GREEN INNOVATION STRATEGY AND PERFORMANCE SUSTAINABILITY OF ISO 14001 CERTIFIED MANUFACTURING FIRMS IN NAIROBI CITY COUNTY, KENYA

BY

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NOVEMBER 2023

DECLARATION

This thesis is my original work and has not been presented for award of a degree in any other institution or university.

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DEDICATION

I dedicate this research to my beloved wife Patriciah Muthoki. No words can express my gratitude for support and encouragement that you gave me in this academic journey. You are an angel in my life. I further dedicate this study to my parents Sammy and Christine Mawia 'The Samkos' for ensuring you took me to school together with my other 9 siblings and for teaching me the value of hard work. Lastly, I dedicate this work to all my friends and in particular my childhood friend James Nyamai (TSC Sub County Director–Machakos County) who for the last 30 years has kept encouraging me to go for bigger things no matter the humble beginning.

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TABLE OF CONTENTS

DECLARATION ..... **ii**
DEDICATION ..... **iii**
ACKNOWLEDGEMENT ..... **iv**
TABLE OF CONTENTS ..... **v**
LIST OF TABLES ..... **ix**
LIST OF FIGURES ..... **x**
ABBREVIATIONS AND ACRONYMS ..... **xi**
OPERATIONAL DEFINITION OF TERMS ..... **xiv**
ABSTRACT ..... **xvi**
CHAPTER ONE: INTRODUCTION **1**
1.1 Background of the Study 1
1.1.1 Performance Sustainability of Firms 5
1.1.2 Green Innovation Strategy 8
1.1.3 Competitive Advantage 11
1.1.4 Regulatory Framework 14
1.1.5 ISO 14001 Certified Manufacturing Firms in Kenya 17
1.2 Statement of the Problem 19
1.3 Objectives of the Study 22
1.3.1 General Objective 22
1.3.2 Specific Objectives 22
1.4 Research Hypothesis 23
1.5 Significance of the Study 24
1.6 Scope of the Study 25
1.7 Limitations of the Study 26
1.8 Organization of the Study 26
CHAPTER TWO: LITERATURE REVIEW **28**
2.1 Introduction 28
2.2 Theoretical Literature Review 28
2.2.1 Triple Bottom Line Theory 28
2.2.2 Green Business Model Innovation (GBMI) 30
2.2.3 Resource Based View (RBV) Theory 32
2.2.4 Institutional Theory 35
2.2.5 Stakeholders Theory 36

2.3 Empirical Literature Review 38
2.3.1 Green Product Innovation Strategy and Performance Sustainability 38
2.3.2 Green Process Innovation Strategy and Performance Sustainability 41
2.3.3 Green Marketing Innovation Strategy and Performance Sustainability 44
2.3.4 Green Organizational Innovation Strategy and Performance Sustainability 47
2.3.5 Green Innovation Strategies, Competitive Advantage and Performance Sustainability 49
2.3.6 Green Innovation Strategies, Regulatory Framework and Performance Sustainability 52
2.4 Summary of Research and Knowledge Gaps 55
2.5 Conceptual Framework 67
CHAPTER THREE: RESEARCH METHODOLOGY 69
3.1 Introduction 69
3.2 Research Philosophy 69
3.3 Research Design 70
3.4 Empirical Model 71
3.4.1 Test for Mediation 72
3.4.2 Test for Moderation 74
3.5 Target Population 75
3.6 Sampling Procedure and Sample Size 76
3.7 Data Collection Instruments 77
3.8 Instruments Validity and Reliability 78
3.8.1 Validity of Research Instruments 78
3.8.2 Reliability of the Instruments 79
3.9 Data Collection Procedures 80
3.9.1 Operationalization and Measurement of Variables 81
3.10 Diagnostic Tests 84
3.10.1 Normality Test 84
3.10.2 The Linearity Test 84
3.10.3 Multi-Collinearity 85
3.10.4 Homoskedasticity/ Homogeneity 85
3.11 Data Analysis and Presentations 86
3.11.1 Control of Type I and Type II Errors 90

3.12 Research Ethics 90
CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSION 92
4.1 Introduction 92
4.2. Descriptive Analysis 92
4.2.1 Analysis of Response Rate 92
4.2.2 Demographic Characteristics of Respondents 93
4.2.3 Firm's Characteristics 96
4.2.4 Green Product Innovation Strategy 98
4.2.5 Green Process Innovation Strategy 101
4.2.6 Green Marketing Innovation Strategy 105
4.2.7 Green Organizational Innovation Strategy 108
4.2.8 Competitive Advantage 112
4.2.9 Regulatory Framework 116
4.2.10 Performance Sustainability of ISO 14001 Certified Manufacturing Firms 120
4.3 Inferential Statistics 126
4.4 Diagnostic Test 126
4.4.1 Normality Test 126
4.4.2 The Linearity Test 127
4.4.3 Multi-Collinearity 129
4.4.4 Homoskedasticity/ Homogeneity 130
4.5 Test of Hypotheses 131
4.5.1 Green Product Innovation Strategy and Performance Sustainability 133
4.5.2 Green Process Innovation Strategy and Performance Sustainability 135
4.5.3 Green Marketing Innovation Strategy and Performance Sustainability 136
4.5.4 Green Organizational Innovation Strategy and Performance Sustainability 138
4.5.5 Green Innovation Strategy, Competitive Advantage and Performance Sustainability 139
4.5.6 Green Innovation Strategy, Regulatory Framework and Performance Sustainability 147
4.6 Qualitative Data Analysis 153
4.6.1 Green Product Innovation Strategy 153
4.6.2 Green Process Innovation Strategy 154

4.6.3 Green Marketing Innovation Strategy 154
4.6.4. Green Organizational Innovation Strategy 155
4.6.5 Competitive Advantage 155
4.6.6 Regulatory Framework 156
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS 158
5.1 Introduction 158
5.2 Summary 158
5.3 Conclusion 161
5.4 Contribution of the Study to Knowledge 163
5.5 Recommendations for Policy and Practice 165
5.6 Recommendations for Further Studies 168
REFERENCES 169
APPENDICES 187
Appendix I: Introductory Letter 187
Appendix II: Questionnaire 188
Appendix III: Research Approval Letter 197
Appendix IV: Graduate School Research Authorization Letter 198
Appendix V: NACOSTI Research Authorization Licence 199
Appendix VI: ISO 14001 Certified Manufacturing Firms in Nairobi City County 200

LIST OF TABLES

Table 2.1: Previous Studies and Knowledge Gaps Summary 58
Table 3.1: Criteria for Mediation Decision 74
Table 3.2: Distributions of the Respondents 76
Table 3.3: Reliability Test results 79
Table 3.4: Variables Operationalization 82
Table 3.5: Statistical Tests of Hypotheses 88
Table 4.1: Demographic Characteristics of Respondents 94
Table 4.2: Firm's Characteristics 96
Table 4.3: Descriptive Statistics on Green Product Innovation Strategy 98
Table 4.4: Descriptive Statistics on Green Process Innovation Strategy 102
Table 4.5: Descriptive Statistics on Green Marketing Innovation Strategy 106
Table 4.6: Descriptive Statistics on Green Organizational Innovation Strategy 109
Table 4.7: Descriptive Statistics on Competitive Advantage 113
Table 4.8: Descriptive Statistics on Regulatory Framework 117
Table 4.9: Descriptive Statistics on Performance Sustainability 120
Table 4.10: Shapiro-Wilk Statistics 127
Table 4.11: Linearity Test 128
Table 4.12: Collinearity Statistics 129
Table 4.13: Levene Statistics 130
Table 4.14: Regression Results for Direct Relationship 132
Table 4.15: Regression Results for GIS on Performance Sustainability 140
Table 4.16: Regression Results for GIS and Competitive Advantage 141
Table 4.17: Regression Results for Competitive Advantage and Performance Sustainability 143
Table 4.18: Mediation Results 144
Table 4.19: Decision Criteria for Mediation 145
Table 4.20: Regression Results for GIS, RF and Performance Sustainability 148
Table 4.21: Regression Results for Moderation 149
Table 4.22: Decision Criteria for Moderation 150

