**THE IMPACT OF TECHNOLOGICAL INNOVATION ON ENVIRONMENTAL SUSTAINABILITY IN DEVELOPING COUNTRIES: EVIDENCE FROM NIGERIA LOW-TECH SMES**

**CHAPTER ONE**

**INTRODUCTION**

In an era marked by unprecedented technological advancement and rapid globalization, the pursuit of sustainable development has emerged as a paramount challenge (Javanmardi, et al., 2023) for nations worldwide. According to Fallah Shayan, et al., (2022), the United Nations Sustainable Development Goals (SDGs) outline a comprehensive framework for addressing global issues such as poverty, inequality, and environmental degradation by 2030. Among these goals, environmental sustainability stands as a cornerstone, emphasizing the urgent need to preserve and protect the planet's natural resources for future generations.

However, the path to achieving environmental sustainability is fraught with complexities (Yang, et al., 2022), particularly in developing countries where the dual imperatives of economic growth and environmental preservation often appear to be at odds (Anwarya, 2022). Technological innovation, while heralded as a catalyst for economic progress, also presents a double-edged sword (Zhou, et al., 2021) concerning its environmental impact (Osheyor, et al., 2024). The dilemma lies in reconciling the imperative for technological advancement with the imperative for environmental stewardship.

**1.1 PROBLEM STATEMENT/RESEARCH RATIONALE**

According to Cetin, (2024), the nexus between technological innovation and environmental sustainability in developing countries presents a multifaceted challenge that warrants thorough investigation. Despite the potential benefits of technological innovation in driving economic growth (Cheng, et al., 2019) and improving living standards, its unchecked proliferation can exacerbate environmental degradation (Mohamed, et al., 2022), posing grave threats to ecosystems and human well-being. Issues such as pollution, resource depletion, habitat destruction (Mondal & Palit, 2021) and urbanization are not merely localized phenomena but have far-reaching implications for global sustainability (Bera, et al., 2023).

Moreover, the uneven distribution of technological resources and capabilities exacerbates disparities within and between nations, further complicating efforts to achieve the SDGs (Mayer-Foulkes et al., 2021). While some regions may have access to cutting-edge technologies that enable environmentally sustainable practices, others may lag behind due to limited infrastructure, funding, or institutional support. This disparity underscores the need for context-specific strategies that account for the unique challenges and opportunities facing developing countries in their quest for environmental sustainability.

In light of these challenges, this research seeks to elucidate the intricate relationship between technological innovation and environmental sustainability in developing countries. By examining the drivers, barriers, and implications of technological innovation within the framework of the SDGs, this study aims to provide insights that inform policy formulation, business strategies, and community initiatives aimed at advancing sustainable development. Through a nuanced understanding of these dynamics, stakeholders can work collaboratively to harness the potential of technology for positive environmental outcomes while mitigating its adverse impacts.

**1.2 RESEARCH AIM AND OBJECTIVES**

The aim of this study is to investigate the impact of technological innovation on environmental sustainability in developing countries, with a focus on identifying challenges, opportunities, and strategies for fostering sustainable development.

**Research Objectives**

1. To examine the technological innovation landscape within low-tech SMEs in a selected developing country, focusing on sectors with potential for significant environmental impact.
2. To evaluate the environmental sustainability practices and outcomes associated with technological innovations implemented by low-tech SMEs, including their effects on air and water quality, land use, and biodiversity.
3. To identify the key factors influencing the adoption and implementation of environmentally sustainable technologies within low-tech SMEs in developing countries.
4. To analyze the role of government policies, regulatory frameworks, and international cooperation in shaping the adoption and impact of environmentally sustainable technological innovations among low-tech SMEs.
5. To provide practical recommendations for enhancing the contribution of technological innovation to environmental sustainability within the context of low-tech SMEs in developing countries, based on the findings of the study.

**1.4 METHODS AND THEORIES**

**Case Study Selection**

The Focus of the research will be on low-tech SMEs in Nigeria that have implemented technological innovations for environmental sustainability. The low-tech SMEs include those in food restaurant; Local and Modern kitchens

**Theoretical Frameworks**

**Innovation Systems Theory**: The research will analyze how the adoption of technology in low-tech SMEs is influenced by broader socio-economic factors, including institutional support, networking opportunities, and knowledge diffusion mechanisms.

**Sustainable Development Theory**: The research will also evaluate the environmental benefits and socio-economic implications of technological innovation in low-tech SMEs within the context of sustainable development goals.

**Methods and Methodology**:

1. **Interviews**: Conduct semi-structured interviews with owners/managers of selected low-tech SMEs to understand their motivations for adopting technological innovations, challenges faced during implementation, and perceived impacts on environmental sustainability. This research will aim for a sufficient number of interviews to achieve data saturation (around 5-7 interviews).

**Data Analysis Techniques**

1. Thematic Analysis: Employ a systematic approach to coding and identifying themes within the interview data. Thematic analysis will involve reading through the data multiple times to identify recurring patterns and themes related to technological adoption, environmental sustainability practices, and challenges faced by low-tech SMEs. By categorizing these themes, the analysis will provide a deeper understanding of the motivations, impacts, and barriers associated with technological innovations in the context of environmental sustainability.

**1.5 SIGNIFICANCE OF THE STUDY**

This study builds upon a rich body of literature that examines the intersection of technological innovation and environmental sustainability, with a specific focus on the context of developing countries.

