

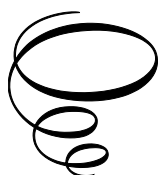
Management Practices, Solutions and Models for Sustainable Business

Management Practices, Solutions and Models for Sustainable Business

Edited by

Shrikaant Kulkarni and
Radhakrishna Batule

**Cambridge
Scholars
Publishing**



Management Practices, Solutions and Models for Sustainable Business

Edited by Shrikaant Kulkarni and Radhakrishna Batule

This book first published 2025

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Copyright © 2025 by Shrikaant Kulkarni, Radhakrishna Batule
and contributors

All rights for this book reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

ISBN: 978-1-0364-4662-8

ISBN (Ebook): 978-1-0364-4663-5

TABLE OF CONTENTS

Preface	vii
---------------	-----

List of Abbreviations	ix
-----------------------------	----

Part I: Sustainable Business with Sound Management Practices

Chapter One.....	2
------------------	---

Designing Sustainable Business Practices for Successful Organization
Jayamala Kiran Shinde, Vaishnvi Nanasaheb Shelke and Jonathan Joseph

Chapter Two	29
-------------------	----

Greening the Workforce for Sustainable Future
Snehal A. Bagul

Chapter Three	56
---------------------	----

Exploring Sustainable Practices at Pilgrimage Sites:
Insights from Supply-Side Stakeholders
Vaishali Singh and Anjan Bhuyan

Part II: Sustainable Business Models for Quality Decision Making

Chapter Four.....	84
-------------------	----

AI-Based Models for Predictive Analysis in Dynamic Environments
*Ishaan Manesh Sarkar, Bhargavi Prakash Muktalkar
and Tarun Madan Kanade*

Chapter Five	114
--------------------	-----

Computer Simulation-Based Models for Sustainable Change
Pankaj Dashore and Rachana Dashore

Chapter Six	135
-------------------	-----

Sustainable Models for Greenovation Excellence
Tarun Madan Kanade, Neha Tejas Wankhede and Payal Sanan

Part III: Sustainable Solutions for Successful Business

Chapter Seven.....	160
Sustainable empowerment of workforce:	
Practices for 21st Century Organizations	
<i>Dipeeka Chavan and Tarun Madan Kanade</i>	
Chapter Eight.....	192
Adoption of Circular Economy and Green Innovation	
<i>Prasann Kumar</i>	
Chapter Nine.....	219
Green and Sustainable Economy for Better World of Work	
<i>Prasann Kumar</i>	

Part IV: Case Studies in Sustainable Business Management

Chapter Ten	262
Organizational Change and Sustainability:	
The Case of Table Grapes in Sonora	
<i>Karla Terán Samaniego, David Félix Gurrola, Jesús M. Robles Parra</i>	
<i>and Jesús A. Lozano Magdaleno</i>	
Chapter Eleven	288
Strategic Sustainability Transformation:	
Navigating Change for Strategic Impact Impact	
<i>Neelkanth Dhone and Swamy Perumandala</i>	
Editorial	320
Business for the Sustainable Future	
<i>Shrikaant Kulkarni</i>	
List of Contributors	336

PREFACE

In the ever-evolving landscape of global economics, the intersection of sustainability and innovation has become a cornerstone for addressing the pressing challenges of our time. "Greenovation: Excellence for a Sustainable and Inclusive Economy" emerges as a beacon of insight and inspiration, offering a comprehensive guide for navigating the complexities of creating an economy that is not only environmentally sustainable but also socially inclusive.

This book is born out of a profound recognition that traditional economic models are increasingly inadequate to meet the demands of our planet and its inhabitants. The relentless pursuit of growth has often come at the expense of our natural resources, leading to environmental degradation, social inequities, and economic disparities. It is within this context that the concept of "Greenovation" takes root, proposing a paradigm shift towards innovative practices that harmonize economic activities with ecological integrity and social well-being.

"Greenovation" is more than just a buzzword; it is a transformative approach that integrates green technologies, sustainable practices, and inclusive strategies to foster a resilient economy. This book delves into the principles, strategies, and real-world applications of greenovation, providing readers with a roadmap to drive sustainable progress and inclusive growth.

The journey through "Greenovation: Excellence for a Sustainable and Inclusive Economy" is structured around key themes that collectively build the case for a new economic model. From exploring the foundational principles of sustainability to examining cutting-edge green technologies, the book provides a holistic view of the innovative solutions that are shaping the future. Moreover, it highlights the importance of inclusivity, ensuring that the benefits of green economic growth are equitably distributed across all segments of society.

