Premier Research Source

Advancing Social Equity Through Accessible Green Innovation

P. William and Shrikaant Kulkarni

IGI Global
Scientific Publishing
Publishing Tomorrow's Research Today

Advancing Social Equity Through Accessible Green Innovation

P. William
Sanjivani College of Engineering, India

Shrikaant Kulkarni
Victorian Institute of Technology, Australia

IGI Global
Scientific Publishing
Publishing Tomorrow's Research Today

Vice President of Editorial: Melissa Wagner
Managing Editor of Acquisitions: Mikaela Felty
Managing Editor of Book Development: Jocelynn Hessler
Production Manager: Mike Brehm
Cover Design: Phillip Shickler

Published in the United States of America by
IGI Global Scientific Publishing
701 East Chocolate Avenue
Hershey, PA, 17033, USA
Tel: 717-533-8845
Fax: 717-533-8661
Website: https://www.igi-global.com E-mail: cust@igi-global.com

Library of Congress Cataloging-in-Publication Data

Names: William, P., editor. | Kulkarni, Shrikaant, editor.
Title: Advancing social equity through accessible green innovation / edited by P. William, Shrikaant Kulkarni.
Description: Hershey, PA : IGI Global Scientific Publishing, [2025] | Includes bibliographical references and index. | Summary: "As the global demand for sustainable practices intensifies in response to escalating environmental challenges, regulatory pressures, and evolving societal expectations, this book offers a comprehensive roadmap to navigating and excelling in the green transition"-- Provided by publisher.
Identifiers: LCCN 2024054522 (print) | LCCN 2024054523 (ebook) | ISBN 9798369394717 (hardcover) | ISBN 9798369394724 (paperback) | ISBN 9798369394731 (ebook)
Subjects: LCSH: Social change--Technological innovations. | Equality. | Green technology--Technological innovations.
Classification: LCC HM846 .A39 2025 (print) | LCC HM846 (ebook) | DDC 303.48/3--dc23/eng/20250211
LC record available at https://lccn.loc.gov/2024054522
LC ebook record available at https://lccn.loc.gov/2024054523

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Table of Contents

Preface xx

Chapter 1
Advanced Predictive Analytics Driving Sustainable and Equitable Green Innovations Through Data-Driven Optimization and Strategic Insights 1
Mahima Bansod, Salesforce, USA

Chapter 2
Advancing Equitable Green Innovation Through Data Analytics Strategies and Insights 17
Vijay Arpudaraj Antonyraj, Equifax, USA

Chapter 3
AI in Monitoring and Improving Air and Water Quality for Green Innovation 33
Somnath Banerjee, AMFAM, USA

Chapter 4
An Analysis Of Green Advertising's Sustainability Strategy and Its Impact on Consumers' Green Consumption Behaviour 47
Deepali Singh, Vivekananda Global University, India
Vandana Madaan, MM Institute of Management, Maharishi Markandeshwar University, India
Shreya Arora, Maharishi Markandeshwar University, India
G. Sagar, School of Management, Bengaluru City University, India
Paramveer Singh, Central University of Punjab, India

Chapter 5
Bias in Green AI Addressing Disparities in Data and Algorithms 63
Abhishek Trehan, JPMorgan Chase & Co., USA

Chapter 6
Building Intelligent Systems With Python: An AI and ML Journey for Social Good 77
Anurag Palakurti, Pennsylvania State University, USA
Divya Kodi, Cyber Security Senior Data Analyst Truist Financial, USA

Chapter 7
Building Tomorrow: A Data and Automation-Driven Future for Social Equity 93
Chandrasekhar Rao Katru, Wells Fargo, USA

Chapter 8
Business Traceability With Existing IIoT Networks via Novel Light Weight Proof-of-Trace (LWPOT) Consensus Blockchain 109
Abhishek Badholia, Shri Shankaracharya Institute of Professional Management and Technology, Raipur, India
Vijayant Verma, Bhilai Institute of Technology, Raipur, India
Anurag Sharma, Rungta College of Engineering and Technology, Bhilai, India
Gurpreet Singh Chhabra, GITAM School of Technology, GITAM University, Visakhapatnam, India

