journey, and we are deeply grateful to those who have supported us along the way. We would also like to extend our gratitude to our friends and colleagues. Your insightful feedback, stimulating discussions, and words of encouragement have enriched this book in many ways.

To the academic and professional communities who have embraced the principles of Industry 4.0 and sustainability, thank you for your pioneering work and for setting the foundation upon which this book is built. Your research, innovations, and dedication to creating a better future have been a constant source of inspiration.

We are also grateful to our publisher, Sultan Chand & Sons and the entire editorial team. Your professionalism, meticulous attention to detail, and unwavering support have made this book a reality. Thank you for believing in this project and for guiding us through the publishing process with such expertise and care.

Finally, we would like to thank the readers of this book. Your interest in integrating Industry 4.0 with sustainable industry practices is a testament to your commitment to creating a more sustainable and equitable world. I hope this book serves as a valuable resource on your journey toward achieving those goals.

Dr. Vikram Bansal
Mrs. Deepthi. B.

Contents

1. Introduction to Industry 4.0 and Sustainable Business Approach	1-18
1.1. Understanding Industry 4.0	1
1.1.1. Evolution of Industrial Revolutions	1
1.1.2. Core Technologies of Industry 4.0	3
1.1.3. Implications for Business and Society	5
1.2. Conceptualizing Sustainable Business Approach	6
1.2.1. Definition and Principles of Sustainability	8
1.2.2. Linkages Between Industry 4.0 and Sustainability	9
1.2.3. Importance of Sustainable Business Practices	12
1.3. Lets Sum Up	13
<i>Self Assessment Questions</i>	15
<i>Answers to Self Assessment Questions</i>	17
2. Enabling Technologies for Sustainable Industry 4.0	19-49
2.1. Internet of Things (IoT) and Sustainability	21
2.1.1. IoT Applications in Sustainable Manufacturing	22
2.1.2. IoT-enabled Resource Optimization	23
2.2. Artificial Intelligence (AI) and Sustainability	26
2.2.1. AI-driven Decision Making for Sustainability	27
2.2.2. Predictive Maintenance and Energy Efficiency	30
2.3. Big Data Analytics and Sustainability	34
2.3.1. Data-driven Insights for Waste Reduction	36
2.3.2. Supply Chain Optimization Through Data Analytics	37
2.4. Lets Sum Up	45
<i>Self Assessment Questions</i>	46
<i>Answers to Self Assesment Questions</i>	49

3. Sustainable Manufacturing Practices in Industry 4.0	51-86
3.1. Lean Manufacturing	52
3.1.1. Lean Principles for Waste Reduction	54
3.1.2. Lean Implementation in Smart Factories	56
3.2. Green Production in Sustainability	58
3.2.1. Eco-friendly Manufacturing Processes	60
3.2.2. Renewable Energy Integration in Manufacturing	62
3.3. Circular Economy Strategies in Industry 4.0	68
3.3.1. Closing the Loop: Reuse, Recycle, and Remanufacture	72
3.3.2. Circular Supply Chains and Product Lifecycle Management	76
3.4. Lets Sum Up	82
<i>Self Assessment Questions</i>	83
<i>Answers to Self Assessment Questions</i>	86
4. Policy and Regulatory Frameworks for Sustainable Industry 4.0	87-118
4.1. Government Initiatives and Incentives	89
4.1.1. Tax Credits for Sustainable Practices	89
4.1.2. Regulatory Compliance and Reporting Requirements	93
4.2. International Standards for Sustainable Manufacturing	94
4.2.1. ISO 14001: Environmental Management Systems	96
4.2.2. ISO 50001: Energy Management Systems	99
4.3. Corporate Social Responsibility (CSR) in Industry 4.0	101
4.3.1. Stakeholder Engagement and Transparency	103
4.3.2. Integrating CSR into Business Strategies	111
4.4. Lets Sum Up	112
<i>Self Assessment Questions</i>	113
<i>Answers to Self Assessment Questions</i>	117
5. Implementation Strategies and Case Studies	119-146
5.1. Adoption Roadmaps for Sustainable Industry 4.0	119
5.1.1. Phased Implementation Approaches	121
5.1.2. Overcoming Implementation Challenges	122
5.2. Collaborative Partnerships for Sustainability	124
5.2.1. Industry-Academia Collaboration	129
5.2.2. Public-Private Partnerships	130
5.3. Case Studies of Successful Implementation	131
5.3.1. Sustainable Transformation of Traditional Industries	131
5.3.2. Small and Medium Enterprises (SMEs) Embracing Sustainability	133
5.4. Performance Metrics and Evaluation	135
5.4.1. Key Performance Indicators (KPIs) for Sustainable Manufacturing	136
5.4.2. Monitoring and Continuous Improvement Processes	139
5.5. Lets Sum Up	141
<i>Self Assessment Questions</i>	142
<i>Answers to Self Assesment Questions</i>	145

