

**GREEN INITIATIVES AND PROFITABILITY OF COMPANIES LISTED AT THE NAIROBI
SECURITIES EXCHANGE**

By

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December, 2025

DECLARATION

I declare that this dissertation is my original work and has not been previously published or submitted elsewhere for award of a degree. I also declare that this contains no material written or published by other people except where due reference is made and author duly acknowledged.

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Dr. Gabriel Munene Laiboni, PhD

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ABSTRACT

Companies in Nairobi have adopted green initiatives, yet there remains limited clarity on how the efforts impact profitability. The study aimed to assess the initiatives on the profitability of companies listed on the Nairobi Securities Exchange. The specific objectives include: energy efficiency, solar lighting, water recycling, and sustainable packaging. The study will apply a descriptive research design to target staff at companies listed on the Nairobi Securities Exchange. It applied the census approach to respondents from 62 registered companies. Data were collected using closed-ended Likert-scale questionnaires via a drop-and-pick method. The analyses that were applied are descriptive and inferential techniques, presented in a visual format using frequency tables and pie charts for straightforward interpretation. The study findings found that green initiatives are key drivers of profitability for companies listed at the Nairobi Securities Exchange. However, adoption and impact vary across firms.

Furthermore, it revealed that while these practices lower costs and boost financial performance, their effectiveness depends on industry needs, investment levels, and available resources. The study showed that green initiatives have a significant positive effect on the profitability of companies listed on the Nairobi Securities Exchange, resulting in lower operational costs, greater competitiveness, and improved long-term financial performance, despite variations in adoption across sectors. This study recommends that companies listed at the Nairobi Securities Exchange prioritise energy efficiency, solar lighting, water recycling, and sustainable packaging as strategic practices to enhance profitability and sustainability. It further suggests that firms invest in modern technologies while policymakers provide incentives and supportive frameworks to encourage wider adoption across different sectors.

Keywords: Green Initiatives, Energy Efficiency, Profitability of Companies, Solar Lighting, Sustainable Packaging, Water Recycling

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DEDICATION

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ABBREVIATIONS AND ACRONYMS

BOD:	Biological Oxygen Demand
DEA:	Data Envelopment Analysis
EPSS:	Environmental, Policy, Social, and Stakeholder
IDT:	Innovation Diffusion Theory
ISO:	International Organization for Standardization
LED:	Light-Emitting Diode
RBV:	Resource-Based View
SEM:	Structural Equation Modelling
SFA:	Stochastic Frontier Analysis
SMEs:	Small And Medium Companies
SWOT:	Strengths, Weaknesses, Opportunities, and Threats
TDS:	Total Dissolved Solids

OPERATIONAL DEFINITION OF TERMS

- Energy Efficiency:** Refers to the ability of an enterprise to minimise energy consumption while maximising output, measured through energy savings, reduced energy costs, optimised electricity usage, and improved fuel efficiency (Otundo, 2024).
- Profitability of Companies:** Represents the financial performance of a business, captured through indicators such as operating income, revenue growth, profit margin, sales volume, and cash flow (Waziri & Njoroge, 2023).
- Solar Lighting:** The use of solar-powered lighting systems in business operations, assessed through factors like installation and maintenance costs, lighting reliability, downtime reduction, and offsetting utility expenses (Tshivhase & Bisschoff, 2023).
- Sustainable Packaging:** Involves the use of environmentally friendly packaging materials, evaluated by packaging waste reduction, recyclable and biodegradable content, supply efficiency, and savings in production costs (Nyaga & Aluoch, 2022).
- Water Recycling:** Refers to the process of reusing treated wastewater for operational needs, measured through the volume recycled, reduction in wastewater output, filtration costs, process continuity, and cost savings (Ronoh, 2021).

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Across the globe, green initiatives such as renewable energy adoption, sustainable sourcing, and waste reduction have become essential to how businesses operate (Odeyemi et al., 2024). These practices are no longer just about environmental responsibility; they are now linked to cost reduction, risk management, and long-term competitiveness. Many global firms have realised that embedding sustainability into their core strategies enhances brand reputation, which aligns with Kenya's Vision 2030 and attracts investors who value environmental, social, and governance (ESG) principles.

In Africa, the transition toward sustainable business models is steadily growing as governments and regional organisations push for green initiatives to address climate change and resource scarcity. Countries such as South Africa and Rwanda have introduced strong policy frameworks to support renewable energy and eco-friendly production (Rotich et al., 2024). However, adoption levels in Africa and across industries differ due to financial constraints, weak policy enforcement, and limited technical expertise. Even so, many African enterprises are beginning to recognise that going green can enhance operational efficiency, build resilience, and unlock opportunities in international markets that favour sustainable practices.

In Kenya, green practices are being adopted, particularly among companies listed at the Nairobi Securities Exchange (NSE). There is increasing pressure to integrate environmental sustainability into corporate strategies. This pressure stems from evolving regulations, growing public awareness, and global supply chain requirements (Takase et al., 2021). Several listed firms

have adopted green initiatives, such as renewable energy use, eco-friendly packaging, and waste reduction, to cut costs and improve brand image. However, some companies remain uncertain about the financial returns of these investments (Okomol et al., 2021). Therefore, the relationship between green initiatives and profitability among companies listed on the NSE remains underexplored. This study, thus, aims to examine how the adoption of green initiatives influences the profitability of listed companies in Nairobi.

1.1.1 Green Initiatives

Green initiatives are actions companies take to reduce their environmental impact. These efforts have grown in importance amid rising global concerns about climate change, resource scarcity, and pollution (Ahmed et al., 2022). Companies across sectors are adopting green practices not only to protect the environment but also to improve efficiency and build a positive reputation (Twagirayezu et al., 2023). The most common green initiatives include energy efficiency, solar lighting, water recycling, and sustainable packaging. These practices help companies reduce waste, cut costs, and comply with stricter environmental regulations.

Energy efficiency involves using energy-saving machines, upgrading building insulation, or switching to LED lighting (Paramati et al., 2022). Solar lighting relies on sunlight as a renewable and clean energy source, reducing dependence on fossil fuels (Falcone, 2023). Water recycling treats used water and makes it usable again, helping reduce fresh water consumption and lower operating costs, especially in the manufacturing and food processing industries (Zhao et al., 2022). Sustainable packaging uses materials that are biodegradable, recyclable, or reusable. It reduces plastic waste and meets consumer demand for environmentally friendly products (Rotich et al., 2024).

Energy efficiency focuses on reducing the amount of energy required to deliver products or services. It plays a critical role in minimising operational costs and lowering carbon emissions. In a business context, this may include replacing outdated machines with energy-efficient alternatives, installing LED lighting, using motion sensors, and installing smart energy meters (Otundo, 2024). One significant indicator is energy intensity, which measures energy use per unit of output. Businesses can also track reductions in monthly electricity bills, which signal the impact of adopted efficiency measures (Takase et al., 2021).

Another key measure is the percentage of total energy demand met through efficient technologies. For example, firms may track the share of office lighting using LED bulbs or the proportion of production powered by low-energy machinery. The installation of building management systems that regulate temperature, lighting, and ventilation is also a strong indicator of energy-efficiency practices. The duration and frequency of energy audits, as well as adherence to ISO 50001 standards, may also be used to evaluate commitment to energy management (Mwanzu et al., 2023). These indicators help assess the extent to which energy efficiency is embedded in daily operations.

Solar lighting uses photovoltaic systems to convert sunlight into electricity for lighting. It is widely adopted as a sustainable alternative to grid electricity and contributes directly to lowering greenhouse gas emissions (Lyu et al., 2023). Key indicators include the number of solar panels installed, total energy output in kilowatt-hours (kWh), and the percentage of lighting needs powered by solar energy. Businesses may also monitor the installation of solar streetlights, solar-powered signage, and rooftop panels as visible signs of adoption (Rotich et al., 2024).

Another useful indicator is the total cost savings realised through reduced electricity bills after installing solar systems. The use of hybrid systems that integrate solar panels with battery

storage increases efficiency and energy reliability. Companies may also measure the lifespan of solar components and the frequency of maintenance to determine system performance. In some cases, businesses track the number of hours of solar-powered lighting per day (Zhao et al., 2022). These indicators help assess not only environmental benefits but also long-term cost savings and energy independence.

Water recycling involves treating wastewater and reusing it for non-potable functions such as toilet flushing, landscaping, and cooling industrial machinery. This practice helps reduce pressure on freshwater sources and lowers water utility costs (Waziri & Njoroge, 2023). The most common indicators include the volume of water reused per day, the percentage of water needs met by recycled water, and the number of recycling units installed. These measures help evaluate both scale and effectiveness of water conservation efforts (Otundo, 2024).

In addition, firms may track changes in monthly water consumption and wastewater discharge before and after the implementation of recycling systems. The quality of treated water, assessed through chemical indicators such as pH, BOD (Biological Oxygen Demand), and TDS (Total Dissolved Solids), also determines system efficiency. Compliance with local water reuse standards and licensing requirements can serve as a regulatory indicator (Lyu et al., 2023). Businesses may also evaluate employee training on water-saving practices and the integration of water meters to monitor use in real time. These indicators ensure that recycling efforts are both safe and impactful.

Sustainable packaging uses materials that are environmentally friendly, recyclable, reusable, or biodegradable. It aims to reduce packaging waste and lower the carbon footprint associated with product distribution (Otundo, 2024). Measures include the percentage of packaging made from recyclable or biodegradable materials, the amount of packaging waste

generated per product, and packaging-to-product weight ratios. These indicators reflect the efficiency and sustainability of packaging design (Mwanzu et al., 2023).

Companies may also assess consumer feedback on packaging, especially related to ease of disposal and environmental friendliness. Another key measure is the percentage of packaging reused or returned, particularly in businesses adopting circular-economy practices. The use of minimal, bulk, or refillable packaging can also be tracked. In e-commerce or retail, firms may track reductions in logistics costs due to lighter packaging. Finally, businesses often report on their packaging innovation initiatives and compliance with extended producer responsibility laws (Waziri & Njoroge, 2023). Together, these indicators provide a complete picture of the environmental and financial impact of packaging choices.

1.1.2 Green Initiatives and Profitability of Companies

In the United States and Germany, enterprise profitability remains a critical goal despite mature markets and advanced infrastructure. Many companies in these economies are operating on thin margins due to rising energy prices, labour costs, and growing competition from emerging markets. For example, in the U.S., small manufacturing firms have seen profit margins shrink by up to 8% over the last five years due to increased operating costs (Khair et al., 2024). In Germany, companies face high energy taxes and strict labour laws that often limit flexibility and reduce short-term profits. Even with access to advanced technologies, these firms struggle to maintain consistent profit growth in saturated markets (MacNeil et al., 2021).

Companies in Japan and Canada are increasingly adopting green initiatives, but profitability often takes a hit in the early stages. In Japan, many companies have invested in energy-efficient systems and solar lighting in response to government incentives. However, the initial

investment often reduces short-term profits, especially for small companies (Ahmed et al., 2022). In Canada, water recycling and sustainable packaging are on the rise, particularly in the food and beverage sector. However, replacing conventional packaging with eco-friendly alternatives raised material costs by 20–30%, putting pressure on profits (MacNeil et al., 2021). These added costs are not always passed on to consumers, especially in competitive industries where price sensitivity is high.

However, global studies in developed countries such as Canada and Germany have shown that green initiatives promote profitability, enhance efficiency, and improve competitiveness. In contrast, the profitability in developing countries like Kenya remains limited. In Germany, companies that invested early in energy efficiency have reported significant cost savings over the last decade. U.S. retail firms using sustainable packaging often see increased customer loyalty and brand value. In Canada, some manufacturers using recycled water systems have lowered annual utility expenses by up to 15% (Khair et al., 2024).

Across various African countries, the profitability of companies remains a pressing issue. In Nigeria, small and medium-sized companies face thin profit margins due to inconsistent electricity, multiple taxes, and limited access to finance (Ogunode & Ayeni, 2024). Ghana's companies, especially in agriculture and manufacturing, continue to struggle with input costs and inefficient supply chains (Twagirayezu et al., 2023). Even in South Africa, where the private sector is more developed, profitability is hampered by inflation and tight regulatory environments (Bisschoff & Tshivshe, 2023). These challenges often limit business growth, job creation, and long-term sustainability. In Ethiopia, for instance, clean energy startups benefit from donor support, but their commercial viability remains low due to limited local demand (Effa et al., 2025). Rwanda's green tourism sector is promising, yet seasonal fluctuations in revenue make

profitability uncertain (Twagirayezu et al., 2023). Many companies in Africa treat green initiatives as secondary goals since the upfront costs are high and returns are delayed. This makes it difficult for firms to balance environmental responsibility with financial survival (Tshivhase & Bisschoff, 2023).

Profitability, therefore, remains the most important concern for companies across Africa. While green practices are encouraged, most businesses focus on cutting costs, increasing efficiency, and expanding markets to stay afloat (Bisschoff & Tshivshe, 2023). Without clear financial incentives or strong policy support, the link between green initiatives and business profit stays weak. For many African firms, the path to long-term sustainability still begins with solving short-term profitability challenges (Tshivhase & Bisschoff, 2023).

In Kenya, companies continue to face profitability challenges despite steady economic growth. Small and medium-sized companies are particularly affected by high operational costs, an unstable power supply, and limited access to credit (Okomol et al., 2021). Inflation and tax pressures have further squeezed profit margins, especially for businesses in retail, manufacturing, and hospitality (Takase et al., 2021). Even with increased digital adoption, most firms still operate under tight budgets, often struggling to break even. These issues have led to frequent business closures and limited reinvestment, which hinders long-term growth and job creation (Falcone, 2023).

Companies adopting clean energy or eco-friendly practices often face high initial costs and a lack of technical skills (Mwanzu et al., 2023). Government incentives exist, but uptake remains low due to weak awareness and uncertain returns. Many businesses view green investments as costly and risky, especially in the short term. As a result, most Kenyan companies prioritise profit-focused strategies over sustainability, focusing on survival in a challenging economic climate

(Takase et al., 2021). These constraints slow the adoption of sustainable initiatives; therefore, it is necessary to understand whether and how green initiatives can deliver measurable profits in listed firms in Kenya.

1.1.3 Companies listed on the Nairobi Securities Exchange

The profitability of companies listed on the Nairobi Securities Exchange (NSE) is shaped by a mix of economic, regulatory, and operational factors. The exchange hosts firms across diverse sectors, including banking, manufacturing, insurance, energy, and telecommunications. Despite their critical role in capital formation and economic growth, many of these listed companies report fluctuating and sometimes declining profits. According to Waziri and Njoroge (2023), more than 40% of NSE-listed firms failed to meet their annual profit targets in recent years. These factors include rising operational costs, exposure to macroeconomic shocks, currency fluctuations, and limited access to affordable credit markets for expansion. The challenges often force companies listed on NSE to prioritise short-term stability over long-term growth.

Profitability also varies widely across sectors. Nyaga and Aluoch (2022) note that the average net profit margin among NSE-listed companies is about 8.5%, with manufacturing and agricultural firms often reporting margins below 5%. In contrast, banks, telecommunications companies, and professional service providers show stronger performance, with margins ranging from 12% to 18%. This gap highlights how some sectors remain highly vulnerable to cost-related pressures and market volatility, while others benefit from economies of scale, diversified revenue streams, and stronger capital bases. Further, some listed firms continue to face compliance and governance challenges that limit investor confidence and access to low-cost financing, thereby affecting profitability.

Operational expenses remain a significant burden for NSE-listed firms. Ronoh (2021) observes that energy costs are particularly high, with electricity bills for large manufacturers and processors exceeding KES 10 million per month. In consumer goods and beverages, packaging and raw material expenses have surged, while utilities such as water and transport costs have risen steadily, further compressing margins. Rising costs leave less room for reinvestment, with Rotich et al. (2024) noting that only a small fraction of listed firms allocated more than KES 500 million toward expansion and modernisation in 2022. Many companies either broke even or recorded reduced profitability, limiting their ability to build resilience against economic shocks.

The inability to reinvest profits into innovation and expansion is a significant concern for listed companies in Nairobi. Firms focus on preserving liquidity to sustain dividends, meet debt obligations, and maintain day-to-day operations, thereby constraining their capacity for strategic investments such as digital transformation, product diversification, or the adoption of sustainable practices (Waziri & Njoroge, 2023). This cycle of modest earnings and limited reinvestment restricts growth, leaving some companies stagnant and unable to compete regionally or globally. Therefore, the study aims to fill the gap in the relationship between green initiatives and profitability and to provide insights for listed companies. The NSE-listed firms operate in a conservative, survival-driven mode, unable to unlock the long-term shareholder value and market leadership that come from sustained innovation and capital investment (Otundo, 2024).

1.2 Statement of the Problem

Profitability is at the core of every successful enterprise, determining a firm's ability to sustain operations, expand market reach, and invest in innovation. Listed firms operate in a demanding environment characterised by high operational costs, regulatory requirements, and changing consumer expectations. These challenges require effective resource management and strategic

decision-making to maintain profitability. According to Otundo (2024), listed companies in Kenya have faced declining profit margins due to rising input costs, taxes, and market volatility. The Capital Markets Authority (CMA, 2023) further reports that profitability among NSE-listed firms has been inconsistent, with several companies in the manufacturing, energy, and retail sectors recording profit declines over the last three years. Similarly, Macharia et al. (2022) note that increasing energy and packaging costs have significantly eroded margins, forcing many firms to cut reinvestment spending. This indicates that profitability remains a significant concern among listed companies in Nairobi, despite their strategic and financial capabilities.