One of the distinguishing features of this book is its emphasis on practical examples and case studies. By showcasing successful implementations of greenovation across various sectors and regions, readers gain valuable insights into the tangible benefits and challenges of transitioning to a

sustainable economy. These case studies serve as both inspiration and a practical guide, demonstrating that the path to sustainability is not only achievable but also economically viable and socially enriching.

The authors of this book bring together a wealth of expertise from diverse fields, including economics, environmental science, technology, and social policy. Their collective wisdom and experience provide a rich tapestry of knowledge that informs the discussions and recommendations presented herein. By drawing on interdisciplinary perspectives, the book offers a nuanced understanding of the multifaceted nature of greenovation and its potential to transform our economic systems.

As you embark on this journey through the pages of "Greenovation: Excellence for a Sustainable and Inclusive Economy," we invite you to envision a future where economic success is measured not just by financial metrics but by the health of our planet and the well-being of its people. Let this book be a catalyst for change, inspiring you to embrace innovative solutions and to contribute to the creation of a sustainable and inclusive economy.

We hope that "Greenovation" will serve as a valuable resource for policymakers, business leaders, academics, and anyone committed to making a positive impact on our world. Together, we can forge a path towards a future that is not only prosperous but also sustainable and just for all.

We extend our deepest gratitude to the contributors, reviewers, and supporters who have made this book possible. Your dedication and passion for sustainability and innovation have been instrumental in bringing this vision to life.

The journey towards a sustainable and inclusive economy is ongoing, and the insights presented in this book are part of a broader dialogue. We encourage readers to engage with the ideas, challenge the concepts, and actively participate in the global effort to create a better future for all.

LIST OF ABBREVIATIONS

TBL	The Triple Bottom Line
SDGs	Sustainable Development Goals
C2C	Cradle to Cradle Design
ESG	Environmental, Social, and Governance
NGO:	Non-Government Organisation
KPIs	Key Performance Indicators
WFH	Work from Home
WFA	Work from Anywhere
RW	Remote Work/Working
OPEC	Organization of the Petroleum Exporting Countries
AI	Artificial Intelligence
ICT's	Information and Communication Technologies
ESG	Environment, Social and Governance
GRI	Global Report Initiative
SSCI	Sustainable Supply Chain Initiative
CSR	Corporate Social Responsibility
HRM	Human Resource Management
SRI	Socially Responsible Investing
NGO	Non-governmental Organization

SDGs	Sustainable Development Goals
UNFCCC: Change	United Nations Framework Convention on Climate
NDCs	nationally determined contributions
CBD	Convention on Biological Diversity
UNCCD	Nations Convention to Combat Desertification
REEEP	Renewable Energy and Energy Efficiency Partnership
PPPs	Public-private partnerships
CSP	concentrated solar power
PV	Photovoltaic
LEDs	light-emitting diodes
IWRM	Integrated Water Resources Management
EPR	Extended producer responsibility
PLM	Product Life Cycle Management
PaaS	Product-as-a-service
SMEs	Medium-sized Enterprises
EPR	extended producer responsibility
CSR	Corporate Social Responsibility
PaaS:	Product-as-a-service
LaaS	Lighting-as-a-service
CE100	Circular Economy 100
AI	Artificial Intelligence
SDGs	Sustainable Development Goals

UNFCCC	United Nations Framework Convention on Climate Change
NDCs'	Nationally determined contributions
CBD	Convention on Biological Diversity
UNCCD	Nations Convention to Combat Desertification
REEEP	Renewable Energy and Energy Efficiency Partnership
PPPs	Public-private partnerships
CSP	Concentrated solar power
PV	Photovoltaic
LEDs	Light-Emitting Diodes
IWRM	Integrated Water Resources Management
EPR	Extended producer responsibility
PLM	Product life cycle management
PaaS	Product-as-a-service
SMEs	Medium-sized enterprises
EPR	Extended producer responsibility
CSR	Corporate Social Responsibility
PaaS	Product-as-a-service
LaaS:	Lighting-as-a-service
CE100	Circular Economy 100
AI:	Artificial Intelligence
LCA	Lifecycle assessment

PART I

SUSTAINABLE BUSINESS WITH SOUND MANAGEMENT PRACTICES

CHAPTER ONE

DESIGNING SUSTAINABLE PRACTICES FOR SUCCESSFUL ORGANIZATION

JAYAMALA KIRAN SHINDE¹,
VAISHNVI NANASAHEB SHELKE²
AND JONATHAN JOSEPH³

^{1,2}STUDENT OF MBA DEPARTMENT, ³THAKUR COLLEGE OF
ENGINEERING AND TECHNOLOGY, MUMBAI, INDIA

Abstract

This chapter delves into the intricate landscape of sustainable business design, unraveling the intricate tapestry of principles, models, and practical applications. Its central focus lies in guiding organizations on the incorporation of sustainability into their fundamental business methodologies. At the forefront of this exploration is a keen emphasis on triple-bottom-line thinking, circular economy models, design thinking, and the pivotal realm of eco-friendly product design. Real-world case studies serve as beacons, illuminating the path toward sustainable business practices, and shedding light on both challenges and opportunities.