LIST OF FIGURES

Figure 2.1: Conceptual Framework 67

Figure 4.1: Response Rate 93

ABBREVIATIONS AND ACRONYMS

BMI	Business Model Innovation
CGGCC	Centre for Green Growth and Climate Change
CSR	Corporate Social Responsibility
COVID-19	Corona Virus Disease -19
DANIDA	Danish International Development Agency
EIA	Environmental Impact Assessment
EMS	Environmental Management Systems
EMCA	Environment Management Coordination Act
ESG	Environmental, Social and governance
GDP	Gross Domestic Product
GIS	Green Innovation Strategy
GMO	Green Market Orientation
GMIS	Green Marketing Innovation Strategy
GOIS	Green Organizational Innovation Strategy
GoK	Government of Kenya
GPI	Green Product Innovation
GPIS	Green Product Innovation Strategy
GPrD	Green Product Development
GPrIS	Green Process Innovation Strategy
HRM	Human Resource Management
ICT	Information Communication Technology
ISSD	International Institute of Sustainable Development
ISO	International Standards of Organization
ITC	International Trade Centre

KAM	Kenya Association of Manufacturers
KEBS	Kenya Bureau of Standards
KNCPC	Kenya National Cleaner Production Centre
LCDs	Least Developed Countries
MPA	Manufacturing Priority Agenda
MVA	Manufacturing Value Added
NACOSTI	National Commission for Science, Technology and Innovation
NCCAP	National Climate Change Action Plan
NEMA	National Environment Management Authority
OECD	Organization of European Economic Development
OHS	Occupational health and safety
OECD	Organization for Economic Cooperation and Development
PDCA	Plan-Do-Check- Act
ROI	Rate of Investment
ROE	Return on Equity
RoK	Republic of Kenya
SMEs	Small and Medium Enterprises
SPSS	Statistical Package for Social Sciences
SEM	Structural Equation Modeling
SSA	Sub-Saharan African
STRs	Sustainability Reporting Tools
SD	Sustainable Development
SDGs	Sustainable Development Goals
SGS	Société Générale de Surveillance
TBL	Triple Bottom Line

UK	United Kingdom
UN	United Nations
US	United States
WCED	World Commission on Environment and Development

OPERATIONAL DEFINITION OF TERMS

Competitive Advantage	These are distinct attributes which firm has which enable the firm to operate more efficiently and in an environmentally friendly way thus superseding performance of their competitors.
Environmental Performance	It is extent to which firm achieve its target of reducing effects of manufacturing activities on the environment through reducing pollution and waste emission, efficient utilization of natural resources and energy and reducing cost of environmental accidents
Financial Performance	It is extent to which firm to achieve its economic targets of the firm through increasing their profitability, reducing cost of materials and energy, return on investments and increasing their market shares.
Firm Sustainability	It is extent to which firm achieves its financial, social and environmental performance targets.
Green Innovation	It involves coming up with new methods, processes, and technologies that add value to the products in an environmentally friendly manner
Green Innovation Strategy	It is approach which involves coming up with new products, processes, methods and technology that are environmentally friendly
Green Marketing Innovation Strategy	It is an approach which enable firm adopt new methods of introducing products to the market in a sustainable and environmentally friendly manner
Green Organizational Innovation Strategy	It is an approach which enables a firm to modify its management systems and business practices to adopt environmentally friendly practices in their operations

Green Process Innovation Strategy	It is an approach which enables firm to adopt novice and efficient production methods and technologies that make firm to be efficient and operate in environmentally friendly manner
Green Product Innovation Strategy	It is an approach which enables firm to use its creative ideas to come up with new products that are environmentally friendly
Intellectual Capacity Utilization	It is using of the cognitive or the intellectual potentials of firm's management in helping firms operate efficiently and in an environmentally friendly manner
ISO Certification	It is an achievement or award given to firms for recognition after meeting certain standards in their operations
Manufacturing Firms	These are firms which are involved in transformation of raw materials (Inputs) in to final products (Output) by adding value to them before taking them to market.
Performance Sustainability	This is ability of a firm to meet economic, social and environmental targets
Regulatory Framework	It is regulations, policies, standards, guidelines and laws that govern how firms should operate in an environmentally friendly way
Social Performance	It is ability of the firm to achieve its targets of improving lives of their employees and the society around the firm through ensuring safety and satisfaction of employees, stakeholders and firm consumers.

ABSTRACT

Performance sustainability has been a major concern for most firms operating in manufacturing sector in Kenya. There has been an increase in environmental crisis related to pollution and unmanaged waste disposal in the industrial sector. Most firms in the manufacturing sector have witnessed a declined profit and 55% of firms having high impact on the environment. Despite clear regulatory framework and increased ISO 14001 certification of firms which is critical as firms go green, challenges relating to performance sustainability of manufacturing firms are still high. This study investigated effect of GIS on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The specific objectives of the study were to determine effect of green product innovation strategy, green process innovation strategy, green marketing innovation strategy and green organizational innovation strategy on the performance sustainability of ISO 14001 certified firms in manufacturing sector in Nairobi, Kenya. The study further established the mediating effect of competitive advantage and the moderating effect of regulatory framework on the relationship between green innovation strategy and performance sustainability of ISO 14001 certified firms in Nairobi, Kenya. The study was guided by triple bottom line theory, green business model innovation, resource-based view theory, institutional theory and stakeholder's theory. Positivism philosophy was adopted in this study involving descriptive and explanatory research design. The target population was 60 ISO 14001 certified manufacturing firms in Nairobi, Kenya. Census of the 60 ISO 14001 certified firms was done where the unit of observation was 300 respondents obtained from the heads of finance, human resource, marketing, ICT and operations departments. To collect data, semi-structured questionnaires were used which were administered through mail survey and drop and pick methods. Face, content and construct validity were used to analyse validity of the tools while reliability was analysed using Cronbach's Alpha coefficient whose threshold was coefficient above 0.7. The response rate was seventy six percent which was sufficient for making inferences and drawing conclusion. Descriptive statistics was summarized using frequencies, percentage, mean and standard deviations. Multiple regression analysis was used for inferential statistics to test hypotheses. Inferential statistics was reported using adjusted coefficient of determination (R^2), F statistics (ANOVA), unstandardized coefficients (beta values) and p values at 0.05 level of significance. The quantitative data was presented inform of figures and tables while qualitative data was presented in narrative form. The findings indicated that GIS had significant positive effect on the performance sustainability of ISO 14001 certified firms. Moreover, green product, green process, green marketing and green organizational innovation strategy were found to be statistically significant and had effect on the performance sustainability. Competitive advantage partially mediated the relationship between GIS and performance sustainability. Lastly, regulatory framework had negative moderating effect on the relationship between GIS and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County in Kenya. The study recommends that the management of manufacturing firms need to come up with green practices which enhances all aspects GIS in order to improve performance sustainability of manufacturing firms. Management of manufacturing firms going green need to leverage on aspects that aids firm to gain competitive advantage like green automation to promote performance sustainability of firms. The government and other stakeholders in manufacturing are advised to come up with flexible regulatory framework which encourages firms to adopt green innovation and at same time attain performance sustainability for manufacturing firms.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Manufacturing is a principal tool for global growth of the economy (United Nations, 2017). Manufacturing entails transforming input (in order to add value in the inputs) in to complete goods and services that can be taken to the market for selling (Levinson, 2018). Globally, manufacturing has grown for the last two decades with Manufacturing Value Added (MVA) increasing by 22.6 percent for the period between 2005 and 2016 although it was least in Least Developed Countries (LDCs) (UN, 2017; World Bank, 2018).

Sustainable manufacturing has gained prominence over the last few decades which is linked to Sustainable Development (SD) concept. The idea of developing sustainably originated from Stockholm conference by UN relating to human environment in 1972 (WCED, 1987; Gholami, Rezaei, Saman, Sharif & Zakuan, 2016). Quest for sustainable manufacturing was intensified after the 1992 'Rio de Janeiro Earth summit' held in Brazil (UN, 1993). The core intention was to transit from 'traditional manufacturing' to sustainable manufacturing which considered environmental concern which was popularized as 3Rs - reduce, reuse and recycle. Recently, sustainable manufacturing has been expanded to cover 6Rs whose scope is re-manufacture, recover, reduce, recycle, redesign and reuse which has formed basis for green innovation and green circular economy (Gholami, et al., 2016).