Chapter 9
Data-Driven Approaches to Equitable Green Innovation Bridging Sustainability and Inclusivity ... 139
Sudheer Panyaram, Amplifycelltech, USA
Muniraju Hullurappa, System Soft Technologies, USA

Chapter 10
Environmental Responsibility and CSR Using Green Management Techniques 153
Shivani Vashist, School of Mefia Studies and Humanities, Manav Rachna International Institute of Research and Studies, India
Farhat Mohsin, Manav Rachna International Institute of Research and Studies, India
Nandini Srivastava, Manav Rachna International Institute of Research and Studies, India
Sunita Shukla, I.T.S. Engineering College, India
Ritika Singh, SCHM, India

Chapter 11
Equitable Green Innovation in Supply Chains Harnessing Machine Learning for Sustainable Development 169
Sri Bhargav Krishna Adusumilli, MindQuest Technology Solutions LLC, USA

Chapter 12
Generative AI for Fraud Prevention: A New Frontier in Productivity and Green Innovation 185
Bhagath Chandra Chowdari Marella, Capgemini America Inc., USA
Divya Kodi, Truist Financial, USA

Chapter 13
Green HRM: Improving Eco-Friendly Practices and Employee Engagement to Strengthen Organizational Sustainability 201
Suprina Sharma, Chandigarh Business School, India
Madhuri Aggarwal, Intelligent Consulting Engineers, Punjab, India
Manu Pattar, Shree Medha Degree College, Ballari, India
Vandana Madaan, Maharishi Markandeshwar University, India
Shreya Arora, Maharishi Markandeshwar University, India

Chapter 14
Green Manufacturing: An Analysis of Sustainable Manufacturing Techniques 219
Padma Mahadevan, International School of Business and Research, India
Ajay Kumar Dogra, Panjab University, India
Mukul Kumar Shrivastava, Galgotias University, India
Vidya Dayinee Sharan, Galgotias University, India
Anjali Singh, Manav Rachna International Institute of Research and Studies, India

Chapter 15
Harnessing Python for AI and Machine Learning: Techniques, Tools, and Green Solutions 237
Bhagath Chandra Chowdari Marella, Capgemini America Inc., USA
Anurag Palakurti, Independent Researcher, USA

Chapter 16
Financial Services and Green Investment on ESG Investing for a Sustainable Future 251
Shaiku Shahida Saheb, VIT- AP University, Vijayawada, India
P. B. Narendra Kiran, Christ University, Bengaluru, India
B. N. Adhithya, New Horizon College of Engineering, Bengaluru, India
P. William, Sanjivani College of Engineering, Kopargaon, India
Pradeep Verma, Amity International Business School, Amity University, India
S. Naga Padma, Dr. Lankapalli Bullayya College, Visakhapatnam, India

Chapter 17
Impact of Water Conservation on Household End-Use Water Consumption 265
Mayurkumar B. Prajapati, Hemchandracharya North Gujarat University, India
Ruby B. Patel, Institute of Architecture, Hemchandracharya North Gujarat University, India
Ajay Kumar Dogra, Panjab University, India
Vikash Singh, Sahkari PG College Mihrawa Jaunpur, Veer Bahadur Singh Purvanchal University, Jaunpur, India
Piyush Kumar, IIMT University, India
Sunita Verma, Delhi Technical Campus, Greater Noida, India

Chapter 18
Implementing Nanotechnology for the Supply of Sustainable Energy to Construct a Green Economy 283
Deepti Taneja, Delhi College of Arts and Commerce, University of Delhi, India
Salam Rajesh Singh, Biramangol College, India
Vandana Madaan, Maharishi Markandeshwar University, India
Amitabh Roy, University of Lucknow, India
Mani Tyagi, KIET Group of Institutions, India
Ranchay Bhateja, KIET Group of Institutions, India