By integrating existing sustainable design principles with essential business fundamentals, a unified framework emerges. This framework is structured around four key literature streams: Eco-design, product service system design, sustainable business model design, and collaborative ecosystem design. These streams delineate the different layers of design for sustainable innovation, providing a nuanced perspective for each. Interwoven within this framework are overarching themes that encapsulate the practical application of sustainable design theory across these distinct levels.

This section not only presents a comprehensive overview but also makes a substantial contribution to both theoretical understanding and practical

implementation. It condenses collective insights into tailored recommendations for academic researchers, industrial designers, and business managers. These insights aim to empower professionals to actively guide their roles towards promoting sustainable development, solidifying their pivotal contribution to the ongoing shift towards a more sustainable future.

Keywords: Sustainable business design, Triple-bottom-line thinking, Circular economy models, Design Thinking, Eco-friendly product design, Sustainable innovation, Collaborative ecosystem design

1.1 Introduction

The escalation of industrial operations within an unsustainable development framework has given rise to a global environmental crisis intertwined with societal challenges. Sustainable design theory offers a substantial body of knowledge on how to address these issues by reconsidering industrial products, processes, and organizational operations within a more sustainable socio-economic system. However, there exists a notable gap between the conceptualization of these ideas and their practical implementation, presenting a challenge that has not received adequate attention. This study aims to address this critical gap by examining how existing sustainable design theories are put into practice in the business realm.

To achieve this, we undertake a comprehensive literature review and conduct interviews with twenty international experts to extract insights from their relevant project experiences. The result is a framework that amalgamates established sustainable design theories with key business concepts, organizing them into four literature streams: codesign, product service system design, sustainable business model design, and collaborative ecosystem design. These streams correspond to four distinct levels of design for sustainable innovation.

The framework also encompasses thematic elements related to the application of sustainable design theory in business practice across the mentioned levels. Building upon this, we delineate our contributions to both theoretical understanding and practical implementation, offering specific recommendations for academic researchers, industrial designers, and business managers seeking to actively contribute to the transition towards sustainable development. By addressing the gap between sustainable design theory and its tangible application in business, this study acknowledges the

pressing need to bridge this divide amid the ongoing global environmental crisis spawned by unsustainable industrial practices [1].

Through an extensive examination of existing literature and interviews with global experts, this study introduces a framework that seamlessly integrates sustainable design theory with vital business concepts. This comprehensive framework consists of four literature streams: codesign, product service system design, sustainable business model design, and collaborative ecosystem design, aligning with distinct levels of design for sustainable innovation. The study identifies pivotal themes associated with the implementation of sustainable design theory across these levels, offering a holistic approach to guide academic researchers, industrial designers, and business managers in actively contributing to the transition towards sustainable development.

Furthermore, the study emphasizes the interconnectedness of economic sustainability with social and environmental considerations. Businesses embracing sustainable practices can realize cost savings through enhanced energy efficiency, waste reduction, and improved resource management. Additionally, investments in sustainable technologies and practices often drive innovation, creating opportunities in new markets and revenue streams.

Moreover, businesses face escalating regulatory pressures globally as governments recognize the paramount importance of sustainable development. Proactively integrating sustainable practices into operations positions businesses to adeptly navigate evolving regulations, mitigating the risk of legal and financial challenges [2].

The contributions to theory and practice are outlined, emphasizing the importance of addressing this critical gap. Recommendations are provided for professionals aiming to leverage their roles in fostering sustainable innovation within organizations. The framework serves as a valuable tool to bridge the abstract speculations of sustainable design theory with concrete actions in the realm of business practice, promoting a more sustainable socio-economic system.

1.1.1 Definition and Importance of Sustainable Business Practices

Sustainability in business encompasses a strategic approach aimed at minimizing the negative environmental impact resulting from a company's

operations within a specific market. Organizations' sustainability practices are typically evaluated using environmental, social, and governance (ESG) metrics. Also referred to as corporate sustainability, this involves the management of environmental, social, and financial considerations to ensure responsible, ethical, and enduring success.

In traditional corporate culture, social and environmental concerns are often viewed as conflicting with financial objectives. For instance, the depletion of nonrenewable natural resources is recognized as an unsustainable practice. However, the reluctance to invest in greener alternatives stems from the immediate cost advantages of continuing to rely on fossil fuels.