The pursuit towards green economy and sustainable manufacturing has been triggered by world experiencing increased climatic changes and environmental degradation

(Borowski, 2020). If world doesn't adopt sustainable manufacturing, it is expected by 2050; material consumption would rise to double while annual waste generation would increase by 70% (Kaza, Yao, Bhada-Tata, & VanWoerden, 2018). Adoption of green economy and sustainable manufacturing helped achieve climatic neutrality and demystify link between economic growth and escalated resource utilization (De Giovanni & Zaccour, 2019).

Denmark leads the world on green economy transition which is anchored on national energy policy and strong engagement in the global debate on green economy. Danish International Development Agency (DANIDA) has supported green growth and climate change mitigation with its development partners (DANIDA, 2011). Green growth connects with Sustainable Development Goals (SDGs) agenda 2030. The goal number 9 advocate for investment on resilient infrastructure, innovation and technology to support manufacturing sector in order to enhance economic growth, job creation and functioning of business and society (UN, 2017). The SDGs goal number 13 also advocate for urgent actions to combat climatic changes and its impacts which green innovation strategy aim to address (UN, 2017).

Manufacturing has not grown consistently in Sub-Saharan African (SSA) and Africa in general. The sector growth SSA has dwindled for the last 10 years with 2019 recording 3.1 percent growth compared to 3.3 percent in 2018 (Kenya National Bureau of Statistics, 2020). The growth has been complicated by inadequate finance, increased geopolitical tension and protectionism (KNBS, 2020). African Agenda 2063 goal number 4 call for transformed economies which advocate for Science Technology and Innovation (STI) driven manufacturing and value addition while goal

number 7 call for environmentally sustainable and climate resilient economies and communities which sustainable manufacturing endeavour to address (AU, 2013).

Kenya is most industrialized country in Eastern and central Africa and in SSA with 80% of the firms located in Nairobi City. Government of Kenya has prioritized manufacturing as key economic pillar in as it is anchored in the 'The Big 4 agenda' and 'Vision 2030' which would stimulate economic development in the country (Kenya Association of Manufacturers, 2019). It is however noted that the sector growth rate has been inconsistent for last 10 years and has lagged behind other sectors with 2019 indicating a declined growth of 3.1% from 4.3% in 2018 (KAM, 2019; KNBS, 2020).

The Kenyan push for sustainable manufacturing is dated back in 1999 when Environment Management Coordination Act (EMCA) was enacted which established National Environmental Management Authority (NEMA) (RoK, 1999). EMCA recommended need for a national policy on environmental sustainability as manufacturing contributed to environmental degradation heavily. Kenya is transiting to green manufacturing where natural assets would be utilized in a sustainable manner while mitigating impact to the people and the environment. Recently for instance, Kenya banned plastic carrier bags through gazette notice No. 2356 which accounted to 9% of the total waste in pursuit of clean production (NEMA, 2018).

Kenya Association of Manufacturers has established Centre for Green Growth and Climate Change (CGGCC) to promote green economy, import-substitution, climate change actions and emphasize on sustainable manufacturing. The Kenyan government through the Ministry of Environment has come up with National Climate Change

Action Plan (NCCAP) which operational between 2018 and 2022 and which advocate for sustainable manufacturing (KAM, 2019). Kenya in 2023 hosted Africa Climate Summit at Nairobi which provided platform for policymakers, practitioners, business people, civil society to interact and show case climatic solutions, identify barriers and opportunities realised in different African region (UNEP, 2023).

Most manufacturing firms in Kenya hardly report on their sustainability strategies. Research by KPMG (2017) indicated that it is only 29 out of 65 listed companies which reported their economic, social and environmental policies and implementation in their annual reports and websites. As Kenya focus on manufacturing to guide its economic growth to double digit and for manufacturing to contribute to 15% of Gross Domestic Product (GDP), sustainable manufacturing is noted to be critical (KAM, 2019).

Jawahir, Badurdeen and Rouch (2014) noted that sustainable manufacturing must help mitigate adverse ecological burden, improve efficiency in utilization of energy and materials. This should extent to reducing waste emission, provide quality health of employees and have cost benefits. They advocate for consideration of economic, societal and environmental impact of manufacturing in the entire product life cycle that is before manufacturing, during manufacturing, product use and after using the product (Gholami, et al., 2016).

Sustainable manufacturing is a key strategy that is linked to green innovation and sustainability of firms (Zailani, 2010; Tariyan, 2016). Achieving ISO 14001 certification relates to Environmental Management Systems (EMS) which has been identified as paramount factor as firms relentlessly work towards green innovation

practices, sustainable manufacturing and ensuring performance sustainability of firms (Testa & Irlado, 2010). ISO 14001 certification enables firms to meet legal and customer needs and build a good relationship with its stakeholders and employees in order to address the imminent question of sustainability of firms (ISO, 2015). It is therefore necessary to investigate how green innovation strategy relate to performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

1.1.1 Performance Sustainability of Firms

Definition of performance sustainability of firms is diverse and depends on various paradigms. It is linked to sustainable development which relates to addressing immediate needs without compromising ability to meet future needs (Gholami, et al., 2016: International Trade Centre, 2019). However, it shouldn't be vague and un-operationalized as it focused mostly on economic growth with little concern on other aspects of sustainable development like social and environment aspects (Amini & Bienstock, 2014).

According to Amini and Bienstock (2014), performance sustainability of a firm relates to how firm's strategy, innovation and level of compliance with regulatory framework are interconnected and their importance in balancing performance of firms economically, socially and environmentally. ITC (2019) defines performance sustainability as ability of firms to incorporate social, economic and environmental factors in to firm's strategy and investment decisions. It relates to mitigating negative effect of business operations while maximizing positive effect of business practices on the environment, community and the economy (ITC, 2019).

Sustainability reporting is best practice for reporting whether firm want to develop and demonstrate its greenness or community-oriented credentials (Kenton, 2020). There are various Sustainability Reporting Tools (SRTs) that have been developed to measure sustainability of firms. These tools include: Triple Bottom Line (TBL) reporting, Sustainable Development (SD) reporting, Corporate Social Responsibility (CSR) reporting, Environmental, Social and governance (ESG) reporting tools.

The sustainability commentary between 1970s and 80s focused on CSR reporting on company's compliance with environment management. This shifted in 1990s to addressing issues relating to community, health and safety and then later the institutionalization of the Triple Bottom Line (TBL) concept (Marlin & Marlin, 2003). TBL has become a key tool for reporting sustainability of firm and it advocate for reporting both financial and nonfinancial aspects of the firm (Kenton, 2020).

The TBL expands the scope of measuring performance from focusing on monetary/ economic dimension (profitability) to using three dimensions that is economic, social and environment performance which are referred as bottom lines (Kraaijenbrink, 2019). The three bottom lines are referred as 3Ps that is Profit, Planet and People and form basis of sustainability of firms (Elkington, 1994). The scholar noted that firms should not aim at making profit (Financial gains) alone but should be structured in manner that it also improves lives of people (social bottom) and the planet (environment bottom) over time. Profits alone cannot account for full cost of doing business thus firms ought to be more proactive on their environmental and social stance as they move towards sustainable manufacturing practices (Huanga & Badurdeen, 2017).

According to Kraaijenbrink (2019), the profit bottom represents economic or firms performing financially which can be operationalized using cost for materials, energy, fee for waste treatment and fine for environmental accidents. Gholami, Sulaiman, Ramayah and Molla (2013) measured financial performance using profitability, Rate of Investment (ROI) and market share. The People bottom on the other line examine the employees and society around where firm operate. It is where firm serve interest of others as its own (Kraaijenbrink, 2019). Huanga and Badurdeen (2017) operationalize social performance using employees, customer and stakeholder's health, safety and their satisfaction.