Existing studies have examined the relationship between environmental practices and firm performance, but few have specifically examined how green initiatives influence profitability among NSE-listed companies. For instance, Lyu et al. (2023) examined the role of smart manufacturing in profitability in China but focused on large industrial firms rather than capital-market-listed enterprises. Martins (2022) studied green marketing and perceived profitability, focusing on consumer responses rather than internal environmental practices. Kariuki (2023) analysed green financing among Nairobi-based manufacturers but did not assess how specific sustainability practices, such as energy efficiency, solar lighting, water recycling, or sustainable packaging, affect profitability.

This gap points to a limited understanding of how green initiatives translate into financial performance among NSE-listed firms. While the global literature supports the notion that sustainability can drive efficiency and profitability, empirical evidence in Kenya's capital market remains scarce. Therefore, this study seeks to fill the gap by examining how selected green initiatives, such as energy efficiency, solar lighting, water recycling, and sustainable packaging, impact the profitability of companies listed on the Nairobi Securities Exchange. The study aims to

provide insights into whether environmentally responsible practices contribute to improved financial outcomes among publicly listed firms in Nairobi.

1.3 General Objective of the Study

The general objective of the study was to establish the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange.

1.3.1 Specific Objective of the Study

- i. To examine the effect of energy efficiency on profitability of companies listed at the Nairobi Securities Exchange.
- ii. To assess the effect of solar lighting on profitability of companies listed at the Nairobi Securities Exchange.
- iii. To evaluate the influence of water recycling on profitability of companies listed at the Nairobi Securities Exchange.
- iv. To investigate the effect of sustainable packaging on profitability of companies listed at the Nairobi Securities Exchange.

1.4 Research hypothesis

- i. **H₀₁:** Energy efficiency has no significant effect on profitability of companies listed at the Nairobi Securities Exchange.
- ii. **H₀₂:** Solar lighting has no significant effect on profitability of companies listed at the Nairobi Securities Exchange.
- iii. **H₀₃:** Water recycling has no significant influence on profitability of companies listed at the Nairobi Securities Exchange.

- iv. **H₀₄:** Sustainable packaging has no significant effect on profitability of companies listed at the Nairobi Securities Exchange.

1.5 Significance of the Study

1.5.1 Companies Listed at the Nairobi Securities Exchange

This study provides practical insight into whether green initiatives enhance or weaken profitability. Many businesses in Nairobi are hesitant to invest in sustainability because they fear it raises operational costs. By analysing real cases and data, the study helps companies understand the financial implications of adopting eco-friendly practices like waste management, energy efficiency, and sustainable sourcing. It also highlights what works and what does not, giving business owners a more up-front path to balance environmental responsibility with profit-making goals.

1.5.2 Policy Makers

For policymakers, the study offers evidence on how environmental regulations and incentives can shape business behaviour. It highlights whether green initiatives are financially viable for companies and identifies potential barriers. This can inform future policies, including tax breaks, subsidies, or regulations that support sustainable growth without overburdening businesses. The findings also help create a balanced policy environment that encourages innovation while addressing climate and environmental goals.

1.5.3 Future Academicians

Academically, the study adds to the growing body of research on sustainable business practices in developing economies. Future researchers and scholars can use it as a reference point for exploring similar themes or conducting comparative studies across regions or sectors. It also offers a Kenyan

perspective that helps bridge the gap between global literature and local realities. This can enrich classroom discussions, fuel new research ideas, and contribute to building knowledge that supports both business and environmental outcomes.

1.6 The scope of the Study

The study assessed the impact of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange. It was controlled by energy efficiency, solar lighting, water recycling and sustainable packaging as independent variables. The study target population was all the companies listed at the Nairobi Securities Exchange. The study was done from May to October 2025.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presented studies conducted to examine green initiatives and the profitability of companies listed on the Nairobi Securities Exchange. It comprises a theoretical review, an empirical review, and the conceptual framework.

2.2. Theoretical Review

The study was based on the following theories: the resource-based view, innovation diffusion, the triple bottom line, and sustainable development.

2.2.1 Resource-Based View Theory

The Resource-Based View (RBV) theory was first proposed by Wernerfelt (1984) and later advanced by Barney (1991), who refined the framework for identifying strategic resources. RBV emphasises that firms gain a competitive advantage from internal resources rather than from external market positioning alone. According to Nayak, Bhattacharyya, and Krishnamoorthy (2023), RBV has evolved to incorporate insights from industrial organisation and strategy, emphasising the need for firms to constantly adapt and reconfigure their internal assets. This makes it especially relevant in dynamic business environments like Nairobi, where companies often operate under high resource constraints. By identifying and investing in high-value resources such

as energy-efficient technologies, firms can create long-term value that sets them apart from competitors.

The RBV theory suggests that not all resources lead to a competitive edge. To be strategically beneficial, a resource must be valuable (help improve performance), rare (not widely available), inimitable (difficult to copy), and non-substitutable. Ferreira and Ferreira (2025) highlight how the field has expanded to include intangible resources like environmental innovation, employee skills, and internal processes. In this light, energy efficiency is not just about reducing utility bills; it becomes a strategic capability. For example, firms with advanced energy management systems or skilled personnel in sustainable operations may not only save costs but also attract eco-conscious customers, secure funding, or meet regulatory standards more easily. These benefits, when bundled together, cannot be easily replicated by competitors, giving such firms an edge in the market.

The relevance of RBV to this study lies in its ability to explain how energy efficiency functions as a strategic internal resource that can enhance profitability. Energy-efficient systems and practices can enable firms to minimise operational costs, improve productivity, and strengthen their competitive position in the market. In the context of companies listed at the Nairobi Securities Exchange, energy efficiency represents a valuable, rare, inimitable, and non-substitutable capability that aligns sustainability with profitability. Through the RBV lens, this study views energy efficiency as a key driver of long-term financial performance, positioning it as an internal strength that supports both economic and environmental goals.

2.2.2 Innovation Diffusion Theory

The Innovation Diffusion Theory (IDT) was developed by Everett Rogers in 1962 in his book *Diffusion of Innovations*. The theory explains how new technologies and ideas spread within a social system over time. According to Yu (2022), this process involves five key stages: knowledge, persuasion, decision, implementation, and confirmation. The rate at which an innovation is adopted depends on factors such as communication channels, social networks, and the perceived usefulness of the innovation. Rogers also emphasised that the success of an innovation depends not only on its technical merit but also on how well it fits into the existing values, experiences, and needs of the users. This theory remains widely used in understanding how and why some innovations succeed while others fail.

IDT classifies adopters into five categories: innovators, early adopters, early majority, late majority, and laggards. Each group adopts technology at different speeds based on their openness to change and social influence. The theory also highlights five perceived characteristics that influence adoption: relative advantage, compatibility, complexity, trialability, and observability. Pinho, Franco, and Mendes (2021) note that these factors are critical for encouraging the acceptance of new systems, particularly in contexts such as education and technology. In a related study, Ho (2022) discusses how disruptive technologies often follow predictable diffusion patterns when users notice clear benefits and low risk. In the case of solar lighting, its affordability, ease of use, and long-term savings can make it highly attractive to companies. Once early adopters demonstrate its value, the more visible and reliable the results, the faster the spread.

The relevance of the Innovation Diffusion Theory to this study lies in its ability to explain how and why companies decide to adopt solar lighting as part of their operations. For firms listed on the Nairobi Securities Exchange, adopting solar lighting can be seen as an innovation that reduces energy costs and enhances operational efficiency, thereby improving profitability. The

theory helps explain the factors that influence adoption, such as perceived economic benefits, organisational readiness, and social influence and how these determine the rate of uptake. By applying IDT, this study anchors solar lighting as the independent variable influencing profitability, providing a framework to understand how innovation adoption contributes to financial performance among Nairobi-based listed companies.

2.2.3 Triple Bottom Line Theory

The Triple Bottom Line (TBL) theory was developed by Elkington (1994) as a framework to have a diverse definition of business success. He argued that corporations should act beyond the traditional focus on financial profit and also account for social and environmental impacts in their performance assessments. He proposed three interrelated dimensions: profit in relation to economic growth and shareholder value, people in relation to social responsibility and community well-being, and planet in relation to environmental sustainability. This framework has been influential in corporate social responsibility and sustainability research because it ties ethical and ecological practices directly to long-term profitability and competitiveness (Farooq et al., 2021). The theory remains a widely applied benchmark, even though it has faced criticism for being difficult to measure consistently (Srivastava et al., 2022).

The core concept of TBL is that sustainable business requires balancing economic, social, and environmental dimensions rather than prioritising one at the expense of the others. Financial performance remains essential, but it is complemented by social value creation through fair labour practices, community development, and equity, as well as environmental stewardship through responsible resource management and pollution reduction. Scholars emphasise that this balance not only helps firms comply with global sustainability goals but also builds long-term resilience by reducing risks associated with resource scarcity, regulatory changes, and reputational damage

(Nogueira et al., 2023). Thus, TBL suggests that by investing in environmental initiatives such as water recycling, businesses can reduce costs, build goodwill, and secure future competitiveness.

The relevance of the TBL theory to this study lies in its ability to demonstrate how environmental sustainability initiatives, such as water recycling, contribute to both profitability and long-term business resilience. Companies listed at the Nairobi Securities Exchange face challenges related to water scarcity, high utility costs, and increasing regulatory and stakeholder expectations. Through the TBL lens, water recycling is viewed not only as an environmental responsibility but also as a strategy that enhances financial efficiency and social credibility. By adopting water recycling systems, firms can lower operational expenses, improve their public image and stakeholder relations, and promote environmental conservation. This threefold benefit aligns directly with the TBL framework and anchors water recycling as the independent variable influencing profitability in this study.

2.2.4 Sustainable Development Theory

The Brundtland Commission popularised Sustainable Development Theory in 1987, which defined sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs. While not attributed to a single proponent, this foundational definition shaped global thinking about the relationship between growth, society, and the environment. Manioudis and Meramveliotakis (2022) discuss how sustainable development has evolved into a broad, interdisciplinary theory rooted in political economy, emphasising the balance between economic growth, social equity, and environmental protection. The theory calls for integrated solutions that consider long-term impacts rather than short-term gains, a perspective that is crucial for businesses seeking to align profitability with sustainability.

Sustainable development theory advocates for practices that promote economic progress while preserving natural resources and social welfare. Hu and Liu (2022) highlight the uncertainty and complexity of sustainability issues, noting that firms must make informed decisions even amid imperfect information. Popkova et al. (2022) further explain that digital technologies have become essential tools for sustainable development, helping businesses monitor environmental performance and optimise resource use. Sustainable packaging aligns closely with this framework by minimising waste, lowering carbon emissions, and appealing to environmentally conscious consumers. It represents a business strategy that balances environmental responsibility with long-term profitability.

The relevance of Sustainable Development Theory to this study lies in its ability to explain how sustainable packaging contributes to both environmental stewardship and financial performance among companies listed at the Nairobi Securities Exchange. The theory provides a foundation for understanding how firms can achieve profitability while reducing their ecological footprint. By adopting sustainable packaging, companies can lower material and disposal costs, enhance brand image, and meet growing market demand for eco-friendly products. This approach reflects the theory's core principle of balancing economic viability with environmental and social responsibility. Therefore, in this study, sustainable packaging is anchored as the independent variable influencing profitability, demonstrating how sustainable business practices can drive enduring economic success.

2.3 Empirical Review

The empirical review summarises past research on the effect of energy efficiency on profitability, highlighting key findings, methodologies, and gaps that inform the current study.

2.3.1 Energy Efficiency and Profitability of Companies

Lukic (2021) focused on the service sector and analysed the relationship between energy efficiency and profitability. The key variables were energy consumption, energy-saving investments, and profit margins. The objective was to determine whether energy efficiency investments directly enhance firm profitability and competitiveness. Using a comparative analysis approach, the study examined selected service companies across Eastern Europe through purposive sampling, with data analysed using descriptive statistics and regression models. The findings showed that firms with higher energy efficiency recorded significantly higher profit margins. At the same time, companies investing in energy-saving technologies achieved lower operational costs, improved competitiveness, and stronger sustainability reputations. The research concluded that long-term energy-saving investments compound profitability, underscoring that minimising energy waste directly contributes to operational success. However, this study presents several gaps that justify further research. It focused on Eastern Europe, excluding developing economies such as Kenya, where business environments and regulatory contexts differ. Moreover, Lukic did not examine publicly listed companies, limiting the relevance of findings to entities like those listed at the Nairobi Securities Exchange (NSE). The study also narrowed its scope to energy efficiency, neglecting broader green initiatives such as waste reduction, renewable energy use, and sustainability reporting, which could influence profitability in different ways. Furthermore, it failed to examine mediating factors, such as firm size, governance, and industry regulation, that shape how environmental practices translate into financial performance. These limitations highlight the need to assess the impact of green initiatives on the profitability of companies listed on the NSE, providing local, sector-specific evidence on how environmental sustainability affects corporate profitability in emerging markets. On the contrary, Milewska and Milewski (2023) investigated production companies in Poland during the energy crisis to assess how energy

consumption costs affect profitability. The objective is to determine the extent to which rising energy costs influence profit margins among large manufacturing firms. The variables included total energy cost, profit before tax, and production volume. A quantitative research design was used, targeting 150 large manufacturing firms through stratified random sampling, and the data were analysed using a panel regression model. The results showed a negative correlation between increasing energy costs and profit margins, especially in energy-intensive industries such as metal processing and chemicals. Firms that had invested in renewable energy sources or modernised production systems recorded slower declines in profitability. Larger and more diversified firms were also better positioned to absorb cost shocks. This study concluded that transitioning to energy-efficient operations is critical for maintaining profitability. However, the findings present notable gaps. Both focused on developed economies, overlooking the dynamics of emerging markets such as Kenya, where the regulatory and infrastructural context differs significantly. Additionally, it did not consider listed companies or service-oriented firms that play a key role in Nairobi's economy. The study also failed to address other green initiatives beyond energy efficiency, such as sustainable supply chains, waste management, or environmental disclosure practices. These limitations create a need for studies examining the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange (NSE) to understand how environmentally responsible practices influence financial performance in developing economies.

Li et al. (2023) examined firms in China's industrial sector to discover the relationship between green finance, energy efficiency, and green total factor productivity. The study aimed to determine whether access to green credit enhances firm productivity through improved energy efficiency. The variables included green credit access, energy consumption, and firm productivity levels. The research used a quantitative design with random sampling targeting over 300 industrial

companies, and was analysed using the Stochastic Frontier Analysis (SFA) model. The findings showed that green financing significantly boosts energy efficiency, thereby enhancing firm productivity and competitiveness. Companies with greater access to green credit adopted energy-saving technologies faster, reduced operational costs, and improved compliance with environmental regulations. The authors concluded that supportive policy frameworks for green lending are essential for improving firm resilience and sustainability. However, despite these insights, the study presents key gaps. It was based in a highly regulated Chinese context, which differs from Kenya's less formalised regulatory environment. The research did not explore how green financing and other sustainability initiatives affect profitability in listed firms, particularly in developing economies with varying access to green credit. Moreover, the study emphasised industrial production sectors, neglecting the service-oriented and diversified corporate structures found in Nairobi's listed firms. Therefore, there is a need for further research to assess the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange, providing localised evidence on how sustainability efforts shape firm performance within Kenya's unique economic and institutional context.

Afolabi et al. (2025) examined the impact of energy efficiency on firm productivity among small and medium enterprises (SMEs) in Nigeria's services and manufacturing sectors. The objective was to assess how the adoption of green technologies influences productivity outcomes. The study analysed variables such as electricity consumption intensity, firm productivity, and green technology adoption. Using a systematic sampling technique, data were collected from a target population of 500 SMEs and analysed using a multiple regression model. The findings showed a strong positive relationship between energy-efficient practices and firm productivity, mainly where solar power and LED lighting were used. Firms that consistently invested in

renewable energy technologies reported reduced operational costs, improved product quality, and higher employee productivity. Furthermore, SMEs that adopted multiple green technologies simultaneously experienced cumulative gains compared to those with partial adoption. The study concluded that government incentives and awareness programs play a crucial role in promoting broader adoption of sustainable energy solutions. However, the research presents key gaps. It focused on general SMEs rather than publicly listed firms, thereby excluding larger, more structured corporations that operate under regulatory and investor scrutiny, such as those at the Nairobi Securities Exchange (NSE). Moreover, while it explored energy efficiency, it did not evaluate other green initiatives, such as environmental reporting, waste management, or carbon-reduction practices that are becoming increasingly relevant to corporate profitability. The contextual differences between Nigeria's SME-based economy and Kenya's mixed market structure also highlight a gap in understanding how formally listed firms integrate green initiatives into profitability strategies. Therefore, there is a need for a study assessing the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange, addressing both firm-level environmental practices and financial outcomes within Kenya's institutional and market environment.

Similarly, Owusu et al. (2022) investigated electricity access and profitability among micro and small enterprises (MSEs) in Ghana, which intended to determine how electricity supply reliability affects firm performance. The study analysed variables such as electricity reliability, hours of service, and profit margins. It employed a survey of 420 MSEs selected by simple random sampling and used Ordinary Least Squares (OLS) regression for analysis. Findings showed that firms with consistent and reliable electricity access reported better financial performance. Companies experiencing fewer power outages and longer service hours achieved higher sales

volumes, reduced maintenance costs, and improved customer retention. Additionally, businesses located in regions with upgraded electricity infrastructure recorded higher monthly profits compared to those in poorly serviced areas. The study concluded that reliable and affordable energy access significantly improves business profitability and sustainability. However, the study presents important research gaps. It focused solely on electricity reliability and did not address the entire green initiatives, such as renewable energy adoption, sustainable production, or environmental management, which are now key determinants of firm profitability. Moreover, the study was limited to informal and small-scale businesses, thus limiting its findings to the structured, listed firms at the NSE. Both researchers omitted green innovation and policy compliance dimensions, leaving an incomplete understanding of how environmentally responsible practices impact firm performance. Consequently, there is a clear need for research that assesses the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange, focusing on how sustainability-driven strategies influence corporate profitability in Kenya's evolving green economy.