In the contemporary global landscape, sustainable business practices have gained paramount importance due to the pressing need to address environmental, social, and economic challenges. These practices, centered around responsible and ethical operations, play a crucial role in fostering long-term success and resilience for businesses.

Primarily, environmental sustainability plays a key role in mitigating the impact of climate change. Embracing eco-friendly practices, such as reducing carbon emissions, minimizing waste, and harnessing renewable resources, not only contributes to a healthier planet but also positions businesses favorably in the eyes of environmentally conscious consumers. As awareness of climate issues increases, consumers are more inclined to choose products and services from companies committed to sustainability [3].

Moreover, social responsibility stands as a pivotal element within sustainable business practices. Companies that prioritize fair labor practices, champion diversity and inclusion, and actively engage with communities foster stronger relationships with employees, customers, and the broader society. This approach not only elevates brand reputation but also cultivates a positive corporate culture that attracts and retains top talent.

The significance of sustainable business practices transcends mere altruism; it has become a strategic imperative for long-term viability. Embracing sustainability aligns businesses not only with global goals for a healthier planet and equitable societies but also enhances their competitiveness, resilience, and adaptability in an ever-evolving business landscape.

Sustainability is now an integral component of any organization, influencing customer choices, garnering employee support, and impacting

investment decisions. Business leaders who incorporate sustainability and ESG considerations throughout their value chains and business models are positioning their companies for sustained success and resilience over the long term.

In embracing a sustainability approach, organizations are called upon to adopt a "long-term" and systemic perspective. This entails a conscientious consideration not only of traditional business metrics such as revenues, costs, and profits but also an awareness of the broader impact of their actions on the physical environment and the well-being of future generations. This holistic outlook encourages a responsible and forward-thinking approach that goes beyond immediate financial gains to prioritize the lasting health and harmony of both society and the planet.

1.2 Foundations of Sustainable Business

The foundation of Sustainable Business aims to equip future business leaders with a comprehensive understanding of the crucial social and environmental issues of our time. Co-authored by a business thought-leader and a public interest policy expert, the text offers a balanced introduction to sustainable business, integrating sustainable policies into core business functions such as leadership, finance, accounting, risk management, marketing, supply chain management, and operations.

Positioning sustainability as a strategic priority across all facets of business, the text meticulously defines key concepts and demonstrates the interconnectedness of social, economic, and environmental trends with corporate strategy. While addressing challenges like climate change, human trafficking, and environmental issues such as water scarcity and ecosystem health, the text provides normative guidance rooted in traditional business value propositions. This approach considers factors such as cost, risk, strategy, marketing potential, and operational feasibility to present a realistic and honest exploration of sustainability within the business context [4].

Furthermore, the text goes beyond traditional learning approaches by incorporating various pedagogical tools in each chapter, enhancing the qualitative-based learning experience. Each chapter concludes with original cases featuring focused questions that assess the comprehension of concepts. In-chapter discussion questions, illustrative diagrams, ethical dilemmas, managerial insights, links to captivating TED Talk videos, and relevant Harvard Business Review cases contribute to the user-friendly

nature of Foundations of Sustainable Business, catering to both instructors and students.

In its second edition, Sustainable Business continues to equip future business leaders with the knowledge and skills needed to address critical social and environmental issues. This engaging textbook provides students with a well-rounded introduction to incorporating sustainable business policies into core business functions and processes. Using a qualitative-based learning approach, the text delves into how leadership, finance, accounting, risk management, marketing, supply chain management, and operations can align with the sustainability goals of the 21st century.

Taking a managerial perspective on sustainable business, the updated edition explores the evolution of business in response to growing consumer and regulatory demands for sustainability. Business topics are initially introduced in a manner consistent with traditional MBA programs and are subsequently scrutinized through the lens of sustainability. Real-life examples of social and environmental leadership are incorporated to highlight the effectiveness of sound sustainable business decisions, contrasting with the negative consequences of outdated, purely economic-driven managerial decision-making. The text also delves into influential concepts grounded in interdisciplinary sustainability research and offers practical insights on translating policy into workplace practices [5].

1.2.1 Principles of Sustainable Business

In our swiftly evolving world, traditional formal rules and laws are diminishing in their efficacy for addressing 'grand challenges,' particularly those that transcend borders, sectors, and actors. These challenges often have a transboundary nature, requiring a more adaptable and encompassing approach. Instead, principles, taking various forms, step in to address the gaps that emerge across different levels of society—be it global, national, local, or personal.

At the global level, the absence of formal laws leaves a 'governance gap.' Here, standards and principles, along with international treaties to acknowledge and affirm them, play a crucial role in guiding behavior. Unlike the realm of global governance, national laws are losing relevance as they were established on past principles, practices, and realities that may no longer hold true.