6. Emerging Trends and Future Directions	147-164
6.1. Advancements in Technology and Innovation	147
6.1.1. Next-generation Technologies for Sustainability	149
6.1.2. Impact of Industry 5.0 on Sustainable Business Practices	151
6.2. Global Trends Shaping Sustainable Manufacturing	153
6.2.1. Climate Change Mitigation Strategies	155
6.2.2. Circular Economy Initiatives on a Global Scale	157
6.3. Lets Sum Up	159
<i>Self Assessment Questions</i>	160
<i>Answers to Self Assessment Questions</i>	164
 Case Studies	 165-204
Leveraging Industrial Internet of Things (IIoT) for Optimal Inventory Management in a Manufacturing Plant	165
Optimizing Manufacturing Processes through Data Analytics and Machine Learning	167
Centralizing Operations with Cloud Computing for Enhanced Manufacturing Efficiency	169
Enhancing Manufacturing Efficiency with Collaborative Robots (Cobots)	172
Leveraging 3D Printing for Mass Customization and Tooling in Industry 4.0	175
Team Penske's Use of Digital Twins in Motor Racing	178
Leveraging Augmented Reality (AR) for Enhanced Surgical Precision	180
StePac PPC Shifts to Real-Time Production Management	183
Transforming Logistics with Industry 4.0: The Implementation of IoT Technology at DHL Supply Chain	185
Transforming Manufacturing with Predictive Maintenance at Siemens	188
Enhancing Retail Operations with AI-Driven Inventory Management at Walmart	190
Transforming Production Efficiency with Robotic Process Automation at TechFusion Industries	193
Enhancing Customer Experience with AI-Powered Chatbots at FinTech Solutions Inc.	195
AI-Driven Customer Insights at EcoGoods Corp.	197
Smart Manufacturing Solutions at Apex Robotics Inc.	199
Bosch Comprehensive Industry 4.0 Deploying IoT	201
Maruti Suzuki India and Industry 4.0	203
 Glossary	 205-208
 References	 209-214

List of Figures

<i>Fig. No.</i>	<i>Pages</i>	<i>Fig. No.</i>	<i>Pages</i>
1.1 : Components of Industry 4.0	2	3.8 : Industry 4.0 Connectivity	69
1.2 : Key Principles of Industry 4.0	5	3.9 : Industry 4.0 for Circular Economy	72
1.3 : Circular Economy	8	3.10 : Remanufacturing	73
1.4 : Linkages between Industry 4.0 and Sustainability	10	4.1 : Production Framework	88
2.1 : Key Technologies of Industry 4.0	20	4.2 : ISO 14001	98
2.2 : Internet of Things (IoT)	21	4.3 : ISO 50001 Energy Management System	101
2.3 : IoT Applications in Manufacturing	23	4.4 : CSR Process	103
2.4 : IoT and Sustainability	25	4.5 : Stakeholders	105
2.5 : AI to Achieve SDGs	27	4.6 : Stakeholder Engagement	109
2.6 : Predictive Maintenance	30	4.7 : Effective Stakeholder Management	109
2.7 : Big Data Analytics	35	5.1 : Industry 4.0 Implementation Framework	121
2.8 : Supply Chain Optimization through Data Analytics	38	5.2 : Phase Wise Implementation	123
2.9 : Inventory Management	42	5.3 : UIP Dataset and Tools	126
2.10 : Supply Chain Risk	45	6.1 : Technology Innovation	148
3.1 : Principles of Lean Manufacturing	54	6.2 : Sustainability	150
3.2 : Lean Manufacturing Components	55	6.3 : Industry 5.0 Key Principles	152
3.3 : Smart Factory	57	6.4 : Sustainable Manufacturing	155
3.4 : Industry 4.0 for Sustainability	59	6.5 : Conventional Mitigation Technologies	157
3.5 : Environmental Assessment	61	6.6 : Circular Economy Initiatives Worldwide	158
3.6 : REs in Building Sector	64		
3.7 : Impact of Renewable Energy Projects	65		