Macharia et al. (2022) examined how energy efficiency affects firm productivity in Kenya's manufacturing sector; however, they did not identify the impact of other green initiatives, such as solar lighting. The study aimed to determine whether adopting energy-saving technologies enhances productivity and cost efficiency. It analysed variables such as energy cost per unit, production output, and energy-saving measures. The research targeted 200 manufacturing firms selected through cluster sampling, and data were analysed using a linear regression model. Findings revealed a significant positive relationship between energy efficiency and productivity. Firms that implemented modern, energy-saving equipment experienced reduced production costs, increased output, and shorter production cycles. The study also found that organizations with

structured energy management policies sustained long-term productivity growth and competitiveness compared to those making ad hoc investments. Additionally, energy-efficient practices were associated with improved workplace conditions, reducing machine downtime while enhancing employee performance. The study concluded that adopting energy-efficient technologies improves both cost control and competitiveness, and recommended targeted government incentives to help SMEs access such technologies. However, this research presents several gaps. While it is based in Kenya and thus contextually relevant, it focused exclusively on formal manufacturing firms, overlooking other sectors such as finance, real estate, and services that dominate the Nairobi Securities Exchange (NSE). The study also limited its analysis to energy efficiency, without exploring other green initiatives like environmental reporting, green financing, waste management, or carbon-reduction efforts that increasingly influence corporate profitability. Furthermore, it did not link green practices directly to firm financial performance metrics such as return on assets or profitability ratios. These limitations highlight the need to focus the study on assessing the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange and on understanding how corporate sustainability practices influence financial outcomes in Kenya's capital markets.

Baraille and Jaglin (2022) conducted a qualitative study on the solar repair trade in Nairobi, exploring informal energy economies and their role in promoting sustainability. The study aimed to understand how informal green enterprises contribute to urban energy access and economic livelihoods. Using ethnographic methods, they studied approximately 50 solar repair technicians and small solar businesses selected through snowball sampling. The study found that while the solar repair sector supports sustainable development by providing affordable energy solutions to low-income households, it operates largely informally with minimal policy or institutional support.

The findings revealed that these enterprises face persistent challenges, including unreliable supply chains, counterfeit products, and limited access to credit. The study also observed that most technicians depend on informal peer-to-peer knowledge transfer rather than structured technical training, which constrains service quality and business growth. Despite these limitations, the solar trade was found to create employment and drive grassroots participation in Nairobi's green transition. The authors concluded that Kenya's green economy policies should integrate informal actors into national strategies to enhance inclusivity and resilience. However, this study also presents critical gaps. It relied entirely on qualitative data, without quantifying the impact of such green activities on enterprise profitability. Moreover, it centred on informal micro-enterprises rather than formal, listed firms that operate within structured financial and environmental disclosure frameworks. The absence of profitability measures and the lack of connection between green initiatives and firm-level financial outcomes leave a significant gap in understanding how sustainability contributes to corporate performance. Therefore, there is a pressing need for research examining the effects of green initiatives on the profitability of companies listed on the Nairobi Securities Exchange to bridge the knowledge gap between green economic participation and measurable financial performance in Kenya's formal corporate sector.

2.3.2 Solar Lighting and Profitability of Companies

Kwon et al. (2021) examined the solar signage industry in South Korea, focusing on how green technologies can be integrated into viable business models using the EPSS (Environmental, Policy, Social, and Stakeholder) framework. The objective of the study was to assess how solar-integrated public infrastructure could generate sustainable revenue while advancing environmental goals. The study analysed variables such as cost structure, revenue models, energy output, and policy alignment. Rather than collecting field data, the researchers adopted a conceptual modelling

methodology, using hypothetical simulations informed by environmental and business data to test different solar signage business models. The findings revealed that embedding solar panels into public signage can create profitable ventures if supported by public-private partnerships. The simulations further demonstrated that revenue could be diversified through advertising income, government subsidies, and carbon credit trading, while operational costs could be lowered through bulk procurement and tax incentives guided by policy. The results also highlighted that projects with strong stakeholder collaboration including local governments, energy companies, and advertisers—had greater sustainability and financial potential. The study concluded that environmental awareness, policy alignment, and stakeholder engagement are critical success factors for such initiatives. However, despite offering a valuable conceptual framework, the research presents key gaps. It relied entirely on simulated data, lacking empirical validation through real-world business cases or profitability assessments. The context was limited to South Korea, a developed and highly regulated economy, making its findings difficult to generalize to developing urban centers like Nairobi. Moreover, the study did not explore how green innovations such as solar integration translate into measurable financial outcomes such as return on investment or profitability ratios within corporate entities. This leaves a crucial knowledge gap on the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange, where real business data, diverse sectoral dynamics, and emerging environmental regulations could offer more practical insights into how green technologies influence corporate financial performance in Kenya's context.

Kalkal and Teja (2022) developed a sustainable energy framework using solar and bio-energy systems to ensure a continuous power supply for small businesses in rural India. The study analysed variables including energy usage patterns, power production costs, scheduling efficiency,

and economic viability. Using optimisation models and smart metering simulations, the researchers examined 50 microgrids across rural regions selected through convenience sampling. Linear programming was applied to determine the most efficient energy scheduling methods. The results showed that optimised energy schedules significantly reduced power wastage, improved cost-efficiency, and enhanced the sustainability of small enterprises. Specifically, small businesses using optimised hybrid systems experienced reduced operational expenses, extended working hours, and higher profitability due to a reliable energy supply. The study further found that combining solar and bioenergy sources produced greater stability than stand-alone solar systems, especially during periods of low sunlight. The authors concluded that decentralised hybrid energy systems could promote business growth and profitability in rural, energy-deficient settings. However, the study's model was confined to rural environments, which differ significantly from urban contexts such as Nairobi in terms of infrastructure, regulation, and firm scale. Moreover, while it linked energy optimisation to profitability for small rural firms, it did not evaluate the financial implications of green initiatives in large, listed companies. The lack of empirical assessment on how corporate adoption of renewable energy affects profitability creates a gap that justifies examining the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange, where business environments are more formalised, competitive, and capital-intensive.

Akeju (2021) investigated profitability strategies among solar energy businesses in Lagos, Nigeria, using a qualitative case study. The study explored variables such as pricing models, client acquisition strategies, financing mechanisms, and after-sales services. Using purposeful sampling, 20 solar entrepreneurs were interviewed, and data was analyzed through thematic coding. Findings indicated that profitability in solar ventures was driven by customer trust, flexible payment

systems, and strong technical capacity. Firms that provided instalment-based financing reported higher sales and improved customer loyalty, while those with efficient technical teams had fewer system failures and enhanced client satisfaction. Additionally, entrepreneurs who conducted educational campaigns in local communities achieved higher adoption rates and greater profitability. The study concluded that sound business practices and financial flexibility are essential for profitability in solar enterprises. However, the study's limitations were notable; it relied on qualitative insights without quantitative measures of profitability and focused solely on solar providers rather than the firms adopting green energy solutions. It did not address how integrating solar or other green initiatives influences the financial performance of established corporate entities. Therefore, there remains a clear gap in understanding the causal link between green initiative adoption and firm profitability within formal markets such as the Nairobi Securities Exchange, where firms face different financial structures, investment capacities, and regulatory incentives compared to informal or SME contexts

Ihirwe et al. (2024) assessed technology management in Rwanda's solar energy sector, focusing on optimisation and its economic impact. Key variables included technology adoption rates, system efficiency, and enterprise performance. The researchers employed mixed-methods, targeting 73 energy managers and solar entrepreneurs through stratified random sampling, and used regression analysis and qualitative interviews. The study found that proper management of solar technologies led to reduced operational costs and improved service reliability, especially for SMEs. In addition, findings revealed that enterprises with structured maintenance schedules and staff trained in solar technology management achieved longer system lifespans and fewer breakdowns, which lowered replacement costs and improved financial stability. The study also highlighted that SMEs integrating digital monitoring tools for solar systems performed better in

terms of energy savings and service continuity. Conclusions emphasized that solar adoption is more beneficial when combined with capacity-building and technical training. Although useful, the study did not assess the profitability of solar-powered companies directly, especially in informal setups like Nairobi's SMEs, highlighting a contextual and methodological gap.

Lyakurwa (2022) investigated solar energy adoption among MSMEs in Tanzania's manufacturing sector, focusing on energy cost reduction, production uptime, and profitability margins. A sample of 84 MSMEs was selected using snowball sampling, and data was analyzed through descriptive statistics and correlation models. The findings showed that firms adopting solar energy enjoyed reduced utility expenses and fewer production disruptions, which improved profitability. Businesses with reliable solar access recorded higher turnover growth and more substantial competitiveness during high-demand seasons. Additionally, companies that used solar systems with small-scale energy storage realised even greater cost savings than those using stand-alone solar setups. The study concluded that solar adoption offers both cost and productivity advantages and recommended supportive government financing programs. However, this study's scope was limited to manufacturing MSMEs in Tanzania, leaving out the service and financial sectors that dominate Nairobi's urban economy. Moreover, it did not explore how green energy adoption affects the profitability of publicly listed firms, which face different financial structures, reporting requirements, and shareholder pressures. This creates a sectoral, geographic, and institutional gap that justifies the current study on the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange.

Opiyo (2023) analysed how business-level strategies influence performance in Kenya's solar industry, using cost leadership, differentiation, and strategic partnerships as key variables.

The study sampled 102 solar firms through systematic random sampling, applying structural equation modelling (SEM) for data analysis. Findings showed that firms combining differentiation with strategic partnerships achieved higher profitability and stronger market positions. For instance, companies that bundled installation and maintenance services with financial collaborations from banks and NGOs reported increased customer loyalty and market penetration. Meanwhile, cost leadership worked well for expanding access among low-income clients but was less sustainable for long-term profits. The study concluded that solar firms benefit most from combining innovation with partnerships. Nonetheless, this research focused exclusively on the supply side of the solar industry, without addressing how the adoption of green energy solutions affects the profitability of other sectors, particularly companies that consume rather than produce green technologies. Furthermore, the study did not account for corporate-scale dynamics such as investor expectations, regulatory incentives, or the impact of ESG (Environmental, Social, and Governance) reporting. This omission highlights a contextual and analytical gap that underscores the need for empirical research on the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange.

Kiboi (2022) conducted a case study on the effectiveness of vertically mounted solar panels at Radisson Blu Hotel in Nairobi, examining variables such as panel orientation, power output, and cost savings. The study used an experimental and observational design centred on one commercial building. Results showed that vertical mounting optimised limited roof space, generated sufficient energy for lighting and HVAC systems, and led to significant operational cost savings. The findings also demonstrated improved building aesthetics and reduced shading, making the approach practical for dense city environments. Moreover, the system minimised

reliance on diesel generators, cutting the hotel's carbon emissions and operational risks during power outages. The study concluded that solar retrofitting is feasible in urban contexts. However, the research was site-specific, focusing on a single high-end hotel, which limits generalisation to other companies of different sizes and industries. It also did not quantify how energy savings translate into profitability metrics like return on investment or earnings growth. These limitations reveal a gap in understanding the broader financial impact of solar and other green initiatives across firms listed on the Nairobi Securities Exchange, emphasising the need for a comprehensive study linking sustainability practices to profitability outcomes in Kenya's corporate sector.

Baraille and Jaglin (2022) investigated the solar repair trade in Nairobi, targeting technicians and micro-businesses in informal settlements. Using qualitative interviews with 60 participants via snowball sampling, the study analysed variables such as solar device maintenance, affordability, and energy access stability. Thematic content analysis showed that accessible solar repair services reduced downtime and energy costs for small businesses. In addition, findings indicated that affordable repair networks helped extend the lifespan of solar products, preventing premature disposal and lowering replacement expenses for micro-entrepreneurs. The study also noted that technicians in informal settlements filled critical service gaps left by formal firms, thereby enabling wider adoption of solar technologies in underserved markets. The conclusions emphasised that informal repair ecosystems play a hidden yet vital role in sustaining green energy adoption. The authors recommended integrating repair technicians into energy planning. However, the study did not directly quantify the effect of such access on business profitability, signalling a gap in linking repair ecosystems to enterprise-level financial outcomes.

2.3.3 Water Recycling and Profitability of Companies

Karim et al. (2022) examined the public water utility sector in Makassar City, Indonesia, focusing on developing a business plan for sustainable economic performance. The study assessed operational efficiency, customer satisfaction, and financial sustainability as core variables. Using a qualitative case study approach, data were collected from one regional public water company through purposive sampling and analysed using SWOT and financial ratio analysis. Findings showed that structured planning, pricing reforms, and infrastructure investment significantly improved financial results. Specifically, the study demonstrated that cost-reflective tariffs reduced financial deficits while improving service reliability, and infrastructure upgrades reduced water losses, boosting revenue collection. Improved customer satisfaction also contributed to the company's financial stability. Moreover, incorporating environmental practices like leakage reduction and wastewater management provided indirect financial gains by reducing operational risks. The study concluded that aligning operational efficiency with environmental goals enhances long-term sustainability. However, while the research effectively linked environmental management with financial performance in a public utility context, it failed to examine private-sector firms or quantify the extent to which such green strategies influence profitability at the enterprise level. Additionally, it overlooked the dynamics of listed companies, which operate under investor-driven profitability metrics. This creates a contextual and institutional gap, underscoring the need to explore the effects of green initiatives on the profitability of companies listed on the Nairobi Securities Exchange.

Zhuang et al. (2022) investigated industrial water use systems across China's major river basins, focusing on recycling efficiency and sustainability. The study analysed recycling ratios, water input-output metrics, and energy use, using panel data from over 100 basins and employing

factor analysis and data envelopment analysis (DEA). Findings revealed wide disparities in water recycling efficiency influenced by governance quality, technological investments, and industrial structure. Basins with higher adoption of advanced recycling technologies recorded lower water and energy consumption, resulting in lower operational costs. The results also showed that regions with stronger governance frameworks achieved higher efficiency levels and lower waste output. Furthermore, scaling up basin-level programs significantly improved overall resource management and cost-effectiveness. The study concluded that basin-targeted efficiency strategies are vital for industrial sustainability and operational savings. However, the research is macro-level, mainly focusing on large-scale industrial systems and overlooking firm-level profitability outcomes, especially in the private business context. It also failed to connect water efficiency improvements to financial performance indicators such as profitability, return on assets, or shareholder value. This leaves a clear empirical and contextual gap regarding how green water management initiatives influence firm profitability, particularly among companies listed on the Nairobi Securities Exchange, where water efficiency and environmental accountability are increasingly tied to sustainable profit growth.

Onuh and Bassey (2021) explored water resource management in Nigeria, drawing comparative lessons from Israel's water management systems. The study examined policy frameworks, reuse technologies, and investment levels as its key variables. Using a comparative policy analysis approach with secondary data and policy documents, the researchers highlighted how Israel achieved superior water outcomes through robust legislation, technological innovation, and decentralised management, while Nigeria's weak enforcement and underinvestment resulted in persistent shortages and inefficiencies. The study emphasised that Israel's success stemmed from long-term planning and massive investment in desalination and wastewater reuse, which

enhanced national water security. The authors concluded that effective governance and regulatory enforcement are critical to achieving sustainability in resource management. However, the study was policy-oriented and did not extend its analysis to business-level effects, particularly how efficient water management translates to enterprise profitability. It also failed to connect green water initiatives—such as reuse technologies or conservation measures—to financial outcomes in the private sector, especially within listed companies. This omission reveals a gap in how green water management initiatives affect profitability among companies listed at the Nairobi Securities Exchange, where environmental accountability is increasingly tied to investor confidence and long-term value creation.

Mwitirehe et al. (2024) examined drinking water supply systems in Rwanda, focusing on access, quality, and reliability using panel data analysis. The variables included coverage ratios, service continuity, and cost per unit. Data were collected from 24 districts using random sampling and analysed using fixed- and random-effects models. The study found that districts with better infrastructure management achieved higher service coverage and lower unit costs. It also revealed that service continuity directly enhanced customer satisfaction, while maintenance inefficiencies increased operational costs and disruptions. Moreover, decentralisation of water management improved responsiveness and efficiency across districts. The authors concluded that sustained infrastructure investment and performance-based management systems were essential for reliable and affordable water service delivery. While this study offered valuable insights into the operational efficiency of public utilities, it failed to examine how water reliability influences firm productivity or profitability, particularly for urban enterprises that depend on a stable water supply. Additionally, the research did not address corporate-level green water initiatives or their contribution to financial performance, leaving a gap in the link between sustainable water

management practices and the profitability of companies listed at the Nairobi Securities Exchange, where such initiatives could materially affect cost structures and returns.

Abdirahim (2024) analysed innovation strategies in water service companies in Mombasa County, Kenya, and their influence on organisational performance. The key variables were technology adoption, customer feedback systems, and smart metering. The study involved 72 staff members selected through stratified sampling and analysed data using regression analysis. The results showed that innovation significantly improved operational efficiency and customer satisfaction, thereby strengthening financial performance. Specifically, smart metering minimised revenue losses from illegal connections, while digital billing platforms enhanced revenue collection and reduced disputes. Additionally, customer feedback systems improved service responsiveness and retention. The study concluded that technological innovation is a viable pathway to operational sustainability and profitability in the water sector. However, its focus on the utility sector limits its applicability to private enterprises, and it did not investigate how such innovations affect the profitability of businesses that depend on improved service delivery, such as those in Nairobi's commercial sectors. The absence of analysis of green water innovations and their profitability implications for listed companies exposes a crucial gap that justifies further research into the effects of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange.