Planet bottom line measure whether firms are able to reduce ecological foot prints, reduce waste, invest in renewable energy and manage natural resources more efficiently (Kenton, 2020). Zhu et al., (2008) measure environmental performance by assessing if there is reduced pollution, greenhouse gas and waste emissions, environmental accidents, reduced cost of green purchasing, logistics, material recovery, level of recycling and frequency environmental penalties. Study by Huanga and Badurdeen (2017) measured environmental performance using parameters like energy and material efficiency, level of waste and emissions and Percentage of product EOL recovered

Kenton (2020) observed that as firm pursue performance sustainability of firm; all the three-bottom line should not oppose each other for a firm to be sustainable. This study operationalized performance sustainability of firms using financial, social and environmental performance which was borrowed from the TBL paradigm. Financial performance was measured using profitability and market share. Social performance

was measured using indicators like employee and customer satisfaction. Environmental performance was measured using indicators like environment-based awards, energy awards and recognition by relevant bodies like KAM.

1.1.2 Green Innovation Strategy

The concept of green innovation strategy is related to sustainable development. Green innovation has many definitions and it relates to the concepts like: environmental innovation, eco-technologies, green technologies and eco-innovation which are used indistinguishably by different authors (Schiederig, Tietze & Herstatt, 2012; Calza, Parmentola & Tutore, 2017). According to Chen, Lai and Wen (2006) green innovation can be defined as hardware or software invention that is connected to goods or methods involving technology that saves energy, recycles and minimise waste, mitigate pollution, come up with green product designs and promote environmental management.

Green innovation has been embraced as a solution to escalating environmental challenges and to enable firms to operate in a sustainable way (Hernandez-Vivanco, Bernardo & Cruz-Cázares, 2018). According to Tariq, Badir, Tariq and Bhutta (2017), green innovation creates value to stakeholders when they intertwine environmental, social and economic aspects of performance of a firm. This has enabled firms achieve its financial targets while addressing environmental challenges relating to manufacturing activities of the firms.

Green innovation strategy has various perspectives which have been expanded from the tradition Schumpeterian school of thought of innovation. According to Rennings (2000), innovation is categorized in terms of process, product and organizational

perspectives. OECD (2009) categorized green innovation strategy using aspects product, process, marketing and organizational perspectives. This study viewed green innovation strategies using OECD paradigm to offer a broader view of the variable.

Green Product Innovation Strategy (GPIS) entails utilisation of novel ideas which result to new designs and manufacturing of new products whose greenness significantly outclass the existing, conventional and rival product (Soylu & Dumville, 2011; Hassan & Ali, 2015). To identify green products precisely, the original raw material ought to be renewable, reduce water effluent, allow waste treatment like recycling, use of less or non-polluting and non-toxic materials and consume less energy during manufacturing (Chiou, Chan, Lettice & Chung, 2011; Zailani et al, 2015). GPIS is wrapped up with 'Three Rs' –reduce, reuse and recycle (Albino *et al.*, 2009; Chuang & Yang, 2014).

Study by Ma, Yin, Pan, Cui, Xin & Rao (2018) indicated that green product innovation significantly contributed to performance sustainability. Ar (2012) indicated that firms gain competitive advantage if they consider environmental issues in coming up with their products. Green product innovation was measured using green differentiated products, products from recycled materials, environmentally friendly products, green labelling and product design modification. This study measured GPIS using products with reusable components, products from recycled materials, products with non-toxic elements and products with after-use instructions.

Green Process Innovation Strategy (GPrIS) is an approach involving utilization of novice and improved production methods and machinery which reduced

environmental burden by reducing adverse environmental, social, human and economic impacts while influencing firm performance in industrial set up (OECD, 2009; Ma *et al*, 2017). Ma, *et al.* (2017) conceptualized green process innovation strategy in terms of efficiency in energy and material utilization and waste emissions. GPrIS is linked to performance sustainability of firms in the manufacturing set up (Xie, *et al.*, 2016). This study measured GPrIS in terms of energy consumption, material consumption, waste material management and green process design.

Green Marketing Innovation Strategy (GMIS) involves coming up with new practices, policy and methods of introducing products in the market in an environmentally friendly way to generate revenue by offering exchanges that fulfil individual and organizational objectives (Eneizan & Wahab, 2016). GMIS has led to increased profitability and reduced cost. It has further improved green product positioning and optimization their market performance when pro-social marketing strategies are credible and trusted (Ackerstein & Lemon, 1999; Leonidou, Katsikeas & Morgan, 2013).

GMIS revolves around four elements of green marketing mix that is: green product, place, promotion and pricing which cover the entire supply chain (Fotiadis, & Christodoulides, 2013). Study by Pathak (2017) operationalized GMIS in terms of green marketing mix that encompass green product, place, price and promotion which was linked to performance sustainability. This study measured GMIS using green branding, green distribution, green pricing and green advertisement.

Green Organizational Innovation Strategy (GOIS) entails new forms of management which incorporate environment management systems and attributes that are linked to standards, guidelines and sustainable management of firms (Maas & Reniers, 2013). Tarijan (2016) noted that there should be clear green objectives and strategies that are connected with firm's activities and budget in order to promote green innovation. Study by Banyhamdan, Al-Ghdabi and Almomani (2019) viewed GOIS based on green human resource practices while Chukwuka and Eboh (2018) conceptualized GOIS using green business practices which are noted to have significant effect on firm sustainability. This study measured GOIS using green business practices, green support systems, environmental knowledge transfer practices and green human resource practices.

1.1.3 Competitive Advantage

According to Christensen (2010) competitive advantage is defined as the benefit a firm offer that generates interests among its consumers to buy their product unlike those of their opponents and which limit ability of the competitors to imitate. It can be qualified as attributes and resources of a firm which make a firm do better than competitors (Leaning, 2009; Singh, 2012). Competitive advantage is relative and can't be owned by a single firm but by group of firms; what matter is which firm supersede other firms by offering superior products which consider both price and non-price qualities (Ambatha & Momaya, 2004).

For sustainable competitive advantage, firms need to withstand competition by making sure competitors can't duplicate positive benefit of the strategy (Barney, 1991). Christensen (2010) noted that attaining competitive advantage require

knowledge on the type of competitors firm has and speed at which consumer's needs are shifting. Resources ought to be unique, valuable, non-transferable and can't be duplicated and need to be properly matched with strategy in a distinct and superior way (Barney, 1991; OECD 2009; Calza, *et al.*, 2017).

Porter (1985) noted that for firms to be competitive there are three key strategies namely: differentiation, cost leadership and focus which helped firm outshine their opponents. Cost leadership strategy enables firms to come up with products with acceptable features by consumers at a relatively lower price than their competitors (Kimiti, Muathe & Murigi, 2020). Success of cost leadership strategy requires reduction of production cost, Research and Development (R&D), reduction of promotion cost and overheads controls in order to achieve low cost position. According to Atikiya, Mukulu, Kihoro and Waiganjo (2015) cost advantage may emanate mostly from efficiency in operations, economies of scope and scale.

Economies of scale involves increasing efficiency through increasing volume of production which in long run reduce average cost per unit (Barney & Hesterly, 2009). On the other hand, economies of scope allow firms to multi task efficiently on utilization of resources, attain synergies in operations and enable resource deployment (Zahavi & Lavie, 2013). Operational efficiency involves effective implementation of firm's processes which in long run leads to cost reduction (Espirah & Murigi, 2019).

Differentiation strategy offer unique products while obtaining price premium that exceeds cost of differentiation (Fogel, 2017). Differentiation strategy should be incorporated in the entire product life cycle to add value so as to distinguish how firm meets consumer heterogeneous needs uniquely (Fogel, 2017). Tacit Knowledge which

is personal is utilized on specific firm activities (Njoroge, 2015). It may entail exploitation of intellectual capabilities of team players uniquely while adopting green innovation to gain competitive advantage (Etzion, 2007; Marin *et al.*, 2015). Lozano (2011) notes unique cognitive abilities, behaviour, attitude and experience owned by individual prompt competitive advantage which can support firm in going green.