On a local scale, organizations find themselves compelled to surpass reliance on (local) laws. To achieve sustainability, they must integrate all relevant contexts and dimensions, encompassing economic, ecological, and social considerations. In essence, navigating these grand challenges demands a departure from traditional legal frameworks toward a more flexible and holistic reliance on principles that can adapt to the complex and dynamic nature of contemporary global issues [6].

The manifestation of principles occurs at three fundamental levels:

1.2.1.1 Systemic Principles: These principles are linked to fundamental and existential 'why' questions. Part I of this framework will delve into whether the principles underpinning the Sustainable Development Goals (SDGs) can be regarded as a new 'paradigm' for sustainable development. It explores why such principles are crucial in navigating today's Volatile, Uncertain, Complex, and Ambiguous (VUCA) world.

1.2.1.2 Societal and Dynamic Principles: This category of principles addresses fundamental analytical, participatory, and procedural 'what' and 'who' questions. In Part II, the focus is on understanding the conditions necessary for an effective cross-sectoral organization of the SDG agenda. It also explores the type of thinking required to facilitate progress in achieving these goals.

1.2.1.3 Strategic and Operational Principles: These principles involve the translation of societal and dynamic principles into practical settings, addressing the question of 'how to make this work.' Part III takes a closer look at sustainable business models, considering organizational power (including resource base, positioning, and sphere of influence) as assets for potential change. It also explores how corporations can actualize ambition and 'intent' based on the systemic, societal, and dynamic principles outlined in Parts I and II.

This three-tiered framework provides a comprehensive perspective, encompassing the overarching philosophy, the necessary conditions for implementation, and the practical strategies for realizing sustainable development goals in a complex and ever-changing global landscape.

1.2.2 Linking Sustainable Practices to Business Objectives

Within the market system, economic scarcities are accurately mirrored by market prices. However, environmental and social scarcities, while integral

to business, are only partially captured in economic transactions. Management responds to perceived scarcities by employing various management instruments. As environmental and social concerns gain prominence, many companies have, over the last decade, introduced specific environmental or social management systems. These systems are designed to address and incorporate these issues, acknowledging their growing significance in the business landscape [7].

To align your business objectives and sustainability goals, you need to adopt some strategies, such as creating a clear and compelling vision and mission that communicates your purpose, values, and goals. Additionally, you should integrate sustainability into your core business strategy, processes, and operations. Moreover, you should build a culture of innovation and learning that encourages employees, managers, and partners to generate ideas, test assumptions, learn from failures, and share knowledge. Finally, it's important to engage with stakeholders and collaborate with them to identify their needs, expectations, and opportunities in order to co-create solutions that benefit everyone.

1.3 Sustainable Business Management Models

The business model concept serves as an abstract representation, illustrating the flow of value and interactions among key elements within an organizational unit. Fundamental to organizations are the activities related to proposing, creating, delivering, and capturing value. Effectively communicating the connections and functions of these elements is crucial for the success of any business. Hence, the business model concept was conceived to streamline the explanation of intricate business ideas.

A business model provides a simplified means of conveying the intricate workflow of a business, enabling the detailed communication of this process to investors within a concise timeframe. The popularity of business models can be attributed to their efficacy in representing the planning, analysis, communication, and implementation of the performance of complex organizational units. Their effectiveness in encapsulating these aspects makes business models a valuable tool in navigating the complexities of modern businesses.

1.3.1 Circular Economy Models

Manufacturing companies are increasingly embracing the concept of the circular economy, wherein businesses establish supply chains that recover or recycle resources used in creating products. CEOs are drawn to the prospect of reducing their environmental impact, minimizing operational waste, and optimizing the use of valuable resources.

However, crafting a circular business model poses significant challenges, and adopting the wrong approach can be costly. A case in point is Interface, an Atlanta-based commercial flooring company. In the 1990s, its founder and CEO, Ray Anderson, envisioned Interface becoming "the first sustainable corporation in the world." To realize this vision, the company aimed to transition from selling to leasing. The Evergreen Services Agreement (ESA) program was introduced, bundling installation, maintenance, and removal of flooring under a single monthly fee. This approach allowed Interface to keep used flooring materials out of landfills and efficiently recycle the valuable raw materials within them [8].

Interface's groundbreaking move aimed to close the loop of the commercial-carpeting supply chain by transitioning to a leasing model. The company invested significant effort, even establishing a network of carpet distributors to serve clients across the United States. Despite these endeavors, after seven years of intensive sales efforts, Interface only managed to secure a handful of lessees.