Gichuki (2023) examined the relationship between water-sector reforms and the financial performance of water and sewerage companies in Nyeri County, Kenya. Variables studied were reform implementation status, revenue collection efficiency, and cost recovery rates. The study used a sample of 8 water companies and applied descriptive statistics and correlation analysis. Findings showed a strong correlation between well-executed reforms and improved financial

performance. More specifically, commercialisation enhanced operational discipline, tariff adjustments improved cost recovery, and investment in customer relationship management systems increased bill payment compliance. The analysis also revealed that companies implementing reforms had greater resilience to financial shocks compared to non-reforming companies. The study concluded that reforms, such as commercialisation and tariff reviews, positively influence sustainability. However, the research was confined to public utilities. It did not examine how these reforms affect profitability in the private sector, especially those listed at the Nairobi Securities Exchange (NSE) that integrate green initiatives into their operations. This creates a gap in understanding the broader financial implications of environmental and operational reforms across sectors, particularly for listed companies that face investor and regulatory pressure to adopt sustainable practices.

Obiero (2022) focused on sustainable energy and water use in horticultural processing among micro, small, and medium enterprises (MSMEs) in Kenya. The study used mixed methods and targeted 120 MSMEs across three counties, selected via cluster sampling. Variables included the cost of water and energy, production output, and environmental compliance. Regression models showed that firms that integrated green practices such as water recycling and solar energy had lower utility costs and higher profit margins. The findings further indicated that companies adopting solar energy reduced electricity costs, enabling reinvestment in production capacity. Water recycling practices improved operational resilience during dry seasons, lowering downtime and increasing output stability. Additionally, firms that complied with environmental standards reported improved market access, particularly in export-oriented horticultural value chains, since compliance boosted brand reputation and customer trust. The conclusion was that resource efficiency directly improves MSME profitability. While this study provides valuable evidence

linking green initiatives to profitability, it focuses on small agricultural firms rather than large, listed companies operating in Nairobi's industrial and service sectors. The gap lies in the lack of empirical evidence on how corporate-level green initiatives, such as energy efficiency investments, waste management, and carbon reduction, affect the profitability of NSE-listed firms operating under different economic, financial, and governance conditions.

2.3.4 Sustainable Packaging and Profitability of Companies

Majid et al. (2023) examined eco-efficiency and sustainable innovation in European SMEs, focusing on how recycling energy and environmental strategies impact business performance. The variables included eco-efficiency scores, energy recovery practices, innovation levels, and profitability metrics. The study used a quantitative survey method involving 325 SMEs across several European countries, selected via stratified random sampling. The analysis employed structural equation modelling (SEM). Results showed that businesses adopting green energy recovery and innovative waste recycling improved both their environmental footprint and financial performance. The findings further revealed that SMEs with higher eco-efficiency scores reduced operational costs, optimised resource use, and enhanced product differentiation in competitive markets. Firms that invested in continuous eco-innovation also reported faster adaptation to changing regulatory standards and stronger partnerships with environmentally conscious suppliers. In addition, sustainable strategies were positively correlated with employee engagement and customer loyalty, amplifying both productivity and sales growth. The authors concluded that eco-innovation is key to competitiveness in sustainability-driven markets. However, this study was limited to European SMEs operating in developed economies with strong regulatory and technological support. It did not examine how eco-efficiency or green innovation influences profitability in emerging markets such as Kenya, where environmental regulations, infrastructure,

and investor priorities differ significantly. This reveals a contextual and sectoral gap in how green initiatives affect firm-level profitability, particularly for publicly listed companies at the Nairobi Securities Exchange (NSE), which face unique financial reporting and sustainability disclosure requirements.

Friedrich (2021) conducted an empirical market study in Germany's apparel industry to compare sustainability measures and their effects on consumers and the market. The variables examined were consumer perceptions, sustainable production practices, and market positioning. A sample of 500 consumers and 20 apparel companies was randomly selected, and the data were analysed using multivariate regression. Findings showed that companies implementing clear and traceable sustainability measures gained stronger brand loyalty and profit margins. The results also highlighted that transparent reporting of supply chains and certifications significantly influenced consumer purchase decisions, with firms practising visible sustainability recording higher repeat purchases and positive word-of-mouth marketing. Additionally, sustainable production was associated with lower reputational risks, enabling companies to secure long-term contracts with major retailers. The analysis further indicated that firms that align sustainability with product quality enjoyed a dual advantage of ethical branding and operational efficiency. The study concluded that market-driven sustainability can be financially rewarding when matched with transparency. However, the focus was primarily on consumer responses to sustainability, not on the internal financial outcomes of green operational strategies. It also centred on privately owned apparel firms in Europe, leaving a gap in understanding how green initiatives directly affect profitability in publicly listed firms operating in developing economies like Kenya. Thus, there remains a lack of empirical evidence linking sustainability-driven production strategies to

profitability performance among NSE-listed companies that operate under different consumer behaviour, policy frameworks, and economic pressures.

Khalid (2021) focused on green process innovation in small packaging companies in the UK and its relationship with long-term business sustainability. The study evaluated variables such as process innovation levels, waste reduction, energy efficiency, and financial performance. Using a survey of 68 packaging firms, selected through purposive sampling, the study applied correlation and regression models. Results revealed that firms adopting green process innovations experienced reduced costs and enhanced market competitiveness. The findings also showed that energy-efficient technologies, such as low-consumption machinery and smart production scheduling, significantly improved productivity while cutting down utility bills. Firms that invested in waste minimisation strategies also reported greater compliance with environmental regulations and improved brand reputation, which in turn attracted eco-conscious customers. Moreover, the analysis revealed that companies actively innovating in green processes gained greater bargaining power with suppliers and positioned themselves better for securing long-term contracts. The study concluded that green innovation directly contributes to profitability through both savings and improved customer appeal. However, this study focused on small packaging companies in developed economies with stable green financing systems. It did not examine how such innovations perform in developing markets such as Kenya, where firms face constraints on capital, infrastructure, and policy. This presents a contextual and practical gap regarding the feasibility and profitability of green process innovations among companies listed at the Nairobi Securities Exchange (NSE), that operate under different financial and environmental conditions.

Palsson and Sandberg (2022) conducted a comparative study of sustainable packaging across food supply chains in South Africa and Sweden, identifying adoption barriers. The key variables were the cost of green packaging, supplier collaboration, regulatory compliance, and firm performance. The researchers used a case study approach involving 15 food companies (8 in South Africa, 7 in Sweden) and used interviews and qualitative coding for analysis. The findings showed that Swedish firms benefited more from supportive regulations and eco-conscious consumers, while South African firms struggled with high costs and supply chain gaps. Additional findings indicated that Swedish companies reported measurable reductions in packaging costs over the long term due to economies of scale and improved supply chain efficiency, while South African firms experienced short-term financial strain when switching to greener alternatives. Supplier collaboration emerged as a key enabler in both contexts, with companies that worked closely with packaging innovators demonstrating higher adoption success. Regulatory frameworks also played a significant role, as Swedish companies aligned sustainability strategies with government incentives, while South African firms cited inconsistent enforcement as a barrier. The authors concluded that successful adoption depends on context-specific enablers. However, this study did not quantify profitability or examine publicly traded firms, making it difficult to generalise the financial implications of sustainable packaging initiatives. Moreover, the exclusion of Nairobi-based companies leaves a regional and empirical gap in understanding how green packaging adoption influences profitability among listed firms at the NSE, especially those in the manufacturing and food sectors operating under unique economic and policy conditions.

Muzamwese et al. (2024) explored enterprise development through networks in Zimbabwe's beverage sector, focusing on the PETRECOZIM initiative, a plastic recycling network. Variables included network collaboration, resource recovery, and enterprise growth. A

qualitative case study method was applied, analysing data from 12 networked SMEs, selected through snowball sampling. Using thematic analysis, the study found that collaboration in green networks improved access to inputs, reduced waste disposal costs, and enhanced market access. The findings also revealed that SMEs within the PETRECOZIM network enjoyed reduced dependency on virgin plastic, thereby lowering production costs and achieving higher levels of resource security. Participation in the recycling network also boosted visibility and brand image, making these enterprises more attractive to sustainability-focused consumers and retailers. Moreover, the shared knowledge and technical support within the network facilitated process improvements and innovation among participating firms. The analysis highlighted that collective action strengthened bargaining power, giving SMEs leverage when negotiating with larger players in the beverage supply chain. The authors concluded that circular economy models can support SME profitability. However, the study was limited to small firms within a single industry and did not include quantitative profitability analysis or examine listed corporations. This creates a methodological and contextual gap, as it remains unclear how participation in green networks or circular-economy initiatives translates into measurable profitability outcomes for large or listed companies in Nairobi's industrial landscape, such as those on the NSE.

Nyoro (2023) focused on sustainable marketing practices and brand performance among food processing companies in Nairobi, Kenya. Variables included eco-branding, green advertising, and perceived sustainability, measured against brand equity and financial growth. The study surveyed 64 companies, selected through census sampling, and used multiple linear regression for analysis. Results showed that firms practising sustainable marketing recorded stronger customer loyalty and modest improvements in profitability. Additional findings revealed that eco-branded firms experienced higher brand recognition and reported improved trust among environmentally

conscious customers. Green advertising strategies were associated with better consumer recall and positive attitudes toward the brand, while perceived sustainability was strongly linked to long-term brand equity. The study also found that companies combining eco-branding with transparent reporting practices experienced higher market share than those relying on messaging. The study concluded that sustainability messaging contributes to business growth but must be backed by authentic practices. Although conducted in Nairobi, the study emphasised branding and consumer perception rather than actual green operational practices, leaving a gap in analysing how core sustainability measures (e.g., energy or waste efficiency) affect bottom-line profitability.

Thiga (2025) examined green packaging and its influence on performance in Kenya's food and beverage manufacturing sector. Variables included packaging material type, supply chain efficiency, and profit margins. The study surveyed 89 firms using systematic sampling and analysed the data using regression models. Findings revealed that firms adopting recyclable, biodegradable packaging experienced lower logistics costs and increased consumer demand. Further analysis indicated that biodegradable packaging improved supply chain efficiency by reducing bulk weight and lowering transport costs, while recyclable materials enhanced compliance with environmental regulations, reducing risks of penalties and delays. Companies that aligned their packaging practices with consumer expectations for sustainability also reported increased repeat purchases and stronger relationships with retailers. The findings additionally highlighted that early adopters of green packaging saw longer-term financial benefits through brand differentiation and cost optimisation across distribution networks. The study concluded that sustainable packaging has both environmental and financial benefits. It recommended government incentives for green packaging adoption. However, while focused on Kenya, the study lacked

granularity regarding Nairobi-based companies, especially small- and mid-sized firms that may face cost barriers to adopting such packaging.

Mumbi et al. (2021) explored the role of green packaging and green distribution in building competitive advantage in Kenya's horticultural sector. Variables included packaging material sustainability, distribution efficiency, and market performance. The study used a sample of 102 horticultural firms, selected through stratified sampling, and applied correlation and regression analysis. The findings showed that green initiatives contributed to export competitiveness and operational savings. More specifically, firms using sustainable packaging materials reported longer product shelf life, reduced post-harvest losses, and compliance with stringent international market requirements. Green distribution strategies, such as energy-efficient cold chain logistics, were linked to reduced transport costs and improved reliability in reaching export markets. The study also highlighted that firms adopting both packaging and distribution initiatives gained access to premium international markets, which boosted profitability and global competitiveness. The authors concluded that investment in green logistics can improve profitability and brand position. However, despite its contribution to understanding the benefits of green initiatives, this study was limited to export-oriented horticultural firms and did not assess how similar practices influence profitability among listed companies operating across diverse sectors, such as manufacturing, energy, or services, at the Nairobi Securities Exchange. This reveals both a contextual and sectoral gap, as the dynamics of green initiatives in non-export, urban corporate environments remain underexplored, underscoring the need to examine their effects on the profitability of companies listed on the NSE.

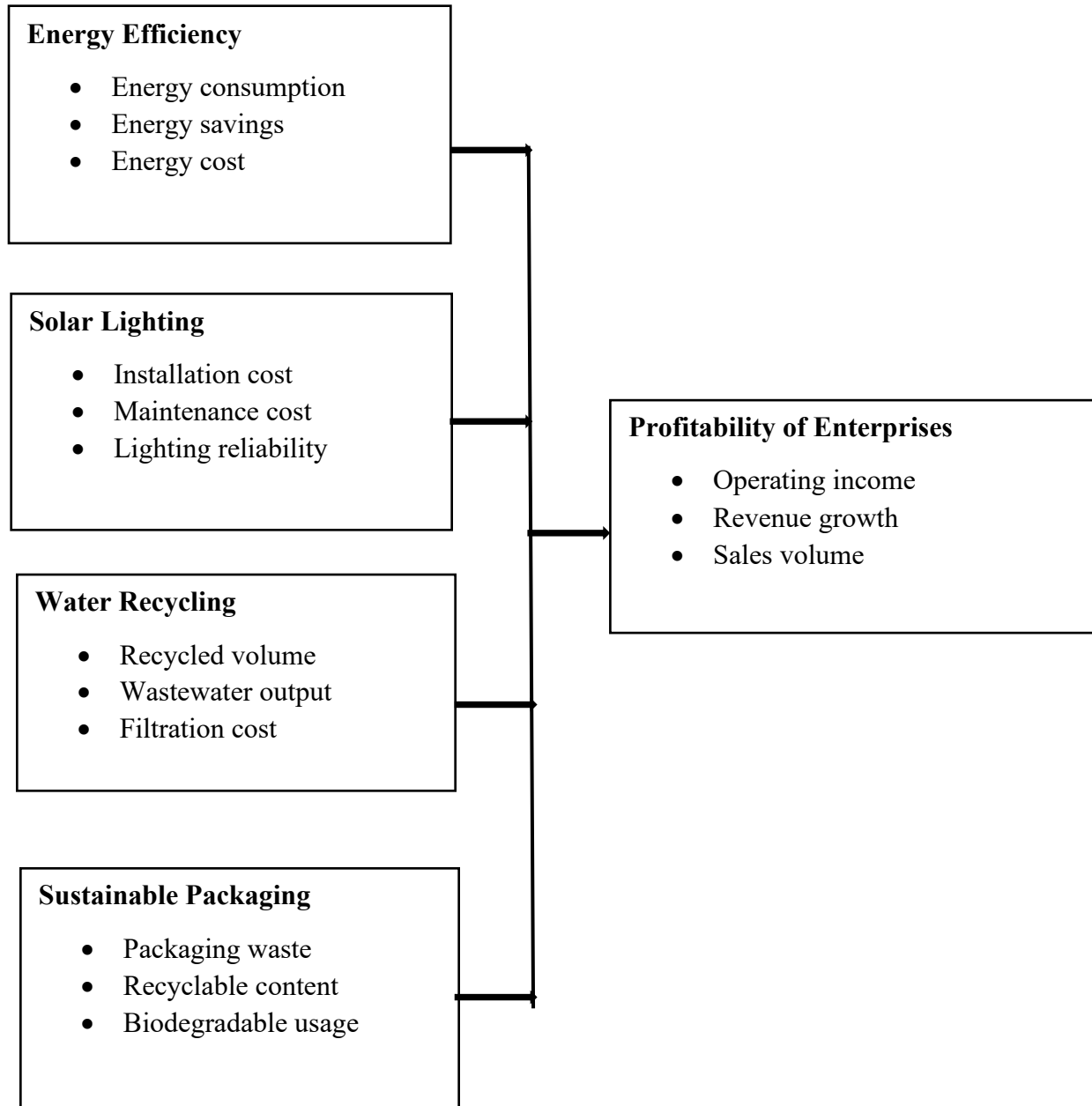
2.4 Conceptual Framework

Independent variables

Dependent variable

The conceptual framework links green initiatives such as energy efficiency, solar lighting, water recycling, and sustainable packaging to the profitability of companies listed on the Nairobi Securities Exchange in Kenya.

Figure 1: Conceptual Framework



2.5 Operationalisation of Variables

Table 1: Operationalization of Variables

Type of Variable	Variable	Variable indicator	Type of Analysis
Independent Variables	Energy Efficiency	• Energy consumption • Energy savings • Energy cost	Descriptive/ Statistics
	Solar Lighting	• Installation cost • Maintenance cost • Lighting reliability	Descriptive Statistics
	Water Recycling	• Recycled volume • Wastewater output • Filtration cost	Descriptive Statistics
	Sustainable Packaging	• Packaging waste • Recyclable content • Biodegradable usage	Descriptive Statistics
Dependent Variable	Profitability of Companies	• Operating income • Revenue growth • Profit margin	Descriptive statistics

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlined the key components of the study's methodology, including the research design, the population under investigation, the sampling strategy and sample size, methods of data collection, procedures for data analysis, and ethical guidelines that will be followed throughout the research process.

3.2 Research Design

This study adopted a descriptive research design using a quantitative approach to examine the effects of green initiatives on the profitability of companies in Nairobi, Kenya. A descriptive research design was justified because it enables researchers to present an accurate picture of existing conditions and relationships without manipulating variables, making it suitable for analysing how green initiatives relate to firm profitability (Saharan et al., 2024). This design was ideal for capturing factual information on practices such as energy efficiency, waste reduction, and sustainable resource management, and linking them to financial indicators, for instance, return on assets, net profit margins, and earnings per share. The quantitative approach was also justified, as it allows the systematic collection and analysis of numerical data, ensuring objectivity and precision. It enabled statistical testing of relationships and hypotheses using measurable indicators, thereby providing empirical evidence on how green initiatives affect financial performance. According to Susilawati et al. (2025), quantitative research is appropriate for explaining relationships between variables using numerical data, which aligns with the objective of this study to determine how green initiatives influence profitability among companies in Nairobi.