Differentiation strategy may further entail efficient utilization of internal capabilities while converting inputs in to output in a firm (Salim, Ab Rahman, & AbdWahab, 2019). This may involve synchronization of resources and capabilities all departments that are involved in value addition and are interlinked so as to be efficient (Iversen, 2000). This can be achieved through automation of all departments such that it can allow easy flow, sharing of information and effective coordination of firm's processes and efficient utilization of resources in distinct way. Rao and Krishna (2003) observed that the sure way of building and sustaining synergy over a long period of time is to make firm unique advantages distinct.

Competitive advantage may be gained by firms going green when all activities are shared and interlinked to enable effective and efficient utilization of resources thus making firm to come up with unique differentiated processes and product which are offered to lower cost thus firm gaining competitive advantage. For manufacturing firms to operate in a sustainable way, ISO 14001 certification is critical for firms to gain competitive advantage. This study operationalized competitive advantage using two perspective of cost leadership strategy and differentiation strategy. Cost leadership was conceptualized using operational efficiency and economies of scale

while differentiation was operationalized using green technology automation, green office synergies and intellectual capability utilization.

1.1.4 Regulatory Framework

Regulatory framework is principles, laws, regulations, directives, decrees and policies designed to govern or control conduct and operations of an institution or individuals (Hunters, 2014). Hunter (2014) conceptualized regulatory framework in to two categories: rule based and objective based regulatory framework. Rule based regulatory frameworks rely on rules and laws enacted by government while objective based regulatory frameworks are based on idea of coming up with guidelines which firms ought to follow (Hinter, 2014). Objective based regulatory framework is more flexible and responds to unique circumstances unlike rule based which are government directive and policies which may rigid (Hinter, 2014).

According to Porter and Van der Linde (1995) the regulatory framework can be coined based 'Porters hypothesis - The win-win scenario'. The hypothesis calls for regulatory framework that prompt green innovation connected with low cost of products and increased value. To come up with win-win solutions that increase economic and environmental gains, regulatory framework needs to be environmentally conscious (Doran & Ryan, 2012; Amores-Salvadó, *et al.*, 2015). Firms should not be reactive by just complying to regulatory framework but should be proactive by managing environmental risk (IISD, 2019). One of the proactive approaches is adoption of environmental management systems as integral part of overall firm management systems (ISO, 2004).

ITC (2019) noted that there was push at the international arena for firms to adopt sustainable practices in order to avoid legal or regulatory sanctions and gain competitive advantage. Firms should address social challenges and challenges relating to safety of products, products quality, pollution of the environment and social inequities (Cheruiyot & Tarus, 2015). If firms fail to adhere to regulatory framework, they risk losing their reputation and license to operate (ITC, 2019). There is need to hire qualified environmental impact assessment (EIA) auditors, engage relevant environmental agency for EIA, comply with house plans and consider health and safety of the workers in pursuit of conforming with regulatory frameworks (ITC, 2019).

Kenya through ministry of environment has instituted various regulatory framework relating to environmental sustainability of firms. These include: EMCA (1999), environment regulation (2003) relating to impact assessment and audit of environment, waste management regulations (2006), conservation of biological diversity regulations (2006), controlled substances (ozone depleting substances) regulations (2007); Noise and Excessive Vibrations Regulations (2009) and Air Quality Regulations (2014). It is expected that firms should comply with those regulations for them to operate in a sustainable way (ITC, 2019).

National Environment Management Authority (NEMA) has taken centre stage in regulating firms to operate in environmentally friendly manner. It formulates environmental regulations to manage waste and mitigate environmental pollution (NEMA, 2012). It works with Kenya National Cleaner Production Centre (KNCPC) which helps NEMA in encouraging cleaner production technologies in line with push

for sustainable manufacturing (NEMA, 2012). NEMA has developed various environmental guidelines to guide sustainable production in various sectors which include: national simplified environmental assessment (sea), national solid waste management strategy; asbestos handling and disposal guidelines, management of used oil in Kenya guidelines; national sand harvesting guidelines and national land use guidelines which guides clean operation and environmental sustainability (ITC, 2019).

Kenyan government has shown commitment in sustainable manufacturing through its NCCAP (2018 – 2022) which identifies the role of manufacturing in climate change mitigation. Major focus is placed on energy, resource and water efficiency, green growth financing, circular economy, climate change programs financing, human capacity improvement in climate change and NEMA regulations' compliance (KAM, 2019). The KAM through its Centre for Green Growth and Climate Change (CGGCC) has focused on promotion of green growth with key emphasize on efficient energy and resource utilization, capacity building, green financing and expos and awards.

Regulatory framework is key in enhancing green innovation in manufacturing (Walker & Wan, 2012; Ma, et al., 2017). The scholars underscored the role played by regulatory framework through government intervention to promote clean production technology. Government need to enact regulations relating to pollution tax, pollution control standards, abatement subsidy, green public purchase law and flexible environmental policy to enhance sustainability of firms. It is however noted

regulatory frameworks changes as per individual country and type of the organization (Chuang &Yang, 2014).

Regulatory framework affects the relationship between GIS and sustainability of firms. Study by Wong (2012) found that stringency of environmental regulations affected green innovation and how firms performed. Nidumolu, et al. (2009) noted that when firms go green willingly before government imposed stringent environmental regulations, they enjoyed first mover advantage unlike competitors who were forced to go green. However, Horbach (2008) observed that firm's greenness and sustainability was not influenced by how stringent regulation are or commitment to the environment sustainability but how they were balanced during implementation of the regulatory framework.

Many scholars have tried to resolve the existing paradox on whether regulatory framework can moderate how performance sustainability was influenced by GIS. To have a win-win situation where sustainability of firms was assured; regulatory frameworks should be flexible, non-punitive and uniform and should fit a certain specific environmental context (Lopez-Gamero, *et al.*, 2010; Lin, *et al.*, 2013). This research measured regulatory framework using environmental regulations, clean technology regulations and NEMA regulation conformance in order to clarify how regulatory framework moderated the relationship between GIS and performance sustainability of firms in Kenyan context.

1.1.5 ISO 14001 Certified Manufacturing Firms in Kenya

The ISO 14001 certification standard was created by ISO in 1996 (ISO, 2013). ISO 14001 deals with Environment Management System (EMS) which outlines the

process for the control and the continuous improvement of an organisation's environmental sustainability. EMS brings environmental concerns on the top notch of all high-level processes of making decision through development of trust among stakeholders by reducing wastage and utilising resources efficiently (ISO, 2015).

ISO reviewed all standards to 2015 version to help firms improve their operations and achieve sustainability targets (KEBS, 2018). The EMS 2015 version works on how to protect environment while taking in to account the risks and opportunity of environment. The key reforms in ISO 14001:2015 encompassed aspects of communication, documentation, strategic management and protection of environment, leadership, lifecycle thinking and environment performance (ISO, 2015).

ISO 14001 standards follow the 'Plan-Do-Check- Act (PDCA) cycle (Colceag, Dascălu, Lungu & Caraiani, 2015). PDCA cycle involves coming up with a policy, action plan, monitoring, corrective actions, review and continuous improvement specifying the process, roles of each team player and time of implementation (Darnall et al., 2008; Curkovic & Sroufe, 2011). It is prudent to check if EMS is effective, suitable and adequate and if it is in congruent with organizational goals for improved environmental performance (Marsh, 2012).

Globally, it was only 8 percent of firms which were ISO 14001 certified (EMS) by 2015 which was relatively lower in Africa (KEBS, 2018). ISO 14001 certification stood at 324,148 globally by December 2015 in 171 countries with Africa certification standing at 2538 firms. East African ISO 14001 certified firms were 108 firms in 2015 (ISO, 2015). The certifying institutions in Kenya include are Bureau

Veritas, SGS, KEBS. There were 51 ISO 14001 certified firms in Kenya in 2013. The number went down to 45 firms in December 2014 (ISO, 2015).