The predominant customer preference for purchasing rather than leasing carpets presented a significant challenge. This preference stemmed from the fact that carpet maintenance was typically categorized under janitorial services, making its costs less visible to customers. As a result, the perceived value did not align with the relatively high monthly fees associated with the Evergreen Services Agreement (ESA) program. Ultimately, the program proved to be not easily scalable.

1.4 Design Thinking for Sustainable Business

Design thinking for sustainable business involves integrating environmental, social, and economic considerations into the product or service development process. Begin by empathizing with stakeholders to understand their sustainability needs and challenges. Define the problem by identifying opportunities for positive environmental and social impact.

Ideate innovative solutions that align with sustainable principles, considering materials, energy efficiency, and ethical practices. Prototype and test these ideas to refine and optimize their sustainability impact. Collaborate with diverse stakeholders to gather feedback and iterate on the designs. During implementation, prioritize sustainable sourcing, production, and distribution methods. Communicate transparently about the product's environmental and social footprint, fostering consumer awareness. Continuously assess and adapt the business model to stay aligned with evolving sustainability goals.

By applying design thinking throughout the business lifecycle, companies can create products and services that not only meet customer needs but also contribute positively to the planet and society, fostering long-term success in a sustainable and responsible manner [9].

1.4.1 Introduction to Design Thinking

Design thinking is an innovative and creative approach aimed at solving complex problems prevalent in today's world. Its primary goal is to generate inventive and user-centric ideas that lead to solutions with a positive impact on the future. Often termed "solution-focused" thinking, design thinking encourages a holistic perspective in problem-solving.

One prominent manifestation of design thinking is human-centered design, which specifically focuses on addressing human wants and needs. Successful design thinking processes prioritize serving and managing unmet human needs over the long term, steering away from short-term "band-aid" solutions. Enhancing the usability and longevity of products is a key element of sustainability, offering a viable option for creating environmentally friendly solutions. The article cited provides interesting examples in sectors notorious for unsustainable production, shedding light on the potential for positive change through design thinking.

As human-centered design gains popularity across various organizations, the adoption and refinement of this approach become increasingly crucial. This is especially true concerning its application to human needs and sustainability issues, emphasizing the significance of developing and honing design thinking skills [10].

There is, however, some confusion surrounding the concepts of sustainable and unsustainable issues. Presently, there is a robust and universal advocacy for human "sustainability." This commonly pertains to how humans engage

with society and the environment to overcome challenges and obstacles. Notable examples include the promotion of renewable energy resources, recycling initiatives, and the overall emphasis on adopting environmentally friendly practices, often referred to as "going green."

Encouraging individuals and businesses to actively participate in recycling, especially items such as cardboard and plastic, is a prevalent theme in achieving a more sustainable future. Companies seeking to enhance their recycling efforts may explore options like plastic balers, available for hire or purchase. Utilizing such equipment can assist in ensuring that both businesses and their employees contribute to creating a healthier environment.

1.4.2 Integrating Design Thinking with Sustainability

Design disciplines have a rich history of developing comprehensive solutions for challenges characterized by complexity, uncertainty, and involvement of multiple stakeholders. Similar challenges are faced by society in implementing the Sustainable Development Goals (SDGs), making design methods a valuable resource. Despite the well-established principles of good design, there has been limited integration of design thinking with sustainability science. In an effort to advance this integration, the authors examine the process of designing "Met a MAP," an interactive graphic tool aimed at collaborative understanding of social-ecological systems and the development of well-integrated solutions.

The creation of Met a MAP involved the application of Research through Design methods, which seamlessly integrate creative and scientific thinking. Through the lens of design thinking, researchers and practitioners from diverse backgrounds engaged in multiple cycles of problem framing, solution development, testing, and reflection. The testing phase was highly collaborative, encompassing the participation of over 150 individuals from various disciplines in workshops, case studies, interviews, and critiques.

Reflecting on this process, the authors discuss key design principles and identify opportunities for integrating design thinking with sustainability science. The goal is to leverage this integration to contribute to the achievement of the Sustainable Development Goals [11].

1.5 Sustainable Supply Chain Management

A sustainable supply chain is one that seamlessly incorporates ethical and environmentally responsible practices into a competitive and successful model. Achieving end-to-end supply chain transparency is essential, requiring sustainability initiatives to span from the sourcing of raw materials through to last-mile logistics, and even encompassing product returns and recycling processes. This holistic approach ensures that every phase of the supply chain adheres to ethical and environmentally conscious standards, contributing to a comprehensive and responsible business model.

1.5.1 Importance of Sustainable Supply Chains

Supply chain sustainability involves companies actively considering the environmental and human impact of their products' journey through the supply chain. This encompasses the entire process, from sourcing raw materials to production, storage, delivery, and all transportation links in between. The overarching goal is to minimize environmental harm, focusing on factors like energy usage, water consumption, and waste production. Simultaneously, it aims to have a positive impact on the people and communities associated with the company's operations. These considerations go beyond the traditional corporate supply chain concerns of revenue and profit.