3.3 Population

A target population refers to the full group a researcher aims to study and draw conclusions about (Mishra & Alok, 2022). This study targeted all companies listed on the Nairobi Securities Exchange, selected due to their publicly available audited financial reports and environmental disclosures, which supported the study's quantitative approach. According to the Nairobi Securities Exchange database (2025), there were 62 companies listed on the Nairobi Securities Exchange, as shown in Appendix II. From each company, one staff member was selected to ensure a balanced and informed perspective on both profitability and green initiatives. This gave a total target population of 62 respondents (Nairobi Securities Exchange database, 2025, <https://www.nse.co.ke/listed-companies/>)

3.4 Sample and Sampling Technique

3.4.2 Sampling Procedure

A sampling procedure is the method used to identify and select individuals from a population for a study (Mishra & Alok, 2022). This study adopted a census approach, targeting all 62 staff from all NSE-listed companies. The census method was clearly justified because it involves collecting data from every member of the population rather than a sample, ensuring that the findings reflect the entire group without sampling error. This approach was suitable given the small, well-defined, and accessible population, allowing for complete representation of views and minimising the risk of bias arising from sample selection. It also enhanced the accuracy and reliability of the results, as every company listed at the Nairobi Securities Exchange was included, providing a holistic understanding of how green initiatives affect profitability across the entire population (Dzwigol, 2022).

3.4.1 Sample Size

A sample size refers to the number of subjects or units selected from a population to participate in a study and provide data (Islam et al., 2022). In this study, a census approach was used, meaning all 62 targeted respondents from all NSE-listed companies were included. The justification for this sample size is based on the principle that when the total population is small, accessible, and well-defined, including all members ensures complete representation and eliminates the risk of sampling error (Mishra & Alok, 2022). A clearly justified sample size helps guarantee that the collected data are sufficient to draw valid and reliable conclusions, improves the statistical power of the analysis, and minimises bias. In this case, the census method provided comprehensive input from key departments, including finance, operations, and sustainability, ensuring the study captured a full and accurate picture of how green initiatives influence the profitability of companies listed on the Nairobi Securities Exchange.

3.5 Research Instrumentation

Research instrumentation refers to the tools used to collect data from respondents in a structured, systematic format (Saharan et al., 2024). This study used a closed-ended Likert-scale questionnaire to gather quantitative data, as it allowed for uniform responses that were easy to code and analyse statistically (Susilawati et al., 2025). The questionnaire was appropriate for measuring perceptions and practices related to green initiatives and profitability across companies. It was divided into six sections: Section A collected demographic and background information about the respondents; Sections B to E addressed the study's core objectives stemming from green initiatives; and Section F captured data on companies' profitability. This structure ensured clarity, consistency, and relevance in the data collected (Mishra & Alok, 2022).

3.6 Pilot Study

A pilot study is a small-scale, preliminary study conducted to test the feasibility, time, cost, risk, and performance of a proposed research instrument before the full-scale study (Mishra & Alok, 2022). This study conducted a pilot test involving 10% of the total sample, 7 respondents drawn from similar NSE-listed firms not included in the main study. The pilot helped identify and fix ambiguities, improve question clarity, and test the questionnaire's flow and structure. Pilot testing enhanced the quality of the research instrument and ensured the reliability of the data collected (Sreekumar & Sreekumar, 2023).

3.6.1 Validity of Research Instrument

Validity referred to the degree to which an instrument accurately measured what it was intended to measure (Sreekumar & Sreekumar, 2023). To ensure content validity, the questionnaire was reviewed by academic supervisors and field experts in finance and environmental sustainability. Their feedback helped refine the questionnaire items to ensure they aligned with the study objectives. Validity was critical to ensure that the data collected was accurate, meaningful, and representative of the concepts being studied (Susilawati et al., 2025).

3.6.2 Reliability of research instrument

Reliability refers to the consistency of a measurement tool in producing similar results under consistent conditions (Susilawati et al., 2025). To test reliability, the study used Cronbach's alpha to assess the internal consistency of the Likert-scale items. A reliability coefficient of 0.7 or higher was considered acceptable for this study (Sreekumar & Sreekumar, 2023). Ensuring high reliability improved the data's trustworthiness and supported valid conclusions from the analysis.

3.7 Data collection

The researcher first obtained an official introduction letter from KCA University to support the application for a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI). This letter, along with the research proposal, was submitted for ethical and regulatory clearance. Once the permit was granted, the researcher reached out to respondents, who were asked to give informed consent before taking part in the study. The questionnaires, along with a brief cover letter, were handed out using a “drop-and-pick-later” method over two weeks to give respondents enough time to complete them. As noted by Sukmawati (2023), self-administered questionnaires were a reliable tool for collecting primary data because they reduced researcher bias and allowed participants to respond thoughtfully. The use of a Likert scale helped capture varying levels of agreement or perception in a structured and measurable way.

3.8 Data Analysis and Presentation

According to Saharan et al. (2024), data analysis involves the systematic process of organising and interpreting collected data to draw meaningful conclusions. In this study, responses from the questionnaires were analysed using SPSS version 20, focusing first on descriptive statistics to summarise trends and general patterns. The results were visually presented through frequency tables and pie charts to enhance clarity and interpretation. To go beyond description, inferential analysis was also applied to examine the relationship between the study’s independent and dependent variables. This was done using a multiple linear regression model, which helped explain how the variables interacted and the extent to which green initiatives influenced profitability.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

Y = Profitability of companies

β_0 = Constant (coefficient of intercept)

X_1 = energy efficiency

X_2 = solar lighting

X_3 = water recycling

X_4 = sustainable packaging

ε Is the error term.

$\beta_1, \beta_2, \beta_3, \beta_4$: Regression coefficients

3.9 Diagnostic Tests

To ensure the accuracy and reliability of the regression analysis, several diagnostic tests were conducted. These checks helped confirm whether the dataset met the key assumptions required for valid statistical inference, thereby strengthening the credibility of the results (Sreekumar & Sreekumar, 2023).

3.9.1 Normality Test

A normality test was conducted to assess whether the data distribution followed a regular pattern, a core assumption of linear regression. The study used the Shapiro-Wilk and Kolmogorov-Smirnov tests to examine normality (Saharan et al., 2024). If the resulting p-values were above 0.05, the data were considered normally distributed. Additionally, visual tools, such as histograms overlaid with standard curves, complemented the statistical tests by providing graphical validation of distribution patterns.

3.9.2 Linearity Test

The linearity assumption was tested to confirm the presence of a straight-line relationship between the independent and dependent variables. The study used the ANOVA lack-of-fit test to determine whether the model adequately fit the data, following the procedure outlined by Susilawati et al. (2025). Establishing linearity was essential to avoid misinterpretation of the regression coefficients.

3.9.3 Multicollinearity Test

Multicollinearity arises when independent variables are highly interrelated, which can distort the regression estimates and reduce model reliability. This study assessed multicollinearity using the Variance Inflation Factor (VIF) and Tolerance Values (TV). As per Dzwigol (2022), a VIF above 10 or a tolerance below 0.1 signalled potential multicollinearity. If detected, steps such as removing overlapping predictors or combining them were considered to improve model robustness.

3.10 Research Ethics

This study adhered to established ethical standards to ensure integrity, transparency, and respect for all participants involved. Participation was voluntary, and all respondents were informed of the study's purpose, what was expected of them, and their right to withdraw at any time without consequences. To protect privacy, no personal identifiers were collected, and all responses were kept strictly confidential and used only for academic purposes. Informed consent was obtained from all participants before data collection. The study avoided any form of coercion, deception, or manipulation. All data were handled securely, and findings were reported truthfully, without fabrication or distortion. Further, the research ensured that businesses participating in the study

were not exposed to any financial, reputational, or operational harm as a result of their involvement. Approval from relevant ethical review bodies or institutions was sought where necessary before the study began.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter provides a comprehensive presentation, analysis, and interpretation of the collected data. It begins by highlighting the response rate to demonstrate the sample's representativeness, followed by the pilot test results, which affirmed the research instrument's reliability and validity. Diagnostic tests, such as normality and multicollinearity assessments, were carried out to confirm the suitability of the data for subsequent analysis. The chapter further presents descriptive statistics to summarise the characteristics of the study variables, as well as inferential analysis to test the research hypotheses and establish the relationships among the variables.

4.2 Response Rate

Table 2: Response Rate

Response Type	No.	Percentages
Returned questionnaire	58	93.5%
Unreturned questionnaire	4	6.5%
Total	62	100.0%

Table 4.1 indicates that of the 62 companies listed on the NSE targeted for the study on green initiatives and profitability, 58 companies returned the questionnaires, yielding a high response rate of 93.5 per cent. In comparison, only four companies (6.5 per cent) did not respond. According to Mugenda and Mugenda (2003), a response rate of 50 percent is adequate, 60 percent is good, and 70 percent or more is considered excellent for analysis and reporting. Therefore, the 93.5 percent response rate achieved in this study is excellent and provides a reliable basis for drawing conclusions on how green initiatives influence the profitability of NSE-listed companies.

4. 3 Pilot Test Results

4.3.1 Validity of Data Collection Instrument

Validity referred to the degree to which an instrument accurately measured what it was intended to measure (Sreekumar & Sreekumar, 2023). To ensure content validity, the questionnaire was reviewed by academic supervisors and field experts in finance and environmental sustainability. Their feedback helped refine the questionnaire items to ensure they aligned with the study objectives. Validity was critical to ensure that the data collected was accurate, meaningful, and representative of the concepts being studied (Susilawati et al., 2025).

4.3.2 Reliability of Data Collection Instrument

Table 3: Reliability of Data Collection Instrument

Reliability Results Variable	Item	Alpha value	Recommendations
Energy efficiency	6	0.784	Good
Solar lighting	6	0.847	Good
Water recycling	6	0.893	Good
Sustainable packaging	6	0.774	Good
Profitability of companies	6	0.881	Good

The reliability results show that all study variables achieved strong internal consistency, with Cronbach's alpha values exceeding the recommended threshold of 0.7, a key standard highlighted by Ganesha and Aithal (2022) as necessary for confirming proper calibration and validity of research tools. Energy efficiency recorded an alpha of 0.784, solar lighting 0.847, water recycling 0.893, sustainable packaging 0.774, and profitability of companies 0.881, demonstrating that the measurement items consistently reflect their intended constructs. As Mazhar et al. (2021) explain, careful design and pretesting of questionnaires strengthen reliability, which is evident here as water recycling, with the highest alpha of 0.893, shows excellent consistency, while sustainable packaging, at 0.774, remains within the "good" range. These strong alpha values confirm that the

questionnaire items were well-structured and dependable for examining the effect of green initiatives on the profitability of companies listed at the Nairobi Securities Exchange.

4.4 Demographic characteristics

Table 4: Demographic characteristics

Variable	Category	Frequency	Percentages
Age Bracket	18–25 years	14	24.1
	26–35 years	12	20.7
	36–45 years	19	32.8
	46–55 years	9	15.5
	Over 55 years	4	6.9
	Total	58	100.0
Highest Level of Education Completed	Diploma	17	29.3
	Bachelor's Degree	28	48.3
	Other	13	22.4
	Total	58	100.0
Years Worked in Current Enterprise	Less than 1 year	13	22.4
	1–3 years	18	31.0
	4–6 years	11	19.0
	7–10 years	10	17.2
	More than 10 years	6	10.3
	Total	58	100.0
Year Enterprise Listed on NSE	Before 2000	18	31.0
	2000–2010	21	36.2
	After 2010	19	32.8
	Total	58	100.0
Sector/Industry Classification	Manufacturing	11	19.0
	Financial Services	9	15.5
	Energy & Petroleum	9	15.5
	Telecommunications	7	12.1
	Commercial & Services	8	13.8
	Construction & Allied	4	6.9
	Other	10	17.2
	Total	58	100.0
Years Company Has Engaged in Green Initiatives	1 year	10	17.2
	2 years	13	22.4
	3 years	18	31.0
	4 years	17	29.4
	Total	58	100.0

The demographic profile of respondents, particularly their age bracket, provides meaningful insight into how green initiatives are perceived and implemented across different generations. The largest group of respondents falls within the 36–45 years category (32.8%), followed by those aged 18–25 years (24.1%). Respondents aged 26–35 years account for 20.7%, while those aged 46–55 years make up 15.5%, and individuals over 55 years represent 6.9%. This distribution indicates that a significant proportion of individuals engaging with company operations and profitability through sustainability practices are in their prime productive years. Fassett et al. (2022) note that demographic characteristics such as age often shape how employees adopt and interpret workplace initiatives, while Titelman and Lauderdale (2023) highlight that generational differences can influence attitudes toward innovation and collective action. Younger employees may therefore be more inclined toward innovative sustainability practices, while the middle-aged workforce brings experience and a focus on aligning green initiatives with long-term profitability.

The educational qualifications of respondents further reinforce the importance of green initiatives in company profitability. A majority of respondents hold a Bachelor's degree (48.3%), while 29.3% have a diploma and 22.4% fall into the “other” category. This distribution suggests that most employees working in these companies have the educational background necessary to appreciate, design, and implement environmentally sustainable practices. According to Mazhar et al. (2021), well-designed demographic questions help reveal how education levels shape awareness and engagement with environmental practices, while Ganesha and Aithal (2022) emphasize the value of collecting reliable education data to assess its influence on research outcomes. Higher education often equips individuals with knowledge on climate change, sustainable technologies, and corporate social responsibility, which can translate into more

effective implementation of initiatives such as solar lighting, water recycling, and sustainable packaging. This, in turn, contributes positively to profitability by enhancing brand image and operational efficiency.

The finding on years worked in the current enterprise highlights the varying degrees of institutional knowledge and exposure to sustainability. A significant proportion of respondents (31.0%) have worked in their enterprises for 1–3 years, while 22.4% have less than 1 year of experience. Another 19.0% have been employed for 4–6 years, 17.2% for 7–10 years, and 10.3% for more than 10 years. Ziegenfuss et al. (2021) observe that well-structured demographic questions about tenure help capture how employee experience impacts engagement with workplace policies. This mix shows that companies listed on the NSE have a blend of fresh entrants who may bring new sustainability ideas and long-serving employees who provide stability and institutional memory. Employees with longer tenures are likely to better appreciate how sustainability initiatives, once adopted, can yield long-term profitability through operational cost reductions and compliance with environmental regulations.

The year of listing on the NSE also provides a useful dimension for linking company maturity to sustainability practices. About 36.2% of companies were listed between 2000 and 2010, while 32.8% were listed after 2010, and 31.0% before 2000. Companies listed earlier tend to have more experience in balancing financial growth with sustainable practices, while recently listed firms may be more aggressive in adopting green initiatives to attract environmentally conscious investors. Fassett et al. (2022) emphasise that including institutional demographics, such as company age, enhances the understanding of how organisational history influences sustainability adoption. The near-even distribution among the three categories demonstrates that

sustainability is becoming a key strategic focus across all generations of listed companies, reinforcing the role of green initiatives as an integral part of profitability in the Kenyan context.

The sectoral distribution of companies provides further insight into how sustainability is embedded within industries. Manufacturing accounts for 19.0% of the sample, financial services for 15.5%, energy & petroleum for 15.5%, telecommunications for 12.1%, commercial & services for 13.8%, and construction & allied for 6.9%. Meanwhile, other sectors not explicitly listed make up 17.2%. For example, energy and petroleum companies may focus on renewable energy projects, while manufacturing emphasises sustainable packaging and waste reduction. Ziegenfuss et al. (2021) point out that capturing such sectoral demographics helps identify patterns in how industries adopt and sustain environmental initiatives. The representation of multiple industries indicates that sustainability is not limited to one sector but is a cross-cutting driver of profitability, with each industry adapting green initiatives to fit its operational model. This diversity underscores the holistic role of sustainability in enhancing company competitiveness at the NSE.

Finally, the number of years companies have engaged in green initiatives reflects the maturity of their sustainability strategies. A significant proportion of companies (31.0%) have engaged in green initiatives for three years, while 29.4% have been engaged for four years. Companies with two years of involvement account for 22.4%, and those with one year represent 17.2%. This shows that nearly 60.4% of the firms have sustained efforts in green initiatives for three to four years, suggesting maturity in sustainability adoption. Consistent with Ganesha and Aithal's (2022) argument on the importance of reliable demographic measurement, such duration data reveal how long-term engagement strengthens profitability outcomes. Companies with longer engagement in green initiatives are more likely to report improved profitability due to accumulated cost savings, enhanced stakeholder goodwill, and compliance with international standards. This

demonstrates that sustained investment in green initiatives has a compounding effect on profitability, making it a strategic imperative for firms listed at the Nairobi Securities Exchange.

4.5 Descriptive Results

4.5.1 Energy Efficiency

Table 5: Energy Efficiency

Statement on Energy Efficiency	Mean	Std. Deviation
The company regularly monitors its energy consumption.	4.16	.834
Energy consumption significantly affects the company's operational costs.	3.97	1.059
The company has adopted measures that result in noticeable energy savings.	4.26	.965
Energy-saving initiatives contribute positively to profitability.	4.07	1.153
Rising energy costs reduce the company's profit margins.	4.19	.999
Managing energy costs improves the company's financial performance.	4.33	.659

The findings on energy efficiency among companies listed at the Nairobi Securities Exchange reveal a strong consensus on its role in profitability. The highest mean score ($M = 4.33$, $SD = 0.659$) indicates that managing energy costs substantially improves financial performance, with the low standard deviation showing close agreement among respondents. Similarly, the adoption of measures leading to energy savings received strong support ($M = 4.26$, $SD = 0.965$), though with slightly higher variability, suggesting differences in the extent to which firms have implemented such practices. Lukic (2021) observed similar trends in the service sector of Eastern Europe, where firms with higher energy efficiency recorded better profit margins, highlighting that energy-saving investments directly improve financial outcomes.