The literature on innovation systems theory provides a theoretical foundation for understanding how technological innovation occurs within the broader socio-economic context of developing countries. Studies such as those by Pyka & Prettner, (2018) emphasize the importance of institutions, networks, and knowledge flows in shaping innovation processes, highlighting the need for supportive policy environments conducive to sustainable technological innovation.

Also, research on sustainable development theory offers valuable insights into the principles and practices that underpin environmentally sustainable development. Works by authors such as Spiliotopoulou & Roseland, (2020), emphasize the interconnectedness of economic, social, and environmental dimensions of development, advocating for integrated approaches that prioritize environmental conservation alongside economic growth.

In addition, empirical studies examining the adoption and diffusion of environmentally sustainable technologies in developing countries provide valuable context-specific insights. For example, research by Vergis, (2020) explores the factors influencing the adoption of renewable energy technologies, highlighting the importance of policy support, financial incentives, and technological capabilities in driving adoption.

Furthermore, case studies focusing on specific sectors or industries shed light on the challenges and opportunities associated with promoting environmentally sustainable technological innovation. For instance, studies by Priya, & Singh, (2022) examine the adoption of sustainable agriculture practices among small-scale farmers in developing countries, elucidating the role of socio-economic factors, market dynamics, and institutional support.

Literature on corporate sustainability strategies and green business practices provides insights into the role of businesses in advancing environmental sustainability. Works by authors such as Darnall, (2010) highlight the business case for sustainability, emphasizing the stakeholder, potential for innovation and competitive advantage through the adoption of environmentally friendly practices.

Therefore, by drawing upon this diverse array of literature, this study seeks to enrich our understanding of the complex dynamics shaping technological innovation and environmental sustainability in developing countries. By providing empirical evidence, actionable insights, and avenues for further research and dialogue, this study aims to support efforts to achieve the United Nations Sustainable Development Goals and foster a more sustainable future for all.

**1.6 STRUCTURE OF STUDY**

Chapter One, "Introduction," covers background information about the study, its aims, objectives, research questions, rationale, significance, and structuring of this dissertation.

Chapter Two, "Literature Review," “Literature Review” provides an in-depth analysis from prior and relevant literature on Technological innovation, and its impact on environmental sustainability. It further explores various studies and scholars’ opinions and findings on the role and impact of Technological innovation on sustainability within Low tech SMEs in a developing country like Nigeria.

Chapter Three "Research Methodology," provides detail on the research methods and the justification behind selecting a particular approach. The data collection techniques, underpinning philosophy, analytical procedures, and ethical concerns raised by these practices are all covered in this section.

Chapter Four "Findings," This chapter presents the findings from semi-structured interviews conducted with participants from low-tech SMEs in Nigeria.

Chapter Five “Discussion of Findings”. This chapter provides a detailed discussion of the findings presented in Chapter Four, linking them with the theoretical frameworks of innovation systems theory and sustainable development theory. The discussion is organized around the main themes identified in the findings: Integration of Technological Innovations, Environmental Outcomes, Challenges and Barriers, and the Role of Government and Policies.

Chapter Six “Conclusion”. This chapter presents the concluding remarks of the study, summarizing the key findings, contributions to theories, literature, and practice, as well as recommendations for policymakers and future research. The limitations of the study are also discussed to provide a comprehensive understanding of the scope and boundaries of the research.

Chapter Seven, "Personal Reflection," employs Gibbs' reflective cycle to reflect on the researcher's personal experiences, insights gained, challenges faced, and lessons learned throughout the research process.

**1.7 CHAPTER SUMMARY AND CONCLUSION**

This chapter lays the groundwork for this dissertation by addressing the intersection of technological innovation and environmental sustainability in developing countries. It begins with an introduction that situates the study within the broader context of global sustainable development challenges, particularly in the face of rapid technological advancement and economic growth pressures.

The Problem Statement/Research Rationale section articulates the central research issue: the complex relationship between technological innovation and environmental sustainability in developing countries. It highlights the dual nature of technological progress, which can both drive economic growth and cause environmental harm, necessitating a nuanced investigation.

The Research Aim is defined as exploring the impact of technological innovation on environmental sustainability, with the goal of identifying challenges, opportunities, and strategies for promoting sustainable development in developing countries.

Research Objectives are outlined to guide the study, including examining the technological landscape within low-tech SMEs, evaluating environmental practices, identifying adoption factors, analyzing policy roles, and providing practical recommendations.

The Methods and Theories section describes the study's focus on low-tech SMEs in Nigeria, using theoretical frameworks like Innovation Systems Theory and Sustainable Development Theory. It details the methodology; including interviews and the planned data analysis techniques using thematic analysis.

The Significance of the Study underscores the contribution of this research to existing literature by integrating diverse theoretical perspectives and empirical findings. It emphasizes the study's potential to inform policy, business strategies, and community initiatives for achieving the SDGs.

Finally, the Structure of the study provides an overview of the subsequent chapters, detailing the content and focus of each section from the literature review to the final discussion and recommendations.

By setting clear research aims and objectives, and outlining a robust methodological approach, this chapter paves the way for a comprehensive examination of how developing countries can harness technological advancements to foster sustainable development. The insights and findings from this study aim to support stakeholders in creating effective strategies that balance economic growth with environmental stewardship, ultimately contributing to the achievement of the United Nations Sustainable Development Goals.