Chapter 19
Industry 4.0: The Impacts of Technological Innovation on Energy Efficiency 301
Syed Shahid Mazhar, Integral University, Lucknow, India
Farhina Sardar Khan, Integral University, Lucknow, India
Nazia Akhlaq, Integral University, Lucknow, India
Dipti Tomar Singh, Integral University, Lucknow, India
Anamika Singh, Integral University, Lucknow, India

Chapter 20
Innovative Pathways to Sustainability: Energy Efficiency and Product Development 317
Ehanul Haque, Integral University, Lucknow, India
Farheen Siddiqui, Integral University, Lucknow, India
Neda Tasneem, Integral University, Lucknow, India
Babar Ali Khan, Jamia Hamdard, New Delhi, India
Arshi Rubab, Integral University, Lucknow, India

Chapter 21
Internet of Things (IoT)-Driven Smart City Development: An Undetected Sustainable Revolution in India 335
Naaz Gorowara, Maharishi Narkandeshwar University, Mullana, India
Mohammad Ahmar Khan, College of Commerce and Business Administration Salalah, Dhofar, Oman
Pankaj Avasthi, GD Goenka University, Gurugram, India
Pankaj Chhuttani, GD Goenka University, Gurugram, India
Raj A. Varma, Symbiosis Law School, Symbiosis International University, Pune, India
Shaili Gupta, Tilak Raj Chadha Institute of Management and Technology, India

Chapter 22
Leveraging Machine Learning for Equitable Green Innovation 351
Anantharaman Janakiraman, Independent Researcher, USA

Chapter 23
Maximizing ROI: The Intersection of Productivity, Generative AI, and Social Equity 373
Venkateswara Rao Anumolu, TCS Inc., USA
Bhagath Chandra Chowdari Marella, Capgemini America Inc., USA

Chapter 24
Quantum Computing for Equitable Green Innovation Unlocking Sustainable Solutions 387
Muniraju Hullurappa, System Soft Technologies, USA
Sudheer Panyaram, Department of Information Technology, ERP Applications, Amplifycell Technologies, Bloomington, USA

Chapter 25
Recently Created Green Technology Business Innovations: Creating a Path Toward Sustainability. 403
Mohammad Ahmar Khan, College of Commerce and Business Administration, Dhofar University, Salalah, Oman
Mili Dutta, Birla Institute of Technology, Ranchi, India
Bikram Kr. Dutta, KIMDS Namkum, India
Anmol Sharma, Chandigarh Group of Colleges, Jhanjeri, India
Naaz Gorowara, Maharishi Markandeshwar Institute of Management, Maharishi Narkandeshwar University, India
Nidhi Tewatia, Noida International University, India

Chapter 26
The Road Ahead: AI and Data Science as Pillars for Sustainable Equity 421
Abhishek Trehan, JPMorgan Chase & Co., USA

Chapter 27
Unlocking New Possibilities: How Advanced API Integration Enhances Green Innovation and Equity 437
Divya Kodi, Truist Finanacial, USA
Swathi Chundru, Motivity Labs Inc., USA

Chapter 28
Modelling on E-Service Quality and Green Logistics Consumer Satisfaction 461
Alok Jain, 10mind.ai, USA
Pradeep Verma, Amity University, India
Vijayshri Khedkar, Symbiosis Institute of Technology, Symbiosis International University, Pune, India
P. William, Sanjivani College of Engineering, Kopargaon, India
Abhishek Badholia, Shri Shankaracharya Institute of Professional Management and Technology, Raipur, India
Gurpreet Singh Chhabra, GITAM School of Technology, GITAM University, India

Compilation of References 477

About the Contributors 503

Index 507

Chapter 20
Innovative Pathways to Sustainability: Energy Efficiency and Product Development

Ehanul Haque
https://orcid.org/0009-0000-3062-0444
Integral University, Lucknow, India

Farheen Siddiqui
https://orcid.org/0000-0003-2910-8157
Integral University, Lucknow, India