Regular monitoring of energy consumption also scored highly ($M = 4.16$, $SD = 0.834$), reflecting recognition of the importance of tracking usage. Rising energy costs reducing profit

margins ($M = 4.19$, $SD = 0.999$) and the positive effect of energy-saving initiatives on profitability ($M = 4.07$, $SD = 1.153$) both underscore the financial risks of inefficiency, consistent with Milewska and Milewski's (2023) finding that rising energy costs threaten profitability in energy-intensive manufacturing. While energy consumption's effect on operational costs was acknowledged ($M = 3.97$, $SD = 1.059$), the wider spread points to variability in perceived impact depending on sectoral differences. This mirrors Milewska and Milewski's (2023) evidence that industry type influences the degree to which energy costs erode profit margins. Li et al. (2023) further demonstrated in China's industrial sector that access to green finance boosts energy efficiency, which in turn enhances productivity and competitiveness, offering lessons for Kenyan firms seeking funding to support sustainable practices. Overall, the means above four demonstrate that energy efficiency is broadly perceived as critical to sustaining profitability, though differences in standard deviations reflect varying levels of adoption and impact across firms. Together, these findings reinforce the literature's consensus that energy-efficient practices, when supported by investment and proper management, deliver measurable financial benefits. However, their impact is shaped by access to finance, industry demands, and firm-specific capabilities.

These results can be explained through the Resource-Based View (RBV), which holds that a resource must be valuable, rare, inimitable, and non-substitutable (VRIN) to provide a competitive advantage. Freeman, Dmytriiev, and Phillips (2021) add that managing such internal resources also strengthens stakeholder relationships, while Davis and DeWitt (2021) highlight how these capabilities drive long-term profitability in complex markets. In this context, Nairobi companies that invest in energy efficiency are not only cutting costs but also building inimitable internal strengths, aligning with RBV's logic that strategic resources underpin sustainable competitive advantage.

Based on these results, the null hypothesis H_{01} : Energy efficiency has no significant effect on the profitability of companies listed at the Nairobi Securities Exchange is not supported. The consistently high mean values above 4.0 for most statements clearly show that respondents agree that energy efficiency plays a significant role in improving profitability. Additionally, the relatively low to moderate standard deviations reinforce the general agreement despite some variation in practices across firms. This provides strong evidence to reject the null hypothesis and conclude that energy efficiency has a significant positive effect on the profitability of NSE-listed companies.

4.5.2 Solar Lighting

Table 6: Solar Lighting

Statement on Solar Lighting	Mean	Std. Deviation
The initial installation cost of solar lighting is affordable for the company.	4.09	1.128
The benefits of solar lighting outweigh its installation costs.	3.90	1.103
The maintenance cost of solar lighting is manageable for the company.	4.03	1.169
Low maintenance requirements of solar lighting improve profitability.	4.09	1.144
Solar lighting provides reliable lighting for company operations.	3.97	1.139
Reliable solar lighting reduces operational disruptions and supports profitability.	4.21	.853

The results on solar lighting and its effect on the profitability of companies listed at the Nairobi Securities Exchange show that it is largely viewed as beneficial, though experiences vary across firms. Reliable solar lighting reduces operational disruptions and supports profitability, with the highest mean ($M = 4.21$, $SD = 0.853$) and a low standard deviation, indicating strong agreement among respondents. This aligns with Ihirwe et al.'s (2024) findings in Rwanda, where proper

management of solar technologies reduced operational costs and improved service reliability, particularly for SMEs. The initial installation cost of solar lighting is affordable for the company ($M = 4.09$, $SD = 1.128$) and the low maintenance requirements of solar lighting improve profitability ($M = 4.09$, $SD = 1.144$), also scoring highly, but their relatively higher standard deviations indicate that companies differ in their experiences regarding affordability and profitability. Similar patterns were observed by Lyakurwa (2022) in Tanzania, where MSMEs adopting solar energy experienced lower utility bills and fewer production interruptions, though affordability and financing options influenced adoption levels.

The maintenance cost of solar lighting is manageable for the company ($M = 4.03$, $SD = 1.169$), and solar lighting provides reliable lighting for company operations ($M = 3.97$, $SD = 1.139$), further reflecting positive perceptions. However, the wider spread suggests mixed adoption levels. Kiboi (2022) similarly demonstrated that solar installations, even in dense urban settings, generated significant energy savings, proving that cost benefits can be realised under different operational conditions.

The benefits of solar lighting outweigh its installation costs, as evidenced by the lowest mean ($M = 3.90$, $SD = 1.103$), and the higher standard deviation highlights diverse views on cost–benefit trade-offs. This finding resonates with Opiyo (2023), who reported that Kenyan solar firms with strong partnerships and differentiation strategies achieved better market performance and profitability, underscoring that financial gains often depend on strategic implementation. Baraille and Jaglin (2022) further showed that accessible repair services reduce downtime and energy costs, an important factor given that maintenance quality can determine long-term profitability. Overall, the means above 4.0, combined with variations in standard deviations, suggest that solar lighting is widely recognised as profitable, though its impact is not uniform across all firms. These results

support the broader literature's view that while solar adoption improves performance, outcomes vary depending on management capacity, financing, and access to technical support.

These findings can be explained using Innovation Diffusion Theory (IDT), which highlights how technology adoption depends on factors such as relative advantage, compatibility, complexity, trialability, and observability (Pinho et al., 2021). Solar lighting's affordability, ease of use, and long-term savings give it a clear relative advantage, making it attractive once early adopters demonstrate its value. Ho (2022) notes that innovations spread faster when users can observe tangible benefits with minimal risk, which mirrors how firms in Nairobi may follow peers who successfully integrate solar lighting into operations. The variations in cost–benefit perceptions and maintenance experiences reflect different adopter categories, from innovators to late adopters, as described in IDT. For NSE-listed companies, early adopters are likely driving wider acceptance by showcasing cost savings and reliability, while others may require incentives or financing support to overcome perceived barriers. This diffusion pattern explains why solar lighting, though profitable overall, shows uneven impacts across firms.

Based on these findings, the null hypothesis **H₀₂**: Solar lighting has no significant effect on the profitability of companies listed at the Nairobi Securities Exchange is rejected. The consistently high means, especially for reliable solar lighting, reduce operational disruptions, support profitability, and lower maintenance requirements, demonstrating a clear link between solar lighting and improved company performance. Although some higher standard deviations indicate variability in experience across sectors, the overall evidence strongly supports the conclusion that solar lighting has a significant positive effect on the profitability of NSE-listed companies.

4.5.3 Water Recycling

Table 7: Water Recycling

Statement on Water Recycling	Mean	Std. Deviation
The company recycles a significant volume of water for daily operations.	4.02	1.221
Increased recycled water volume has reduced overall water expenses.	3.57	1.230
Water recycling has reduced the company's wastewater output.	4.36	.873
Lower wastewater discharge has contributed positively to profitability.	3.97	1.213
The cost of filtration is affordable for the company.	4.19	1.162
Investment in filtration systems improves long-term profitability.	4.36	.742

The results on water recycling and its influence on the profitability of companies listed at the Nairobi Securities Exchange indicate strong support for its positive financial impact, though with some variability across firms. Investment in filtration systems improves long-term profitability, recording the highest mean ($M = 4.36$, $SD = 0.742$), and the low standard deviation shows close agreement among respondents. Water recycling has reduced the company's wastewater output, and it also scored highly ($M = 4.36$, $SD = 0.873$), reflecting consistent acknowledgement of its operational and environmental benefits. Karim et al. (2022) similarly found that clear planning, pricing reforms, and infrastructure investment improved financial outcomes in a public water utility in Indonesia, reinforcing the idea that well-structured recycling strategies can sustain profitability.

The cost of filtration is affordable for the company ($M = 4.19$, $SD = 1.162$) and the company recycles a significant volume of water for daily operations ($M = 4.02$, $SD = 1.221$), but their higher standard deviations point to differences in cost structures and adoption levels across

firms, a pattern echoed by Zhuang et al. (2022), who reported wide disparities in recycling efficiency across industrial river basins in China due to governance and investment variations. Lower wastewater discharge has contributed positively to profitability ($M = 3.97$, $SD = 1.213$), suggesting agreement on its role in financial performance, though the wide spread shows variation in the extent of impact. This finding aligns with Onuh and Bassey (2021), who emphasized that strong governance and technological innovation drive better outcomes in water management systems, as seen in Israel's success compared to Nigeria's underinvestment.

Increased recycled water volume has reduced overall water expenses, resulting in the lowest mean ($M = 3.57$, $SD = 1.230$), with the high standard deviation highlighting divergent experiences on direct cost savings, a trend similar to Zhuang et al.'s (2022) observation that basin-specific strategies and technology scaling are necessary to overcome efficiency gaps. Overall, the high means above 4.0 in most items, combined with moderate to low standard deviations in key areas, suggest that water recycling is broadly recognised as profitable, despite differences in experiences across companies. These results reflect the broader literature's message that while environmental practices can enhance profitability, their impact depends on supportive governance, infrastructure, and firm-level commitment.

The positive financial outcomes of water recycling among NSE-listed firms can be understood through the lens of the Triple Bottom Line (TBL) theory. TBL argues that sustainable business requires balancing economic, social, and environmental dimensions rather than prioritizing one at the expense of the others (Nogueira et al., 2023). In this study, investments in filtration systems and reduced wastewater output represent the "planet" dimension, while cost savings and profitability reflect the "profit" component. By recycling water, firms not only cut operational expenses but also reduce risks from water scarcity and align with growing regulatory

and investor expectations. This mirrors Karim et al.'s (2022) findings on the value of strategic planning and Zhuang et al.'s (2022) emphasis on technology adoption, showing that environmental stewardship can strengthen financial performance. For NSE-listed companies, adopting water recycling systems embodies TBL's call for integrated strategies, where sustainability practices enhance profitability, build reputation, and secure long-term competitiveness.

Based on these findings, the null hypothesis H_{03} : Water recycling has no significant influence on the profitability of companies listed at the Nairobi Securities Exchange is rejected. The consistently high means, particularly in investment in filtration systems to improve long-term profitability and in water recycling to reduce wastewater output, demonstrate a clear link between water recycling practices and improved profitability. Although some items show higher standard deviations, reflecting variability in the scale of benefits, the overall evidence strongly supports the conclusion that water recycling significantly contributes to the profitability of NSE-listed companies.

4.5.4 Sustainable Packaging

Table 8: Sustainable Packaging

Statement on sustainable packaging	Mean	Std. Deviation
Reducing packaging waste has lowered the company's operational costs.	4.38	.671
Managing packaging waste contributes positively to company profitability.	3.81	1.100
Using recyclable content in packaging has reduced material expenses.	4.33	.781
Recyclable packaging improves brand reputation and financial performance.	4.19	.999
The company actively uses biodegradable packaging materials.	4.12	.975
Biodegradable packaging supports long-term profitability.	4.29	.649

The results on sustainable packaging and its effect on profitability of companies listed at the Nairobi Securities Exchange reveal strong agreement on its positive financial impact, though with slight variations across firms. Reducing packaging waste has lowered operational costs for the company recorded the highest mean ($M = 4.38$, $SD = 0.671$), and the low standard deviation indicates close agreement among respondents. This supports Thiga's (2025) findings that recyclable and biodegradable packaging reduces logistics costs while boosting consumer demand, demonstrating how operational savings and market appeal can work together to improve performance.

Using recyclable content in packaging has reduced material expenses followed closely ($M = 4.33$, $SD = 0.781$), showing consistent acknowledgment of cost savings, a pattern similar to Nyoro's (2023) observation that authentic sustainability messaging strengthens customer loyalty and leads to modest profitability gains when backed by real practices. Biodegradable packaging supports long-term profitability also scored highly ($M = 4.29$, $SD = 0.649$), with its low standard deviation further reinforcing consensus, echoing Mumbi et al. (2021) who found that green initiatives in horticultural firms created export competitiveness and operational savings.

Recyclable packaging improves brand reputation and financial performance ($M = 4.19$, $SD = 0.999$) and the company actively uses biodegradable packaging materials ($M = 4.12$, $SD = 0.975$) highlight generally positive views, though their higher standard deviations suggest varied adoption levels and perceived benefits across companies. These variations reflect what Thiga (2025) reported in the food and beverage sector, where adoption of green packaging was influenced by differences in supply chain efficiency and material availability. Managing packaging waste contributes positively to company profitability recorded the lowest mean ($M = 3.81$, $SD = 1.100$), and its higher standard deviation reflects differences in how firms experience the direct link

between waste management and profitability. This aligns with Nyoro's (2023) caution that sustainability messaging must be backed by authentic practices to realize full financial gains. Overall, the majority of mean values above 4.0, coupled with relatively low standard deviations in key areas, demonstrate that sustainable packaging is widely recognized as a driver of profitability, even as firms adopt it at different levels and experience varied financial outcomes.

These results are well explained by sustainable development theory, which stresses the need to meet current business goals while preserving resources for future generations (Manioudis & Meramveliotakis, 2022). The cost savings from reducing packaging waste and the long-term profitability of biodegradable materials show how firms can balance economic growth with environmental protection, a core principle of the theory. Hu and Liu (2022) note that companies face uncertainty when making sustainability decisions, requiring informed strategies that secure both present profits and future resilience. Popkova et al. (2022) highlight how digital technologies can help firms track environmental footprints and optimise resource use, strengthening the link between sustainable packaging and long-term competitiveness. Silva (2021) adds that such initiatives enhance legitimacy and competitive advantage as consumers and regulators favour eco-friendly practices. The consistently high mean scores in this study reflect how Nairobi firms are adopting packaging strategies that not only improve profitability but also fulfil the theory's call for integrated, future-focused business practices.

Based on these results, the null hypothesis H_{04} : Sustainable packaging has no significant effect on the profitability of companies listed at the Nairobi Securities Exchange is rejected. The consistently high means, particularly in reducing packaging waste, lowering operational costs, and using recyclable materials in packaging, provide strong evidence that sustainable packaging contributes positively to profitability. Although some items with higher standard deviations reveal

variations in experience across firms, the overall findings strongly support that sustainable packaging has a significant effect on the profitability of NSE-listed companies.

4.5.5 Profitability of Companies

Table 9: Profitability of Companies

Statement on Profitability of Companies	Mean	Std. Deviation
The company consistently records positive operating income.	4.33	.758
Higher operating income has strengthened the company's profitability.	3.79	1.151
The company has experienced steady revenue growth in recent years.	4.21	.932
Revenue growth contributes directly to improved profit levels.	4.10	1.150
The company records consistent growth in sales volume.	4.05	1.033
Increased sales volume has a positive impact on company profitability.	4.24	.757

The results on profitability of companies listed at the Nairobi Securities Exchange indicate strong recognition of factors that drive financial performance, though with some variations across firms. The company consistently records positive operating income had the highest mean ($M = 4.33$, $SD = 0.758$), and the low standard deviation reflects strong consensus on stable income generation. Increased sales volume has a positive impact on company profitability followed closely ($M = 4.24$, $SD = 0.757$), again showing close agreement on its importance. These findings echo Afolabi et al. (2025), who observed that energy-efficient practices in Nigerian SMEs significantly improved productivity and profitability, particularly when solar and LED technologies were adopted. Just as energy efficiency strengthened Nigerian firms' financial performance, the stable operating income and sales growth among Kenyan listed companies show that cost-saving and revenue-generating strategies remain critical drivers of profitability. However, Afolabi et al. also

noted that government support and awareness programs are necessary for wider adoption of energy-efficient measures, which may similarly benefit Kenyan companies seeking to sustain these profitability trends.

The company has experienced steady revenue growth in recent years ($M = 4.21$, $SD = 0.932$) and revenue growth contributes directly to improved profit levels ($M = 4.10$, $SD = 1.150$), highlighting the role of revenue expansion in profitability, though the higher standard deviations suggest different levels of growth experienced across firms. This aligns with Kalkal and Teja (2022), who found that optimal energy scheduling and decentralized energy models in rural India reduced power wastage, improved cost-efficiency, and enhanced business sustainability. The emphasis on cost efficiency in their study reflects the way steady revenue growth supports long-term profitability among NSE-listed companies, even when individual firms experience varying growth rates. Just as Indian businesses benefited from optimized resource use, Kenyan firms can leverage efficient operations to maintain competitive profitability despite market uncertainties.

The company records consistent growth in sales volume ($M = 4.05$, $SD = 1.033$), reinforcing the sales–profit link but with some variability across respondents. The lowest mean was recorded in higher operating income, which has strengthened the company’s profitability ($M = 3.79$, $SD = 1.151$), with the high standard deviation indicating diverse experiences in translating operating income into overall profitability. This variability mirrors the findings of Mwitirehe et al. (2024) in Rwanda, where regions with stronger management and maintenance systems achieved higher service levels and lower costs. Similarly, Kenyan companies with better operational management are more likely to convert operating income into sustained profitability. Overall, most mean values above 4.0 and relatively low standard deviations in key indicators reflect that

companies listed at the NSE generally enjoy strong profitability, although differences in revenue and income growth.