List of Tables

<i>Table No.</i>	<i>Pages</i>	<i>Table No.</i>	<i>Pages</i>
2.1 : Advantages and Disadvantages of IoT-enabled Resource Optimization	25	3.6 : Meaning, Definition of Circular Supply Chains and Product Lifecycle Management	76
2.2 : AI Application in Different Sectors and their Description	28	3.7 : Strategies and Implementation	78
2.3 : Predictive Maintenance and Energy Efficiency Initiatives Across Diverse Sectors	33	4.1 : The Advantages and Disadvantages of Tax Credits for Sustainable Practices	90
2.4 : Disadvantages of Predictive Maintenance	33	4.2 : Strategies for Effective Stakeholder Engagement	106
2.5 : Transportation and Logistics Optimization	39	4.3 : Tools and Techniques for Transparency	108
2.6 : Warehouse Management and Optimization	40	4.4 : Challenges and Barriers	108
3.1 : Advantages and Disadvantages of Lean Implementation in Smart Factories	57	5.1 : Principles of Building Trust and Transparency	128
3.2 : Eco-friendly Manufacturing Process	62	5.2 : Performance Metrics Definition and Examples	135
3.3 : Circular Economy Principles and Strategies	70	5.3 : Advantages and Disadvantages of Key Performance Indicator (KPI) for Sustainable Manufacturing	138
3.4 : Advantages and Disadvantages of Closing the Loop Strategy	74	5.4 : Tools/Technologies for Monitoring and Continuous Improvement Processes	140
3.5 : Examples of Closing the Loop Strategy	75		



Abbreviations

AI : Artificial Intelligence	PLM : Product Lifecycle Management
IIoT : Industrial Internet of Things	EAM : Enterprise Asset Management
IoT : Internet of Things	DCS : Distributed Control System
AR : Augmented Reality	SCADA : Supervisory Control and Data Acquisition
VR : Virtual Reality	FMS : Flexible Manufacturing System
ML : Machine Learning	AGV : Automated Guided Vehicle
DL : Deep Learning	AM : Additive Manufacturing
CPS : Cyber-Physical Systems	BDA : Big Data Analytics
ICT : Information and Communication Technology	BMS : Building Management System
ERP : Enterprise Resource Planning	CPS : Cyber-Physical Systems
MES : Manufacturing Execution System	5G : Fifth Generation Mobile Network
PLC : Programmable Logic Controller	LCA : Life Cycle Assessment
HMI : Human-Machine Interface	CSR : Corporate Social Responsibility
SCM : Supply Chain Management	ESG : Environmental, Social, and Governance
CNC : Computer Numerical Control	KPI : Key Performance Indicator
RFID : Radio Frequency Identification	LED : Light Emitting Diode
PLC : Programmable Logic Controller	PV : Photovoltaic
CNC : Computer Numerical Control	EV : Electric Vehicle
CAD : Computer-Aided Design	ESG : Environmental, Social, and Governance
CAM : Computer-Aided Manufacturing	
BIM : Building Information Modeling	