Firms are pursuing adoption of ISO certification in quest for better performance (Evangelos & Psomas, 2013). Psomas and Kafetzopoulos (2014) noted that if firms are certified, they perform better than firm which have not attained ISO. Many firms in Kenya are rushing to attain ISO 14001 certification yet their performance is questionable (Zaramdini, 2007; Emeka et al., 2008; Anyango et al. (2012). Kenya was ranked 123rd on the country's environmental performance index in 2015 (ISO, 2015).

ISO 14001 enables organizations to reduce burdens of institution's activities on the environment (Orzes, Touboulic, Culot, & Nassimbeni, 2019). It was however noted there was notable increase on environmental crises despite clear regulatory frameworks, adoption of EMS and greening of firm activities (Ololade & Rametse, 2018). There are few studies that have been done in Kenya in connection with GIS and performance sustainability of firms that have adopted ISO 14001 certification in Kenya. Thus, this study investigated how performance sustainability was influenced by GIS among manufacturing firms which have attained ISO 14001 in Nairobi City County, Kenya.

1.2 Statement of the Problem

Manufacturing is fundamental pillar of enhancing economic growth and development in Kenya (KAM, 2019). However, the performance sustainability of firms in manufacturing sector has been inconsistent for last 10 years (KNBS, 2019). The sector has lagged behind other sector like agriculture and hospitality sectors. For

instance, the sector growth dropped from 3.3 percent in 2018 to 3.1 percent in 2019 (KNBS, 2019).

Manufacturing firms in Kenya have found it difficult to adopt sustainable manufacturing propelled by lack of proper policies and regulations, lack of qualified personnel on greening and cost related to going green (KAM, 2019). Most manufacturing firms have failed to achieve their profitability targets and those dealing with exports have lost their market share abroad for the last 5 years (Wangui, 2019). There was a notable decline on the outputs of most firms with only 46% of the firms operating optimally due to costly energy, lack of finance and poor automation where it's only 11% which were fully automated (Wangui, 2019).

The social performance of firms has been challenged for the last one decade. Despite increase in sector employment opportunities by 11% in 2019, employee turnover increased. Safety of employees was challenged with only 10% of employees being covered by social and health insurance systems (KNBS, 2019; Danish Trade Union Development Agency, 2020). In terms of the training, it was noted that 62% had not trained their staff on sustainability issues (KAM, 2019).

The environmental performance was also challenged as it was noted that 55% of firms had high impact on the environment with 67% of the firms not recycling waste water and less than half of firms recycling solid waste. It was only 3 out of 10 firms which had energy audit in 3 years and only 38% of firms had sustainability department in 2019 (KAM, 2019). It was further noted that despite government conducting audits to check on the compliance and only 3% of firms facing action for non-compliance still

the environmental load was still high. This indicated performance sustainability challenges among manufacturing firms in Kenya despite increased adoption of ISO 14001 certification of firms and clear regulatory framework governing manufacturing.

There was notable gap on the conceptualization of GIS and performance sustainability which was noted to be varied and perceptual depending on the study. The conceptualization of dimensions of GIS varied from one study to another. Some studies have one dimension of GIS for instance, Alsughayir (2017) conceptualized GIS using green product innovation while Buswari, Setiawan, Sumiati and Khusniyah (2021) combined green product and marketing innovation in operationalizing GIS. There was a gap in that there was no known research that was done on GIS and performance sustainability when competitive advantage acted as mediator and regulatory framework as the moderating variable.

The existing empirical studies have indicated an inconclusive result on how GIS related to performance sustainability of firms. Study by Ma, et al. (2018) indicated a positive relationship while study by Ryszko (2016) indicate there was no relationship between GIS and firm's performance sustainability. The existing studies further had notable methodological gaps. Some studies used small sample size, self -report and qualitative data which lacked statistical inferences for instance, study by Alsharif and Tong (2019) while study by Cao, et al. (2019) used convenient sampling which was not suitable for hypotheses testing thus calling for further investigation.

This study tried to bridge the existing gaps while responding to the suggestions made in the previous research on how GIS was linked to performance sustainability. It was evident that there were attempts to address ecological questions in manufacturing

through regulatory framework like NEMA regulations but it was not satisfactory. This study therefore investigated whether GIS had effect on the performance sustainability of manufacturing firms located in Nairobi City County which had attained ISO 14001 certification.

1.3 Objectives of the Study

This study sought to achieve the following general and specific objectives:

1.3.1 General Objective

To investigate effect of green innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

1.3.2 Specific Objectives

i. To determine effect of green product innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.
ii. To establish effect of green process innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.
iii. To determine effect of green marketing innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.
iv. To determine effect of green organizational innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

v. To establish the mediating effect of competitive advantage on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

vi. To determine the moderating effect of regulatory framework on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

1.4 Research Hypothesis

Ho_1: Green product innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya

Ho_2: Green process innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

Ho_3: Green marketing innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

Ho_4: Green organizational innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

Ho_5: Competitive advantage has no significant mediating effect on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

Ho_6: Regulatory framework has no significant moderating effect on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

1.5 Significance of the Study

This research would be vital to policy makers and institutions like KEBS, NEMA and ministries like environment, trade and industrialization both in national government and county governments. The study would offer crucial knowledge and on how green innovation strategy can be implemented. It would further advance how green innovation strategy may enhance performance sustainability of firm while taking in to account environmental concerns.

The study would be of importance to executives of firms going green. It would offer a requisite knowledge that would guide firms in the entire process. This would help them know how they can evaluate the trade-offs associated with firms going green and being in position to sustain their competitive advantage as they transit to greenness which would help firms to go green comfortably.

This study would offer a repertoire of unique theoretical, practical and methodological knowledge thus contributing to body of knowledge. Theoretically, the study would expound the existing theories relating to variables of the study which add new

knowledge on the theories. It would also help build new theory or modify the theories thus forming basis for succeeding studies by scholars and academician.

1.6 Scope of the Study

This research was conducted in sixty ISO 14001 certified in Nairobi City County which deals with value addition in manufacturing sector. The organizations were certified by any of the following certifying institutions in Kenya: Kenya Bureau of Standards, Bureau Veritas (K) Ltd and SGS (K) Ltd. The ISO 14001 certified manufacturing firms were drawn from 12 out of the 14 sectors of manufacturing which deals with value addition. The study further focused on green innovation strategy where it captured four dimensions of green innovation strategies. The dimensions included green product, process, marketing and organizational innovation strategies as proposed by OECD in 2009.

The study involved firms which were ISO 14001 certified by end of the year 2019. The firms certified up to 2019 were considered because process of going green and achieving ISO status starts long before achieving the status by undergoing various assessment and audits so that the firms may be ISO certified. This means pursuit of going green takes time before being actualized thus being considered fit for this inquiry. The research time frame was three years between 2017 and 2019. The year 2020 up to 2022 were not included in the study because most businesses were affected by COVID-19 pandemic forcing most of firms to scale down their operation or even some businesses to close down.

1.7 Limitations of the Study

This research was limited in the following ways. First, the researcher encountered challenge of getting data due to sensitivity of data required in this study. This made the respondents uncomfortable to give out the data. To address the challenge, research had to reassure the informants of confidentiality while handling the data.

Secondly, the researcher experienced challenge on reviewing literature. This was because the topic was not adequately studied in both local and developing country's context. This challenge was addressed by reviewing relevant empirical studies done in other sectors and in developed economies and connecting it with resident context.

Lastly, the inquiry captured all aspects on green innovation which some may be not practiced in all firms. This might make respondents to give false answers jeopardize the data's internal validity. To address this, the researcher used simplified questionnaire and briefed the respondents on how to fill the questionnaire.

1.8 Organization of the Study

The study comprised of the preliminary part and five chapters. The content of the preliminary part included title page, declaration by both students and supervisors, dedication of the study, acknowledgement of key people involved in coming up with this study. It further encompassed the table of contents, list of tables, list of figures, abbreviations and acronyms, definition of terms and abstract which gave the executive summary of the study. Chapter one entailed introduction and background of the study where key variables of the research were discussed, statement of the problem, study objectives and research hypothesis. It further included significance of the study and

stated who were key beneficiaries of the study, scope of the study, things that would limit this study and how the study has been organized.