4.6 Diagnostic Tests

4.6.1 Normality Test

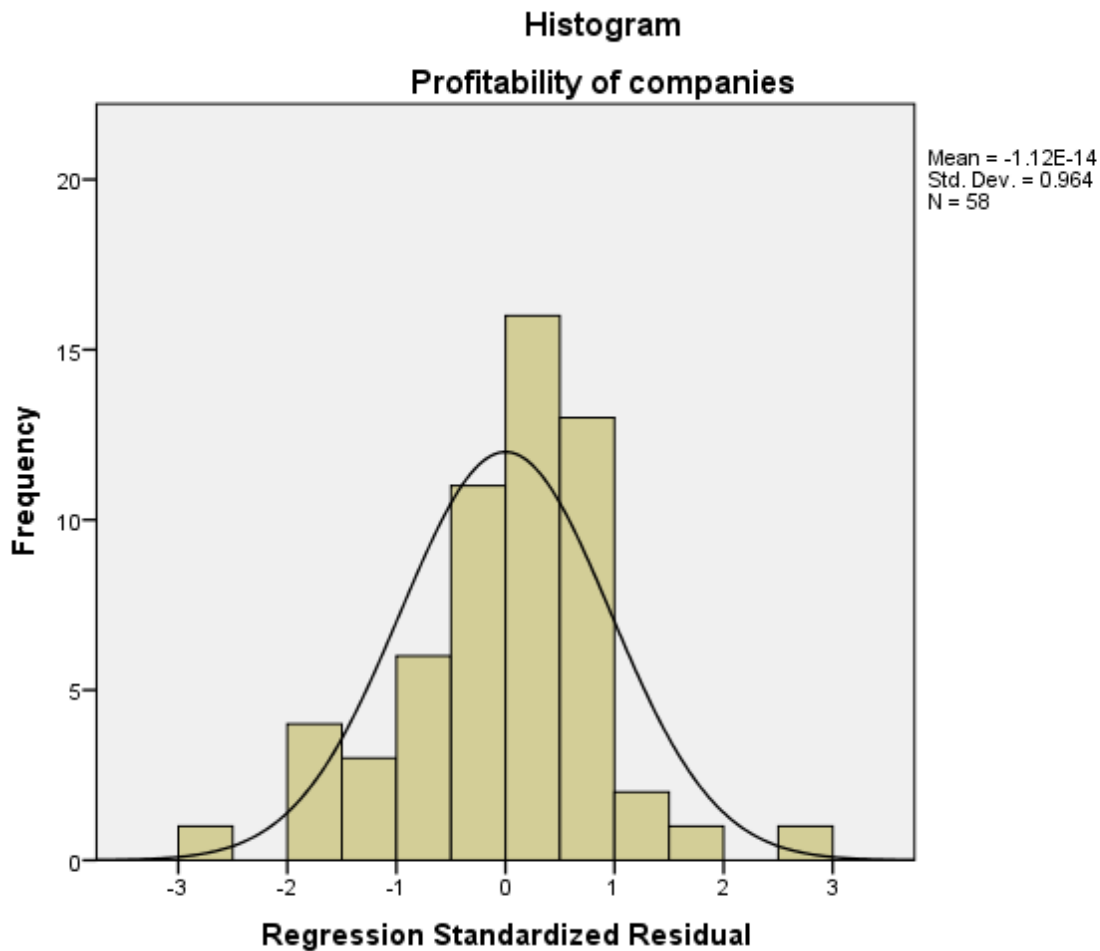


Figure 2: Histogram

The histogram of regression standardized residuals for the model predicting profitability of companies from energy efficiency, solar lighting, water recycling, and sustainable packaging shows a roughly bell-shaped distribution centered around zero. The residuals are fairly symmetrical with most values clustering between -2 and +2, and only a few outliers beyond this

range. The mean of the residuals is approximately zero ($-1.12\text{E-}14$) and the standard deviation is close to 1 (0.964), which aligns with the assumptions of normality in regression analysis. Tsagris and Pandis (2021) note that while formal normality tests are often debated, a visual inspection of residuals through histograms remains a practical way to assess whether the normality assumption is reasonably met. In line with their view, the current histogram supports the conclusion that the residuals of the model are approximately normally distributed, suggesting that the predictors satisfy the normality assumption required for valid inference in multiple regression.

4.6.2 Linearity Test

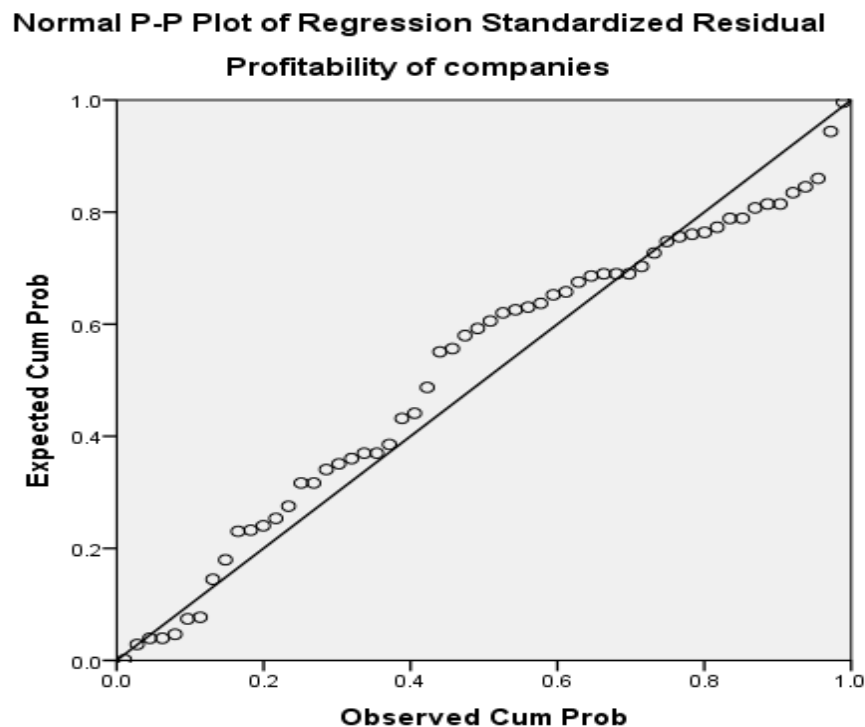


Figure 3: Normal P–P plot

The Normal P–P plot of regression standardized residuals shows that the observed cumulative probabilities range from 0.0 to 1.0 along the x-axis, while the expected cumulative probabilities also range from 0.0 to 1.0 along the y-axis. Most of the plotted points fall close to the diagonal line stretching from (0.0, 0.0) to (1.0, 1.0), with only minor deviations observed in the mid-range between 0.4 and 0.8 on both axes. This indicates that the residuals are approximately normally distributed, which supports the assumption of linearity in the regression model. Alita et al. (2021) similarly emphasized that when residuals closely follow the diagonal in a P–P plot, the normality assumption is satisfied, allowing reliable use of multiple linear regression. Consistent with their findings, the present results confirm that the predictors energy efficiency, solar lighting, water recycling, and sustainable packaging have a relationship with the dependent variable, profitability of companies, that is suitably captured by a multiple linear regression model, ensuring valid and interpretable statistical estimates.

4.6.3 Multicollinearity Test

Table 10: Multicollinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Energy efficiency	.919	1.088
	Solar lighting	.360	2.777
	Water recycling	.687	1.455
	Sustainable packaging	.357	2.797

The collinearity statistics show that all predictors fall within acceptable limits, indicating no serious multicollinearity in the model predicting the profitability of companies. Energy efficiency has the highest tolerance of 0.919 and the lowest VIF of 1.088, showing very low correlation with the other predictors. Water recycling also shows a safe tolerance of 0.687 and a

VIF of 1.455. Solar lighting and sustainable packaging have lower tolerances of 0.360 and 0.357 with corresponding VIF values of 2.777 and 2.797, suggesting a moderate relationship with other variables but still well below the critical VIF threshold of 10. These results confirm that energy efficiency, solar lighting, water recycling, and sustainable packaging can be included in the regression model without risk of multicollinearity-induced bias. This aligns with Bayman and Dexter (2021), who explained that multicollinearity becomes problematic only when VIF values rise above critical thresholds, leading to unstable coefficient estimates and inflated standard errors. The low VIF values in this analysis reflect the conditions described by Bayman and Dexter, showing that the predictors are sufficiently independent to provide reliable and interpretable regression results while maintaining the integrity of the profitability model.

4.7 Inferential Results

Inferential statistics are used even in a census study to test relationships and draw conclusions about variables within the population. Although data is collected from all respondents, inferential analysis helps determine the strength, direction, and significance of relationships, especially when testing hypotheses or comparing findings with other studies.

4.7.1 Correlation

Table 11: Correlation Table

	Energy efficiency	Solar lightin g	Water recycling	Sustainabl e packaging	Profita bility of compa nies
Pearson Correlati on	1	.043	-.166	-.109	-.137

Energy efficiency	Sig. (2-tailed) N	.748 58	.214 58	.415 58	.307 58
Solar lighting	Pearson Correlation Sig. (2-tailed) N	1 58	.499** .000 58	.779** .000 58	.798** .000 58
Water recycling	Pearson Correlation Sig. (2-tailed) N	1 58	.519** .000 58	.394** .002 58	
Sustainable packaging	Pearson Correlation Sig. (2-tailed) N			.938** .000 58	
Profitability of companies	Pearson Correlation Sig. (2-tailed) N				1
**. Correlation is significant at the 0.01 level (2-tailed).					

The correlation results show varying relationships among the predictors and profitability of companies, revealing patterns that align with broader research on sustainability and innovation. Energy efficiency has weak and insignificant correlations with solar lighting ($r = 0.043$, $p = 0.748$), water recycling ($r = -0.166$, $p = 0.214$), sustainable packaging ($r = -0.109$, $p = 0.415$), and profitability ($r = -0.137$, $p = 0.307$), indicating little direct association. This limited link reflects the view of Abdirahim (2024), who argued that profitability depends less on isolated efficiency measures and more on innovative strategies like digitalization and automation to improve operations and customer satisfaction.

In contrast, solar lighting shows strong and significant positive correlations with water recycling ($r = 0.499$, $p = 0.000$), sustainable packaging ($r = 0.779$, $p = 0.000$), and profitability ($r = 0.798$, $p = 0.000$), echoing Baraille and Jaglin's (2022) finding that accessible solar repair services reduce downtime and energy costs, making solar-based solutions a key driver of business performance. Water recycling also correlates significantly with sustainable packaging ($r = 0.519$, $p = 0.000$) and profitability ($r = 0.394$, $p = 0.002$), reinforcing Abdirahim's (2024) observation that innovation strategies strengthen operational efficiency and financial outcomes. Sustainable packaging exhibits the strongest positive relationship with profitability ($r = 0.938$, $p = 0.000$), a result consistent with Friedrich (2021), who showed that companies adopting clear and traceable sustainability measures gain stronger brand loyalty and higher profit margins. Together, these correlations suggest that while energy efficiency alone does not directly increase profitability, innovative, market-driven sustainability practices such as solar solutions, water recycling, and sustainable packaging play a decisive role in improving financial performance, especially when supported by accessible services and transparent practices.

4.7.2 Model Summary

Table 12: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.956 ^a	.914	.908	.11381

The model summary shows a strong relationship between the predictors energy efficiency, solar lighting, water recycling, and sustainable packaging and the profitability of companies. The correlation coefficient (R) of 0.956 indicates a very strong positive association. The R Square value of 0.914 means that about 91.4% of the variation in profitability is explained by the four predictors,

while the remaining 8.6% is due to other factors not included in the model, such as market conditions or management practices. The Adjusted R Square of 0.908 confirms that this high explanatory power remains robust even after adjusting for the number of predictors. The standard error of the estimate is 0.11381, which is relatively small and indicates that the model's predicted profitability values are close to the actual observed values. However, the unexplained 8.6% shows that additional variables could still influence company profitability. These results mirror Akeju (2021), who found that profitability in solar ventures was strongly linked to customer trust, flexible payment systems, and technical capacity, highlighting that, beyond energy-related practices, effective business operations and financial strategies also play a critical role in sustaining profitability, just as the unexplained portion of this model suggests.

4.7.3 ANOVA

Table 13: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.358	4	1.839	142.015	.000 ^b
	Residual	.686	53	.013		
	Total	8.044	57			

The ANOVA results show that the regression model explaining the relationship between energy efficiency, solar lighting, water recycling, sustainable packaging, and the profitability of companies listed at the Nairobi Securities Exchange is highly significant. The regression sum of squares was 7.358 compared to a residual sum of squares of only 0.686, out of a total of 8.044, indicating that the predictors explain a substantial proportion of the variation in profitability. With an F-value of 142.015 and a significance level of $p = .000$, the model is statistically significant, meaning that the combined effect of the four predictors has a strong and reliable influence on

profitability. The small residual mean square (0.013) further confirms that little unexplained variation remains in the model, reinforcing the robustness of the predictors in explaining company profitability. These findings align with Macharia et al. (2022), who found that energy efficiency practices in Kenya's manufacturing sector significantly improved productivity and reduced costs. Just as Macharia et al. showed that firms adopting modern, energy-saving equipment enhanced their competitiveness, the present results demonstrate that energy efficiency, solar lighting, water recycling, and sustainable packaging collectively strengthen profitability among NSE-listed firms, highlighting the value of targeted investments and supportive government policies in driving sustainable financial performance.

4.7.4 Coefficients of regression

Table 14: Coefficients of Regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.896	.206		4.345	.000
Energy efficiency	.053	.026	.084	2.015	.049
Solar lighting	.208	.058	.238	3.563	.001
Water recycling	.127	.036	.171	3.539	.001
Sustainable packaging	.746	.060	.832	12.399	.000

The regression output shows that the constant term is positive and significant ($B = 0.896$, $t = 4.345$, $p = 0.000$), meaning that even without the influence of energy efficiency, solar lighting, water recycling, or sustainable packaging, companies listed at the Nairobi Securities Exchange still record a baseline level of profitability. This indicates that while other factors contribute, there are inherent aspects of firm operations and market conditions that sustain profitability.

Energy efficiency has a positive effect on profitability, with an unstandardized coefficient of $B = 0.053$ and a standardized beta of 0.084 . The t -value of 2.015 and significance level of $p = 0.049$ show that its influence is statistically significant, though modest compared to the other predictors. This suggests that improvements in energy efficiency contribute to profitability, but its effect is relatively smaller, likely due to variations in energy management practices across firms. These results align with Owusu et al. (2022), who found that electricity reliability in Ghanaian micro and small enterprises strongly influenced profit margins. While Owusu et al. emphasized that access to affordable and stable energy was more critical than efficiency alone, the Kenyan context shows that even incremental gains in efficiency can enhance profitability, especially where firms already enjoy steady energy access.

Solar lighting demonstrates a stronger effect on profitability, with $B = 0.208$ and a standardized beta of 0.238 . The t -value of 3.563 and significance level of $p = 0.001$ confirm that it has a significant and meaningful impact. This indicates that investment in solar lighting reduces operational costs and improves reliability, which directly enhances the financial performance of NSE-listed companies. Kwon et al. (2021) reached a similar conclusion in South Korea, where integrating solar technology into business models—such as solar signage—created viable commercial opportunities when paired with strong policy support and stakeholder engagement. Like Kwon's findings, the Kenyan results show that solar adoption not only cuts costs but also aligns with broader environmental and market trends, making it a key driver of profitability.

Water recycling also contributes positively, with $B = 0.127$ and a standardized beta of 0.171 . The t -value of 3.539 and significance level of $p = 0.001$ show a significant effect on profitability. This means that initiatives such as recycling water, lowering wastewater discharge, and affordable filtration systems play a substantial role in improving long-term profitability among

companies. Gichuki (2023) observed similar outcomes in Nyeri County, Kenya, where well-implemented water sector reforms improved revenue collection efficiency and cost recovery rates, demonstrating how better resource management strengthens financial performance. Sustainable packaging emerges as the most influential factor, with $B = 0.746$ and a very high standardized beta of 0.832. The t-value of 12.399 and significance level of $p = 0.000$ highlight its dominant role in enhancing profitability. Palsson and Sandberg (2022) found that supportive regulations and eco-conscious consumers in Sweden helped firms adopt sustainable packaging profitably, while South African firms struggled with cost barriers. Likewise, the Kenyan evidence shows that reducing packaging waste and using recyclable or biodegradable materials cuts costs and boosts brand reputation, making sustainable packaging the most critical determinant of profitability when supported by market demand and regulatory incentives.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusions, and recommendations on the profitability of companies listed on the Nairobi Securities Exchange.

5.2 Summary of Findings

5.2.1 Energy Efficiency

The findings demonstrate that energy efficiency is highly regarded by companies listed at the Nairobi Securities Exchange as a fundamental factor in enhancing profitability and sustaining competitiveness. Respondents overwhelmingly agreed that effective management of energy costs translates directly into improved financial performance, reflecting a strong consensus on the role of energy efficiency in business success. Lukic (2021) observed similar trends in the service sector of Eastern Europe, where firms with higher energy efficiency recorded better profit margins, highlighting that energy-saving investments directly improve financial outcomes. The adoption of energy-saving practices was also supported, although the degree of implementation varied across firms, suggesting differences in organisational priorities, resource capacities, and sectoral needs. Regular monitoring of energy consumption was identified as a crucial practice, emphasising the importance of consistent tracking to ensure efficiency and avoid unnecessary wastage. Rising

energy costs were perceived as a critical risk to profit margins, further reinforcing the value of energy efficiency in mitigating vulnerabilities posed by volatile energy markets. Moreover, energy-saving initiatives were widely acknowledged to contribute positively to profitability, though firms reported different experiences depending on their level of investment and the specific measures applied. This mirrors Milewska and Milewski's (2023) evidence that industry type influences the degree to which energy costs erode profit margins. Li et al. (2023) further demonstrated in China's industrial sector that access to green finance boosts energy efficiency, thus enhancing productivity and competitiveness, offering lessons for Kenyan firms seeking funding to support sustainable practices. The role of energy consumption in shaping operational costs was recognised, but its impact appeared to differ across industries, pointing to sector-specific variations in energy intensity and cost structures. Taken together, the findings reveal that energy efficiency is not merely a cost-control mechanism but a strategic driver of profitability and long-term resilience, with companies recognising its importance even as they differ in the extent of its adoption and perceived outcomes.