About the Authors



Dr. Vikram Bansal is a distinguished academic and professional with extensive expertise in the field of Management Science, with a particular focus on Sustainable Business Practices, Tourism, and Entrepreneurship. Dr. Bansal's professional journey is diverse, ranging from academic roles to business development in the private sector. His is reflected in his teaching, which spans both postgraduate and doctorate levels. He has held various key positions, including as an Associate Professor and Head of Department. He currently faculty at the Atal Bihari Vajpayee School of Management and Entrepreneurship at Jawaharlal Nehru University (JNU), New Delhi, where he specializes in Marketing Management, Entrepreneurship, and Industry 4.0.

In addition to teaching, Dr. Bansal has been actively involved in research and consultancy projects. He has led projects sponsored by NITI Aayog, Government of India, and the Indian Council of Social Science Research, focusing on Industry 4.0 and MSMEs. His research interests lie in exploring the nexus between technology and sustainable business practices, with numerous publications to his name in national and international journals. These publications cover a range of topics from Start-ups' ecosystem and Indian Knowledge System in management area. He is also an active member of various editorial boards and academic societies, contributing to the broader management and social sciences research community.

With a career spanning academia and industry, Dr. Vikram Bansal continues to contribute significantly to the discourse on sustainable development and innovation in the contemporary business era.



Deepthi B. is a distinguished and accomplished educator, researcher, and academician who has significantly contributed to business adoption of commerce and technology. Currently, she serves as a faculty in the Commerce Department at MJPTBCW Degree College for Women under the Government of Telangana, India. Her role at the institution is marked by her commitment to excellence in teaching and mentoring, where she continually strives to inspire and educate the next generation of business professionals and entrepreneurs.

Her academic achievements are notable, with Deepthi being JRF qualified, credentials that reflect her scholarly prowess and dedication to advancing her expertise. In pursuit of higher academic distinction, she is currently doing her doctorate at the prestigious Jawaharlal Nehru University (JNU), New Delhi. Her doctoral research aligns with her deep interest in the intersection of technology and business, particularly focusing on the role of Industry 4.0 in shaping the future of small and medium-sized enterprises (SMEs).

Her work continues to inspire not only her students but also her peers and industry professionals who seek to understand and navigate the complexities of modern business environments. Through her research, publications, and teaching, Deepthi B. remains a key contributor to the ongoing transformation of business practices in the digital era.

A Dive into the World of Blockchain Technology

**Ms. Sakshi Ahlawat • Dr. Upendra Pratap Singh
Dr. Deepti • Dr. Pawan Kumar**

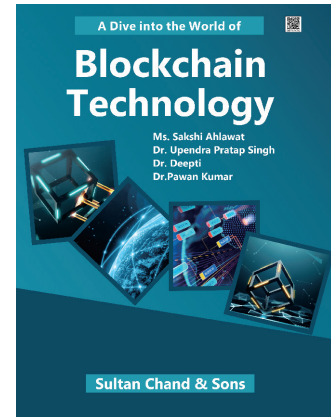
Salient Features

This is a textbook that focuses on providing an insight into the world of Blockchain Technology for students who are Beginners and interested in learning about the real world applications of the Technology. The following are the salient features of the book:

- Introduces the concept and origin of Blockchain to Beginners.
- Explains the implementation of Blockchain in various Sectors.
- Explores the uses of Blockchain in sectors like Education, Legal Industry, Land Records, Financial Sector, Global Supply Chain, Healthcare, Airlines, and Payment Channels.
- Explains the concept of Tokenized Economy through Blockchain.
- Advocates and explores the issues related to governance of a Decentralized Blockchain Network.
- Familiarize students with the technology and software's used for implementation of Blockchain.
- Introduces the Ethereum Network and various Applications of Ethereum in the technology world.
- Introduces Solidity, the most used programming language used for Ethereum platform.
- Explores the future of the Blockchain Technology.