Chapter two presented extant theoretical literature upon which the research variables were anchored on. The chapter presented extant empirical literature which thematically presented green innovation strategy, competitive advantage and regulatory framework and how they related to performance sustainability. It further highlighted empirical gaps that were identified from the studies reviewed and conceptual framework which expounded the relationship between the variable. Chapter three discussed methodology of the study. The chapter entailed philosophy guiding the research, research design adopted during the study, research empirical model, population targeted in this study and sampling technique and sample size. It further presented data collection tools, assessment of validity and reliability of tools, data collection methods, operationalization of variables, diagnostic tests, how data was analysed and presented and research ethics.

Chapter four discussed issues related to how research findings were analysed and presented for easy understanding by the readers. The section was organized in to three sections which included results of descriptive data, results which enabled research to draw inferences and analysis of qualitative data. The last section was chapter five which drew summary and conclusion based on study findings. The section further clarified on how knowledge was advanced through this research, made recommendations on how study can help improve policy and practice and went ahead to propose areas which required further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature relating to variables under investigation. The core theories anchoring the research were reviewed plus extant empirical literature based on study variables to establish the existing research gaps. The chapter further brought forth a conceptual framework that linked the existence of relationship between the study variables.

2.2 Theoretical Literature Review

This section presented key theories that were used to inform the study variable. The main theory was triple bottom line theory. The theory was supported by green business model innovation, resource-based view theory, institutional theory and stakeholder's theory.

2.2.1 Triple Bottom Line Theory

The proponent of this theory was Elkington (1994). The theory posits that the key purpose of any organisation should not be getting financial gains only but it should improve the lives of people who relate with the firm and the environmental setting of the firm. The theory came up with three bottom lines which each firm should purpose to attain which are summarised as 3Ps standing for Profit, People and Planet. The first P for profit represents the financial performance of a firm. The second P which stands for people represent the social performance of the firm while the third P stands for planet representing environmental performance. TBL theory propose that measurement of sustainability of a firm should combine both financial and

nonfinancial measures of performance in order to account for total cost of doing business (Kraaijenbrink, 2019).

Sustainability of firms is attained when environmental, economic and social perspective of performance are connected. The theory focuses on sustainability where the three bottoms are worked simultaneously so that as firm address profit (if firm is performing financially), people (if firm is socially responsible) and it can also address planet (if firm is environmentally responsible). TBL theory advances the traditional accounting framework where focus was on monetary profits while currently focus is on sustainability which adds social and environmental performance (Gholami, et al., 2016).

Sustainability extend focus to examine whether firm serves interests of others like employees, stakeholders as it serves its own interests and address environmental concerns like environmental degradation and global warming. This can be realised through waste reduction, utilising natural resources efficiently and utilisation of renewable energy (Kenton, 2020). Basically, as firm pursue profits it should pursue sustainability by ensuring its operation doesn't oppose people and the planet bottom lines.

TBL approach may be limited in that it may not be easy to measure social and environmental bottom lines in quantitative terms as it may be subjective as it is for financial performance for instance putting value of dollar on oil spill (Kenton, 2020). It is further noted that it is not easy to maximize financial return while doing the greatest good to the society and environment. It however noted ignoring sustainability

approach has heavy price including environmental degradation, destruction of natural resources and exploitation of employees (Kenton, 2020).

TBL theory is relevant in that it tries clarify how best performance sustainability of firms may be achieved in a firm. The theory clarifies how firms can perform financially and assure environmental safety as firm go green and get ISO 14001 accredited which deal with environmental issues. TBL theory informed performance sustainability which is the dependent variable of this study.

2.2.2 Green Business Model Innovation (GBMI)

The proponent of this model was Bisgaard, Henriksen and Bjerre (2012). It illuminates it's focus on appropriate utilization of resources in a sustainable manner so that in future we may have no resource inadequacy originating from ecological burdens superseding the previous generation. The model tries to expound the process of firms going green and what entails greenness in a firm.

The key proposition of GBMI is that when new paradigm of sustainability is coined, it ought to appreciate the role played by innovation as a vital element that would led firms to be competitive as they initiate new products (green tech and clean tech) or change the way they do business (Bisgaard *et al.*, 2012). The changes adopted on the organizational processes are the green business model innovation where innovation results to changes in production by coming up with new substitute which encourage use of green inputs, allow recycling and reusing of materials to make the process and products in the long run green. There is need to restructure the current operations of firms in a manner that it allows coming up with other new strategic alternatives. The model clarifies on components which need to be checked which range from the

customers, firm's operations designs and financial viability of the firms. The shift by firms need to capture aspects like re-designing alternatives, modification and fashioning value as the firms go green (Osterwalder & Pigneur, 2010).

The scholars hypothesise the model using two standpoint which are incentive and life-cycle model. The incentive model includes sales, systems and performance-based model which connects to greenness through raw material and energy efficiency while life-cycle model involves aspects like take back management, green supply chain management and industry symbiosis (Bisgaard, *et al.,* 2012). Life cycle model is viewed as a paramount trigger to green client responsiveness, chase for competitive advantage and increased cost of inventory. It is however noted by Blackman et al. (2010) that the model doesn't come on silver platter but is associated with various deficiencies which encompass having limited knowledge in the entire supply chain and having enormous cost which is linked with the process of greening a firm.

Green business model innovation has credits associated with it. The benefits encompass coming up with good ecological effect, changing production methods to come up with new products which are ecologically friendly. The long-time impact ranges from utilisation of raw materials, water and energy efficiently while reducing waste and GHG emissions (Bisgaard *et al.,* 2012).

The model advocate for need to initiate policy guidelines which acts as a propeller for green growth in firms and which further aid for firms adopting greenness in their firms to succeed. It is through the policy guidelines where adoption of green growth is regulated at all levels locally and globally. In order to have better knowledge of challenges in going green and cohesion in action as firm go green, there is need for

negotiation between all stake holders, regulatory bodies and other concerned investors in order to offer concrete solutions to the challenges (OECD, 2012).

There are innumerable challenges linked to incentive model of GBMI. These challenges range from inflexibility of contracts, uncertain saving by customers, big investment to come up with green products, uncertain payback time of customers and it's impossible to bring forth other organization in the value chain (FORA, 2009). It can however be improved by promoting sustainable standards, increasing efficiency and improving flexibility in contact that last for longer period. It is proposed that in lifecycle model that organizations ought to support research and development, initiate recycling systems, promote green procurement and standardize procedures for going green. Networks and partnership are noted to be key for firms going green since firms doesn't work in isolation (FORA, 2009).

GBMI is connected to this study in that it expounds on procedure of going green. It also clarifies how relevant regulations are key to the performance sustainability of the firms. Thus, the theory informed independent variable (Green innovation strategy), moderating variable (Regulatory framework) and dependent variable (Performance sustainability of firm).

2.2.3 Resource Based View (RBV) Theory

This model was advanced Penrose (1959) and later improved by Barney (1991). The key tenets of this model are to underscore the paramount role taken by institution's resources and competences in helping firm realize competitive advantage; a precursor towards sustainable organizational performance. Barney (1991) noted that when

internal resources and capabilities are pooled together and combined well they lead to firm performance.

Firm resources are stock owned by business which may be implicit, not simple socially and which can be grown or multiplied (Barney, 1991; Peteraf, 1993; Black & Boal, 2007). Capabilities on the other hand are processes which utilize resources to offer value strategic intent (Morgan, Katsikeas & Vorhies 2012). Resources are noted to be key ingredient in promoting capabilities while these capabilities utilize resources to accomplish anticipated results (Barney, 1991).

Grant (1991) grouped resources in to three distinct categories that is personnel-based resources, tangible and intangible resources. The tangible resources include tools, machines, materials and financial components of firm while the intangible resources comprise of skills base, technology and reputation of the firm. Lastly, personnel-based resources encompass knowledge, commitment, culture, training and loyalty. It is noted that performance of firms varies due to heterogeneous resources they hold, which ought to be valuable, rare, can't be substituted or imitated by competitors so as to gain competitive advantage. (Barney, 1991; Dierickx & Cool, 1989).