5.2.2 Solar Lighting

The findings indicate that solar lighting is widely perceived as beneficial to the profitability of companies listed at the Nairobi Securities Exchange. Nonetheless, firms report different levels of experience and impact. Respondents strongly agreed that reliable solar lighting reduces operational disruptions and contributes positively to financial performance, reflecting a high level of consensus on its strategic value. Kiboi (2022) similarly demonstrated that solar installations, even in dense urban settings, generated significant energy savings, proving that cost benefits can be realised under different operational conditions. Solar lighting was also viewed as affordable to install and inexpensive to maintain, with many companies recognising its role in lowering operational costs

and supporting profitability. However, variations in responses suggest that while some firms find solar lighting highly affordable and effective, others experience challenges depending on their resources, investment priorities, and sector-specific energy demands. The technology was also seen as providing reliable lighting for business operations. Although its cost–benefit trade-offs were not uniformly accepted, highlighting differences in adoption levels and perceptions of long-term returns. This reflects the findings of Ihirwe et al. (2024) in Rwanda, where proper management of solar technologies reduced operational costs and improved service reliability, especially for SMEs. Collectively, the responses underscore that solar lighting is widely recognised as profitable, but its impact varies across industries, reflecting differences in energy needs, financial capabilities, and operational structures among firms.

5.2.3 Water Recycling

The findings reveal that water recycling is strongly perceived as an important driver of profitability among companies listed at the Nairobi Securities Exchange, even though firms reported varying levels of adoption and impact. Respondents agreed that investing in modern filtration systems significantly enhances long-term financial performance, while reducing wastewater output was also acknowledged as a major benefit, both from operational and environmental perspectives. The practice was further considered affordable in terms of filtration costs and valuable in supporting daily operations through recycling significant volumes of water, though companies differed in how effectively these measures were implemented. Lower wastewater discharge was also recognised as contributing positively to profitability, though the extent of its effect varied across industries. Some firms testified that recycling led to notable reductions in water expenses, while others experienced less direct financial relief due to sector-specific cost structures and varying water consumption patterns. This mirrors Karim et al.'s (2022) findings on the value of strategic planning

and Zhuang et al.'s (2022) emphasis on technology adoption, showing that environmental stewardship can strengthen financial performance. For NSE-listed companies, adopting water recycling systems embodies TBL's call for integrated strategies, where sustainability practices enhance profitability, build reputation, and secure long-term competitiveness. Overall, the responses highlight that water recycling is not only a tool for environmental sustainability but also a strategic approach to enhancing efficiency and profitability, with differences in outcomes arising mainly from the scale of investment and the degree of integration into daily operations.

5.2.4 Sustainable Packaging

The findings indicate that sustainable packaging is strongly perceived as enhancing the profitability of companies listed on the Nairobi Securities Exchange. Although there is variation in the extent of adoption and perceived benefits. This supports Thiga's (2025) findings that recyclable and biodegradable packaging reduces logistics costs while boosting consumer demand, demonstrating how operational savings and market appeal can work together to improve performance. Respondents overwhelmingly agreed that reducing packaging waste plays a significant role in lowering operational costs. At the same time, the use of recyclable materials in packaging was also highlighted as a key factor in reducing material costs. Biodegradable packaging was widely acknowledged as a contributor to long-term profitability, with responses showing strong consensus on its financial and environmental value. In addition, recyclable packaging was seen as improving both brand reputation and financial performance, although the extent of adoption varied across firms. The use of biodegradable materials in company operations was also viewed positively, though differences emerged depending on the level of investment and strategic commitment to sustainable practices. Hu and Liu (2022) note that companies face uncertainty when making sustainability decisions, requiring informed strategies that secure both

present profits and future resilience. The management of packaging waste was recognised as important in enhancing profitability, but responses were more diverse, suggesting that firms differ in their experiences regarding its direct financial benefits. Silva (2021) adds that such initiatives enhance legitimacy and competitive advantage as consumers and regulators favour eco-friendly practices. Taken together, the findings underscore that sustainable packaging is not only a tool for environmental stewardship but also a critical driver of cost efficiency, brand positioning, and profitability, with variations mainly determined by the level of integration into company operations.

5.3 Conclusions

The study concluded that energy efficiency has a significant positive effect on the profitability of companies listed at the Nairobi Securities Exchange. It established that firms which adopt effective energy management strategies, including cost control, regular monitoring, and investment in energy-saving initiatives, are better positioned to enhance their financial performance. The strong agreement among respondents underscores the value of integrating energy efficiency into core business operations, despite variations in practice across sectors. Ultimately, the evidence demonstrates that energy efficiency is not merely a cost-saving strategy but a strategic driver of competitiveness and long-term profitability.

The study concluded that solar lighting has a significant positive effect on the profitability of companies listed at the Nairobi Securities Exchange. It was established that firms adopting solar lighting benefit from reduced operational disruptions, affordable installation, and low maintenance costs, and enhance their financial performance. Although differences exist in the perceived cost–benefit trade-offs across sectors, the overall evidence indicates that solar lighting supports efficiency, reduces reliance on costly energy sources, and strengthens long-term profitability. This

demonstrates that solar lighting is not just an environmentally sustainable option but also a strategic tool for improving companies' profitability.

The study concluded that water recycling has a significant positive influence on the profitability of companies listed at the Nairobi Securities Exchange. It was established that firms that invested in efficient filtration systems and adopted recycling practices benefited from improved long-term financial performance, reduced wastewater output, and enhanced operational efficiency. While there is variation in the extent of direct cost savings, particularly in water-related expenses, the overall evidence shows that water recycling strengthens profitability while advancing environmental sustainability. This positions water recycling as both a financial and ecological strategy that companies can leverage for long-term competitiveness.

The study concluded that sustainable packaging has a significant positive effect on the profitability of companies listed at the Nairobi Securities Exchange. Firms that actively reduce packaging waste, incorporate recyclable materials, and adopt biodegradable solutions benefit from lower operational costs, stronger brand reputation, and improved long-term financial performance. Although some firms experience differences in the scale of impact due to varied adoption levels, the evidence consistently demonstrates that sustainable packaging enhances profitability while simultaneously advancing corporate responsibility and environmental sustainability.

5.4 Recommendation

The study recommends that energy efficiency, solar lighting, water recycling and sustainable packaging be prioritised as a strategic component of business operations for companies listed at the Nairobi Securities Exchange to reduce costs and enhance competitiveness. Firms should invest in technology and innovation practices that promote efficient energy use, establish systems for

continuous monitoring of consumption, and build internal capacity to implement innovative cost-saving measures.

In addition, industry regulators and policymakers should support companies through incentives, awareness programs, and guidelines that encourage the adoption of energy-efficient practices. By doing so, organisations can not only reduce operational costs but also strengthen their profitability and sustainability in an increasingly competitive market.

The study recommends that companies listed on the Nairobi Securities Exchange adopt solar lighting more widely as part of their operational and financial strategies. Firms are encouraged to invest in reliable solar lighting systems, not only to reduce disruptions and operational costs but also to improve sustainability and resilience against rising energy prices. To address sectoral variations, companies should conduct cost-benefit analyses tailored to their energy needs and explore financing models that ease the initial installation burden. Furthermore, policymakers and regulators should provide incentives such as tax rebates or subsidies to promote greater adoption, ensuring that firms across industries can fully harness the profitability benefits of solar lighting.

The study recommends that water recycling should be implemented and included as a strategic practice among companies listed at the Nairobi Securities Exchange. Therefore, firms are encouraged to invest in advanced filtration systems and develop capacity for large-scale recycling to ensure long-term profitability and operational efficiency. Additionally, companies should integrate water recycling into their sustainability frameworks to reduce environmental risks and regulatory costs while improving their corporate image. To enhance adoption across industries, policymakers and regulators should provide supportive incentives such as tax breaks, subsidies, or low-interest financing for green technologies, enabling firms with varying financial capacities to

invest in water recycling. Such measures will ensure that water recycling continues to deliver both profitability and sustainability benefits across different sectors. The study recommends that companies listed on the Nairobi Securities Exchange prioritise sustainable packaging as a strategic initiative. Firms should integrate recyclable and biodegradable materials into their packaging processes to reduce costs and strengthen their brand image among environmentally conscious consumers. Companies are also encouraged to invest in innovative waste management practices that align with global sustainability standards while improving efficiency. At the policy level, regulators and industry stakeholders should create frameworks that incentivise sustainable packaging through tax reliefs, subsidies, or recognition programs, thereby encouraging wider adoption across different sectors. Such efforts will not only improve firm-level profitability but also contribute to environmental conservation and sustainable economic growth.

5.5 Recommendation for Further Research

Future research should investigate the long-term impacts of sustainability practices such as energy efficiency, solar lighting, water recycling, and sustainable packaging on the profitability of companies listed at the Nairobi Securities Exchange. Such studies could focus on the relationships between green initiatives and sector-specific variations to explain why some industries experience greater financial benefits than others, while also examining the influence of regulatory policies, technological innovations, and financing mechanisms on adoption.

Longitudinal research would further provide valuable insights into how continuous investment in these sustainable practices contributes to profitability, competitiveness, and corporate sustainability over t

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APPENDICIES

Appendix I: Research questionnaire

Cover Letter

Sophie Kapkarich

23/07/2025

Dear Sir/Madam,

I am conducting an academic research project titled "**Effects of Green Initiatives on Profitability of Companies Listed at Nairobi Securities Exchange.**" This study seeks to explore how practices such as energy efficiency, solar lighting, water recycling, and sustainable packaging influence the financial performance of listed companies. The research focuses on companies listed on the Nairobi Securities Exchange. Your organization has been selected as a key participant for my research due to its industry relevance and contribution to sustainable practices.

The information gathered will be used strictly for academic purposes and will be treated with the highest level of confidentiality. The questionnaire is brief and should take only a few minutes of your time. Your participation will highly enhance the quality and relevance of this study. I kindly request your support and the support of relevant staff in completing the questionnaire. Thank you in advance for your cooperation and contribution to this important research.

Sincerely,

Sophie Kapkarich

SECTION A: Background of the Study / Demographic Information

Please respond by ticking (✓) the most appropriate option or filling in the blank where necessary.

A. Respondent Information

1. Age Bracket:

- ☐ 18–25 years
- ☐ 26–35 years
- ☐ 36–45 years
- ☐ 46–55 years
- ☐ Over 55 years

2. Highest Level of Education Completed:

- ☐ Diploma
- ☐ Bachelor's Degree
- ☐ Other (please specify): _____

3. Number of Years Worked in the Current Enterprise:

- ☐ Less than 1 year
- ☐ 1–3 years
- ☐ 4–6 years
- ☐ 7–10 years
- ☐ More than 10 years

4. Year the Enterprise Was Listed on the NSE:

- ☐ Before 2000
- ☐ 2000–2010
- ☐ After 2010

7. Sector/Industry Classification:

- ☐ Manufacturing
- ☐ Financial Services
- ☐ Energy & Petroleum
- ☐ Telecommunications
- ☐ Commercial & Services
- ☐ Construction & Allied
- ☐ Other (please specify): _____

8. The number of years the company has had in the green initiatives

- ☐ Less than 1 year
- ☐ 2–4 years
- ☐ 5–7 years
- ☐ 7–10 years

SECTION B: Effect of Energy Efficiency on Profitability

Instructions: Indicate the extent to which you agree with each statement by ticking the appropriate box.

1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

Number	Statement	1	2	3	4	5
1	The company regularly monitors its energy consumption.					
2	Energy consumption significantly affects the company's operational costs.					
3	The company has adopted measures that result in noticeable energy savings.					
4	Energy-saving initiatives contribute positively to profitability.					
5	Rising energy costs reduce the company's profit margins.					
6	Managing energy costs improves the company's financial performance.					

SECTION C: Effect of Solar Lighting on Profitability

Instructions: Please indicate the extent to which you agree with the following statements regarding solar lighting in your organization.

1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

Number	Statement	1	2	3	4	5
1	The initial installation cost of solar lighting is affordable for the company.					
2	The benefits of solar lighting outweigh its installation costs.					
3	The maintenance cost of solar lighting is manageable for the company.					
4	Low maintenance requirements of solar lighting improve profitability.					
5	Solar lighting provides reliable lighting for company operations.					
6	Reliable solar lighting reduces operational disruptions and supports profitability.					

SECTION D: Effect of Water Recycling on Profitability

Instructions: Please indicate the extent to which you agree with the following statements regarding water recycling in your organization.

1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

Number	Statement	1	2	3	4	5
1	The company recycles a significant volume of water for daily operations.					
2	Increased recycled water volume has reduced overall water expenses.					
3	Water recycling has reduced the company's wastewater output.					
4	Lower wastewater discharge has contributed positively to profitability.					
5	The cost of filtration is affordable for the company.					
6	Investment in filtration systems improves long-term profitability.					

SECTION E: Effect of Sustainable Packaging on Profitability

Instructions: Please indicate the extent to which you agree with the following statements regarding sustainable packaging in your organization.

Number	Statement	1	2	3	4	5
1	Reducing packaging waste has lowered operational costs for the company.					
2	Managing packaging waste contributes positively to company profitability.					
3	Using recyclable content in packaging has reduced material expenses.					
4	Recyclable packaging improves brand reputation and financial performance.					
5	The company actively uses biodegradable packaging materials.					
6	Biodegradable packaging supports long-term profitability.					

SECTION F: Profitability of Companies

Instructions: Please indicate the extent to which you agree with the following statements regarding the financial performance of your organization.

1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

Number	Statement	1	2	3	4	5
1	The company consistently records positive operating income.					
2	Higher operating income has strengthened the company's profitability.					
3	The company has experienced steady revenue growth in recent years.					
4	Revenue growth contributes directly to improved profit levels.					
5	The company records consistent growth in sales volume.					
6	Increased sales volume has a positive impact on company profitability.					

Appendix II: Research Authorization Letter



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KCA UNIVERSITY SCIENTIFIC & ETHICS REVIEW COMMITTEE

REF: KCAU/SERC/SOB0280

Date: 8TH SEPTEMBER, 2025

TO: SOPHIE KAPKARICH (24/04297)

Dear Sir/Madam,

RE: GREEN INITIATIVES AND PROFITABILITY OF COMPANIES LISTED AT THE NAIROBI SECURITIES EXCHANGE

This is to inform you that the KCA University Scientific Ethics Review Committee (KCAUSERC) has reviewed and approved your research proposal. Your application approval number is **KCAUSERC/SOB0280**. The approval period is **8th September, 2025 – 8th September, 2026**. This approval is subject to compliance with the following requirements.

- i. Only approved documents, including informed consents, study instruments, and MTAs, will be used.
- ii. All changes, including (amendments, deviations, and violations), are submitted for review and approval by **KCAUSERC**.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events, whether related or unrelated to the study, must be reported to **KCAUSERC** within 72 hours of notification.
- iv. Any changes, anticipated or otherwise, that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **KCAUSERC** within 72 hours.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days before expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to **KCAUSERC**.

Before commencing your study, you will be expected to obtain a research license from the National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,

Dr. Caroline Ntara,
Chairperson,
KCA University Scientific & Ethics Review Committee.



Appendix III: NACOSTI Letter

 REPUBLIC OF KENYA	
RefNo: 858060	Date of Issue: 16/September/2025
RESEARCH LICENSE	
	
This is to Certify that Miss. Sophie Kapkarich Kapkarich of KCA University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: GREEN INITIATIVES AND PROFITABILITY OF COMPANIES LISTED AT THE NAIROBI SECURITIES EXCHANGE for the period ending : 16/September/2026.	
License No: NACOSTI/P/25/4179680	
858060	
Applicant Identification Number	Ag. Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
	Verification QR Code
	
NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.	
See overleaf for conditions	

Appendix IV: List of companies listed on the Nairobi Securities Exchange

No.	Name of Company
1	Eaagads Ltd
2	Kapchorua Tea Co. Ltd
3	Kakuzi Ltd
4	Limuru Tea Co. Ltd
5	Sasini Ltd
6	Williamson Tea Kenya Ltd
7	Car & General (K) Ltd
8	Absa Bank Kenya PLC
9	Stanbic Holdings Plc
10	I&M Holdings Ltd
11	Diamond Trust Bank Kenya Ltd
12	HF Group Plc
13	KCB Group Ltd
14	NCBA Group PLC
15	Standard Chartered Bank Kenya Ltd
16	Equity Group Holdings Plc
17	The Co-operative Bank of Kenya Ltd
18	Express Ltd
19	Kenya Airways Ltd
20	Nation Media Group Ltd
21	Standard Group Ltd
22	TPS Eastern Africa (Serena) Ltd
23	Scangroup Ltd
24	Uchumi Supermarket Ltd
25	Eveready East Africa Ltd
26	Longhorn Publishers Ltd
27	Deacons (East Africa) Plc
28	Sameer Africa PLC (Sameer Africa Ltd)
29	Nairobi Business Ventures Ltd
30	Homeboyz Entertainment PLC (if listed)
31	Athi River Mining (ARM Cement)
32	Bamburi Cement PLC
33	Crown Paints Kenya PLC
34	E.A. Cables PLC
35	E.A. Portland Cement Ltd
36	Total Kenya Ltd
37	KenGen Ltd
38	Kenya Power & Lighting Co. Ltd
39	Umeme Ltd

40	Jubilee Holdings Ltd
41	Sanlam Kenya PLC
42	Kenya Re-Insurance Corp. Ltd
43	Liberty Kenya Holdings Ltd
44	Britam Holdings Ltd
45	CIC Insurance Group Ltd
46	Olympia Capital Holdings Ltd
47	Centum Investment Co. Ltd
48	Trans-Century Ltd
49	Home Afrika Ltd
50	Kurwitu Ventures
51	Nairobi Securities Exchange Ltd
52	B.O.C Kenya Ltd
53	British American Tobacco Kenya Ltd
54	Carbacid Investments Ltd
55	East African Breweries Ltd
56	Mumias Sugar Co. Ltd
57	Unga Group Ltd
58	Kenya Orchards Ltd
59	Flame Tree Group Holdings Ltd
60	Safaricom PLC
61	Laptrust Imara I-REIT (REIT)
62	ABSA New Gold ETF (ETF)