Contents

- Blockchain for Beginners
- Bitcoins or Genesis of Blockchain Technology
- Model of Blockchain Technology Implementation
- Role of Blockchain Technology in Education
- Role of Blockchain Technology in Legal Industry
- Role of Blockchain Technology Technology in maintaining Land Records
- Role of Blockchain Technology in the Financial Sector
- Role of Blockchain Technology in Global Supply Chain
- Role of Blockchain Technology in Health Sector
- Role of Blockchain Technology in Aviation Sector
- Role of Blockchain Technology in Payment Systems
- Role of Blockchain Technology in Tokenized Economy
- Governance of Blockchain Technology
- Tools and Software used for Blockchain Technology or Technology behind Blockchain Technology
- Ethereum Network and its Applications
- Solidity
- Future of Blockchain Technology



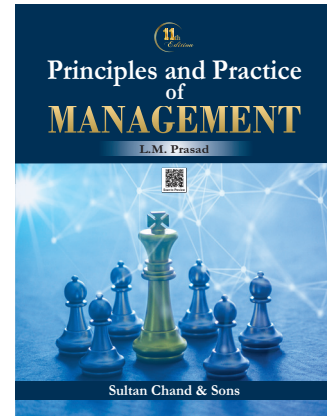
Principles and Practice of Management

L.M. Prasad

About the Book

The Revised 11th edition of *Principles and Practice of Management* continues to build on our commitment to reflect the latest advancements in management theory and practice. The book proudly introduces a new chapter: “Role of Indian Ethos in Managerial Practice”. This chapter emphasizes the increasing relevance of integrating cultural and philosophical perspectives into contemporary management.

Indian traditions offer profound insights into ethical leadership and decision-making. This new chapter examines how concepts from Indian philosophy, such as *Dharma* and *Karma*, can complement modern management practices, providing a richer, more comprehensive approach to leadership and organizational behavior.



Contents

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Part II – Planning: Fundamentals of Planning • Organizational Plans • Decision Making

Part III – Organizing: Fundamentals of Organizing • Power and Authority • Conflict and Coordination • Organizational Change

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Part VI – Controlling: Fundamentals of Controlling • Control Techniques

Part VII – Management Practices: Management Practices of Prominent Countries and Business Leaders • Role of Indian Ethos in Managerial Practice

Appendices • Glossary • Subject Index

About the Book

The book "Industry 4.0: A Sustainable Industrial Approach" explores the intersection between cutting-edge technologies and sustainable Industrial practices. It highlights how Industry 4.0, the current wave of digital transformation, integrates technologies like the Internet of Things (IoT), Artificial Intelligence (AI), Big Data Analytics, and Cyber-Physical Systems (CPS) into traditional manufacturing. These innovations form the foundation of what is known as the "smart factory."

The authors trace the evolution of industrial revolutions, emphasizing how Industry 4.0 aims to enhance efficiency, flexibility, and resource optimization. By linking advanced technologies with sustainability, this book illustrates how industries can reduce waste, conserve energy, and adopt eco-friendly practices while remaining competitive in a rapidly changing global market.

In addition to the technical advancements, the book delves deeply into the principles of sustainability, such as reducing environmental impacts, fostering social equity, and ensuring economic viability. The authors propose that these principles, combined with Industry 4.0 technologies, offer a comprehensive path to a more sustainable future for industries across the globe. Throughout the chapters, the book presents case studies, best practices, and roadmaps for companies aiming to transition into Industry 4.0. These real-world examples illustrate how industries, from large corporations to small and medium-sized enterprises (SMEs), are embracing digitalization and sustainability.

The final chapters explore the case studies mapped to each chapter provide valuable insights into how different industries and companies are implementing sustainable practices in line with Industry 4.0 principles. The book encourages businesses to think not just about profit, but also about their environmental and social impact, urging a long-term, holistic approach to business operations.

This book is a valuable resource for academicians, business leaders, technologists, and policymakers looking to understand how Industry 4.0 can drive sustainability, innovation, and economic growth simultaneously.

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