For a more comprehensive understanding of supply chain sustainability, foundational definitions and answers to common questions can be considered. Supply chain sustainability (SCS) involves meeting stakeholders' needs through business practices that value and protect natural resources, reduce environmental impact, and enhance social well-being. Sustainable supply chain management enables managers to understand their company's supply chain processes, identifying opportunities for improvement in both environmental and social sustainability.

Moreover, supply chain sustainability aids individuals within a company in achieving their life goals by promoting appropriate decision-making in production. Supply chain managers play a crucial role in understanding the life cycle of various materials and making informed choices that align with the company's supply chain and broader sustainability objectives.[12]

1.5.2 Strategies for Sustainable Supply Chain Design

The environmental contamination and resource shortages resulting from human production and consumption activities have become significant threats to social welfare and sustainable development, garnering global attention and prompting a search for effective solutions. This has sparked a fundamental revolution in various industries, including Household Electrical Appliances. Governments are tightening regulations, imposing policies such as cap and trade and carbon taxes to compel producers to fulfill their social responsibilities. Simultaneously, consumers are exhibiting a rising environmental awareness, influencing their purchasing decisions, with research indicating that a majority of Americans are willing to pay more for environmentally friendly products.

Motivated by both government regulations and market demand, firms are increasingly inclined to introduce green product design. However, this endeavor requires substantial investments and can potentially lead to an intensive "Arms Race in Greenness" with competitors. The competition has extended beyond technological advancements to nonmarket means, such as legal battles over patent infringement on environmentally friendly technologies.

While competition in green product design intensifies on the upstream supply side, the downstream retail side faces complexities, particularly with the surge of electronic commerce. Online sales have significantly expanded, capturing a substantial market share from offline sales, notably in China. This shift has transformed the concentration ratio of the retail industry, with Suning leading as the first channel of home appliances in China. Appliance manufacturers like Haier, Midea, and Gree increasingly rely on retail platforms like Suning, engaging in competition that influences sales rankings. With growing channel power, large retailers have a significant opportunity to leverage manufacturers' competition by manipulating retail prices [13].

1.6 Eco-Friendly Product Design

1.6.1 Sustainable Product Design Principles

Sustainable product design principles prioritize minimizing environmental impact throughout a product's lifecycle. First, emphasize resource efficiency by selecting eco-friendly materials and reducing waste in production. Design for durability, encouraging longevity and reparability to extend product lifespan. Incorporate renewable energy sources in manufacturing

processes to decrease reliance on fossil fuels. Optimize transportation efficiency to reduce carbon emissions during distribution. Consider end-of-life scenarios by designing products for easy disassembly and recycling. Encourage a circular economy approach, where materials can be reused or repurposed. Minimize water usage in production and select non-toxic materials to reduce environmental harm. Embrace minimalist design to reduce unnecessary components and packaging, lowering overall environmental footprint. Involve stakeholders in the design process to ensure diverse perspectives and sustainability goals are considered.

Lastly, prioritize social responsibility by ensuring fair labor practices and ethical sourcing. By integrating these principles, sustainable product design aims to create environmentally conscious, socially responsible, and economically viable products for a more sustainable future.

1.6.2 Innovations in Sustainable Product Design

Sustainable product design has witnessed remarkable innovations in recent years, driven by a global push towards environmental consciousness. One key trend is the integration of recycled and biodegradable materials into product manufacturing. Companies are increasingly utilizing post-consumer recycled content, such as recycled plastics or reclaimed fibers, to reduce reliance on virgin resources and minimize environmental impact.

Another noteworthy innovation involves the implementation of circular design principles. This approach emphasizes product durability, reparability, and recyclability. Designing products with modular components facilitates easy repairs and upgrades, extending the lifespan of the item and reducing overall waste. Additionally, companies are exploring closed-loop systems where products are returned, disassembled, and their materials reused for new products.

Advancements in bio-based materials have also played a pivotal role in sustainable design. Researchers are exploring alternatives to traditional petroleum-based plastics, incorporating materials derived from plants, fungi, or agricultural waste. These bio-based materials not only reduce dependence on finite fossil resources but also often have a lower environmental impact throughout their life cycle.[14]

Furthermore, the rise of 3D printing technology has enabled more precise and efficient use of materials, minimizing waste during the manufacturing process. Companies are leveraging 3D printing to create intricate designs

that optimize material usage and enhance product performance. This approach aligns with the principles of sustainable design by promoting resource efficiency.