Neda Tasneem
Integral University, Lucknow, India

Babar Ali Khan
Jamia Hamdard, New Delhi, India

Arshi Rubab
https://orcid.org/0009-0005-4533-6143
Integral University, Lucknow, India

ABSTRACT

Sustainable development is crucial for achieving global economic growth, environmental protection, and social justice. Balancing these pillars necessitates advancements in energy efficiency and product innovation. This research explores how these components can mitigate environmental impacts, enhance economic competitiveness, and advance societal goals. It utilizes a multifaceted research method, combining qualitative and quantitative approaches to evaluate the impact of energy efficiency and innovative product design. Key findings reveal that integrating renewable energy sources, advanced energy management technologies, and eco-friendly product innovations significantly contributes to sustainability goals. Effective implementation of these strategies can reduce energy consumption, lower carbon emissions, and stimulate economic growth.

DOI: 10.4018/979-8-3693-9471-7.ch020

INTRODUCTION

Sustainable development has become a central theme in addressing the global challenges of economic growth, environmental protection, and social equity. At the core of sustainable development lies the need to balance these three pillars without compromising the ability of future generations to meet their own needs. With growing concerns over climate change, resource depletion, and energy scarcity, energy efficiency and product innovation have emerged as critical components of a sustainable development strategy (Ahn, Kang, & Hustvedt, 2016). These two aspects, when integrated into a comprehensive development approach, not only contribute to reducing environmental impacts but also drive economic competitiveness and societal advancement. Energy efficiency plays a pivotal role in sustainable development by minimizing the environmental footprint of energy consumption while maximizing productivity and economic output. Energy-intensive industries, which are responsible for a significant portion of global greenhouse gas emissions, must focus on implementing energy-saving technologies and practices to achieve sustainability goals. One of the key strategies for enhancing energy efficiency is the transition toward renewable energy sources, such as solar, wind, and hydropower, which offer clean and abundant alternatives to fossil fuels. Additionally, smart grid technology and advanced energy management systems allow for the optimization of energy distribution, minimizing losses and improving the reliability of energy networks. The development and deployment of energy-efficient buildings, appliances, and transportation systems further contribute to reducing energy demand while promoting sustainable urbanization. Governments, businesses, and individuals must work collaboratively to create policy frameworks, incentives, and awareness campaigns that encourage energy-efficient behaviors and investments.

Simultaneously, fostering product innovation is essential for sustainable development as it enables the creation of new goods and services that meet the evolving needs of society while reducing environmental degradation. Eco-design, which emphasizes the environmental impacts of products throughout their lifecycle, encourages companies to rethink traditional manufacturing processes (Guo, Cui, Sun, & Zou, 2022). By integrating sustainable materials, energy-efficient production methods, and waste reduction practices, businesses can develop products that minimize resource use and environmental harm. Circular economy models, which focus on recycling, reusing, and repurposing materials, provide an innovative approach to addressing waste and resource scarcity. These models encourage businesses to design products with longevity and reparability in mind, reducing the need for new resources and lowering waste production. Green technologies, such as electric vehicles, biodegradable materials, and energy-efficient electronics, are revolutionizing industries by offering sustainable alternatives that meet both environmental and consumer demands. The Figure 1 highlights a variety of eco-friendly items that contribute to reducing environmental impact. These products, such as reusable grocery bags, bottles, and cups, help eliminate the need for single-use plastics, which significantly reduces waste. Other items, like LED lightbulbs, represent energy-efficient solutions that consume less electricity and have a longer lifespan, further conserving resources. Products made from renewable materials, such as wooden combs and toothbrushes, are biodegradable, offering alternatives to plastic that reduce pollution. Personal hygiene items like menstrual cups and reusable cotton pads also reduce waste by replacing disposable sanitary products. Compostable items, such as compost bins, are another important aspect of sustainability, allowing individuals to recycle organic waste and reduce landfill use (Carrillo-Hermosilla, del Río, & Könnölä, 2010). Eco-friendly kitchenware, including bamboo cutlery and metal straws, similarly replace disposable plastics, promoting a lifestyle centered around reuse and sustainability.