Collaborative efforts between industries and academia have spurred innovation, with a focus on creating sustainable packaging solutions. From biodegradable packaging materials to minimalist designs that reduce excess material usage, packaging innovations contribute significantly to overall product sustainability.

1.7 Corporate Social Responsibility (CSR)

1.7.1 Embedding CSR in Business Practices

Corporate Social Responsibility (CSR) involves integrating ethical, social, and environmental considerations into a company's business practices. Embedding CSR in business is not just a philanthropic gesture but a strategic move that can positively impact the company's reputation, employee morale, and long-term sustainability.

Companies can start by aligning CSR with their core values and incorporating it into their mission statement. This sends a clear signal to stakeholders about the company's commitment to responsible business practices. Moreover, integrating CSR into the company's strategy ensures that it becomes an integral part of decision-making processes. Engaging employees in CSR initiatives fosters a sense of purpose and pride. This involvement can range from volunteer programs to promoting environmentally friendly practices within the organization. A socially responsible business can attract and retain top talent, contributing to a positive workplace culture. Transparency in communication is crucial. Regularly reporting on CSR activities, achievements, and challenges demonstrates accountability and builds trust with customers and investors. Adopting sustainable and ethical sourcing practices further reinforces a company's commitment to CSR [15].

Collaboration with external stakeholders, including NGOs and local communities, enhances the impact of CSR initiatives. By addressing social and environmental issues relevant to the business, companies can create shared value and contribute to the overall well-being of society.

1.8 Challenges and Opportunities in Implementing Sustainable Practices

Implementing sustainable practices presents both challenges and opportunities for businesses and communities. One significant challenge lies in the initial investment required for adopting eco-friendly technologies and practices. Many organizations hesitate due to concerns about the associated costs, despite the potential long-term benefits.

Moreover, a lack of awareness and understanding about sustainable practices can impede their widespread adoption. Educating stakeholders about the environmental and social benefits of sustainability is crucial to overcoming resistance and fostering a culture of responsible practices.

On the flip side, embracing sustainability offers numerous opportunities. Cost savings are possible through energy efficiency, waste reduction, and resource optimization. Companies can enhance their reputation by aligning with environmentally conscious consumers and stakeholders, potentially gaining a competitive edge in the market.

Regulatory changes and government incentives can also create opportunities for businesses to transition to sustainable practices. Companies that proactively comply with and exceed environmental standards may enjoy favorable treatment and incentives from authorities.

In terms of community impact, sustainable practices can contribute to social responsibility and inclusivity. Local job creation, improved living conditions, and community engagement can result from sustainable initiatives. Collaborations with local communities can foster a sense of shared responsibility for environmental stewardship. While challenges like initial costs and awareness gaps exist, the implementation of sustainable practices offers a multitude of opportunities. The shift towards sustainability not only benefits the environment but also provides economic advantages, enhances reputation, and fosters positive community relationships. Navigating these challenges and seizing these opportunities is essential for creating a more sustainable and resilient future [16].

1.9 Case Studies

A holistic approach to sustainability is adopted in presenting these case studies, acknowledging environmental and social challenges as integral components of maintaining a sustainable business (refer to Figure 1). The

perspective recognizes that technology, while beneficial for enhancing corporate sustainability, is not the sole solution, and changes in business processes can be equally effective. Consequently, a range of scenarios will be provided to offer comprehensive insights into the Environmental, Social, and Governance (ESG) framework. This approach ensures a well-rounded exploration of sustainability, addressing both technological and procedural dimensions to demonstrate a multifaceted understanding of ESG considerations.

1.9.1 Case Study 1

UPS has implemented the On-Road Integrated Optimization and Navigation (ORION) system as a solution to improve transportation efficiency and address the environmental impact of greenhouse gas (GHG) emissions. With transportation activities contributing nearly 30% of US GHG emissions, optimizing delivery routes is a crucial aspect for companies like UPS that distribute goods across regions.

ORION, an AI-based route optimizer, was initiated in 2012 and has been under continuous development by UPS. The system focuses on minimizing the number of turns during deliveries, thereby enhancing transportation efficiency. The implementation of ORION has resulted in significant benefits for UPS.

Notably, ORION saves UPS approximately 10 million gallons of fuel annually. Beyond the financial advantages, this translates to a reduction of UPS's carbon footprint by 100,000 metric tonnes each year. To put it in perspective, this reduction is equivalent to removing more than 20,000 cars from the roads. The successful implementation of ORION highlights the potential of AI systems in mitigating the environmental impact of transportation activities.

It's worth noting that there are public cloud route optimizer systems available for businesses to deploy without the need for building hardware. These tools operate on a software-as-a-service model, allowing firms to subscribe and leverage route optimization services, contributing to more sustainable and efficient transportation practices [17].