Firm need to keep on combining varied resources held by firm so that they can modify existing capabilities and come up with new ones (Eisenhardt & Martin, 2000). Barney (1991) observed that firms hold repertoire of strategic and operational resources which can be used in varying amount and quantity so as to meet specific firm's demands. Capabilities are noted to be key ingredient in stimulating firm

resources to conduct their operations, refresh their stature and grow their wellbeing (Teece, Pisano & Shuen, 1997).

When firm holds unique resources and distinctive capabilities, they strategically adjust to fit to their external variation thus successful application of the strategy (Slotegraaf, Moorman, & Inman, 2003). There is need for alignment between strategy and external environment (Venkatraman & Prescott, 1990). Likewise, green innovation strategy needs to be well aligned with ecological and market pressure and regulatory frameworks in place to remain relevant.

To address environmental challenges caused by firms, it is necessary to have specialized unique and distinct resources to address them (Fraj, Martinez & Matute, 2011). There is need for wisdom when operating in volatile market environment which is elicited by variance in consumptions patterns, preferences and taste. The changes in the industry structure calls for proper reconfiguring of resources in order to maintain firm competitiveness (Teece *et al*., 1997).

The relevance of RBV theory is that firms should utilise the repertoire of resources and unique capabilities so that they may remain competitive as they address the ecological issues and aid firms in going green to enhance performance sustainability of firms. It is paramount to note that when green resources are combined well and capabilities effectively utilized, a firm gain and sustain its competitive advantage over its competitors. Thus, this theory informed adequately the green innovation variable which is predictor variable and competitive advantage which is the mediating variable.

2.2.4 Institutional Theory

The proponent of this theory was Scott (1995) and there after expounded in 2008. The theory is anchored on the deep and more resilient aspect of social structure. The theory focusses on steps followed in coming up with systems and models like cognitive models, guidelines, culture and practices and how they get adopted as guiding principle of people's social behaviors.

Scott (1995) view institution as intellectual, derived from norms, regulatory structure and processes that enhance stability and meaning to social behavior. The theory accentuate that firms replicate the behavioural norms of other actors in the organization's field of operation to survive in the business. Kraft's Public Policy (2007) connects the theory with policy making which guide lawful and prescribed aspect of authority.

According to Scott (2008), the key tenets of institutional theory are based on coherent myths and legitimacy. The theory emphasizes on the connection between an organization and the contextual settings they are operating. Greenwood and Hinnin (1996) notes that the environment which manufacturing firms are operating in demands for environmental consciousness in response to market and institution pressure which boast efforts for firms to going green.

The institution theory values the involvement of organization actors who are guided by rules to justify any activity or strategy they take (Schoenberg, *et al.*, 2013). Institutional theory lays its basis on that to attain sustainable competitive advantage, firm rules, norms and belief need to be socially acceptable and responsible. This can

be inspired by socially responsible cultural institutions that create incentives for such behavior (Oliver, 1997).

According to Quazi and O'Brien (2000), culture of an industry determines industry positioning. Industry position determines how firm should be perceived by public and level at which it should be scrutinized depending on public, government and competitive structure of the industry. Research and Development (R&D) activities are supported when firm acquire legitimacy by addressing stakeholder needs which advocate for firms going green in order to gain from the merits of proactive social action.

The theory is linked to this research in that due pressure from many consumers and regulatory institutions in going green; many organizations have readjusted their system and process to going green. To attain sustainable competitive advantage, organizations need to reconfigure their structures to adopt a culture that propels firm towards going green innovation in line with regulatory institutions. Thus, this theory sufficiently informs the independent variable (Green innovation strategy) and moderating variable (Regulatory framework) which prompt firms going green.

2.2.5 Stakeholders Theory

Ansoff (1965) was the first to coin this theory and was later advanced further by Freeman in 1984. The key tenets of this theory are that the interests and welfare of stakeholders and stockholders in an organization are most pivotal for firm to realize its superior performance (Freeman, *et al.,* 2010). According to Freeman (1984)

stakeholders are defined as people who act independently or jointly as a team and whose activities influence the objectives of the organization.

Stakeholders extend beyond those who gain from decision made in the firm to all those who internally or externally make decision which affects the business. Stakeholders of any organization are noted to include: stockholder (investors), suppliers, staffs, creditors, local community, groups of public interests, clients and even government institutions (Freeman, *et al.*, 2010). Freeman recognizes government as key stakeholder who takes a vital role in influencing performance of a firm through the regulatory framework they institute (Freeman, 1984).

The theory places firm's leadership in prime position of understanding how key stakeholders in firm link to come up for cordial relationship which add values so that in case of conflicting interest they may consider the trade-off to make all parties comfortable (Freeman, *et al.*, 2008; Harrison, Bosse & Phillips, 2010). The value system of stockholders needs to be considered to ensure they don't conflict with practices of stakeholders. There is need to align firm practices with stakeholders' practices to attain maximise firm gains (Sisodia, *et al.*, 2007; Nesvadbora, 2010).

The theory has various assumptions which include the presumption of egoism where firm need have duty to maximise their own wellbeing and that of others. Secondly, they should establish rules of the game to fill obligation to all involving six principle that is; the principle of entry and exit, governance, externalities, contracting cost, agency and limited morality with intention of ensuring interest of each stakeholder are put in consideration (Freeman, *et al.*, 2010).

The theory is relevant as it informs dependent variable (Performance sustainability of firms) and moderating variable (Regulatory framework). Regulatory framework and stakeholders are viewed as conditions outside the firm which drives and enhances green innovation in firms. These push towards greening of firms indistinctly influence how firms perform when exposed to certain conditions, culture and varied stakeholder pressure.

2.3 Empirical Literature Review

This section reviewed the exiting empirical researches thematically based on the variables under investigation in this study. The review points at the conceptual, theoretical, methodological, empirical and contextual gaps of the study. The gaps in the current studies formed basis for this study and future research.

2.3.1 Green Product Innovation Strategy and Performance Sustainability

Xiao, Hajar and Hutahayan (2022) conducted a descriptive study on influence of product innovation strategy on performance of selected large manufacturing firms in Beijing, china. Performance was operationalized using both financial and non-financial metrics to measures. The target population was large firms operating in Beijing China where unit of observation was middle management level, such as supervisors. The data was gathered by utilising questionnaires. The analysis of data was done using descriptive and inferential statistics. The study findings concluded that there was a positive relationship exists between product innovation strategy and performance of large manufacturing firms in Beijing China. It was further found that product innovation enhances the quality of manufacturing in the elements of the existing products. The study was limited in that it was conducted in large

manufacturing firms and in Chinese firms which contextually limits generalization of findings to other contexts. Secondly, the study analysed data quantitatively and lacked some insights that can be drawn from qualitative analysis.

Zhang, Zeng and Tse (2021) examined the antecedents and consequences of green product innovation among Chinese manufacturing industry. The study was anchored on triple bottom line which incorporate the three aspects of sustainability which include economic, environmental and social performance of firms. The study was quantitative and involved 239 senior managers and directors in the Chinese manufacturing firms. The data was collected using questionnaire and analysed using structural equations modelling. The results of the study indicated that formal control and social control should be applied as complements in promoting green product innovations. Green Product Innovation (GPI) adoption had impact on both social and environmental performance. The relation between GPI and financial performance was mediated by both environmental and social performance. The study had various limitation including being quantitative which makes it difficult to track the adoption process of GPI which is possible using qualitative approach. Secondly the study focuses solely on the Chinese manufacturing industry, and therefore has limited generalizability.

Alsharif and Tong (2019) conducted a study linking environmental sustainability on green product innovation three construction companies based in Saudi Arabia. The inquiry was qualitative and was a case study. To collect data, the researcher reviewed existing documents and interviews respondents. It was found that green product innovation was connected to environmental sustainability. The study was limited by

using three companies which cannot be analysed statistically thus lacking statistical rigor. The study also used case study and qualitative research which lack statistical inferences thus limiting generalization of study findings. The current study examined GIS and sustainability of ISO 14001 certified firms in Kenyan context where both quantitative and qualitative approach was combined.

Ma, *et al.* (2018) conducted a survey on green product innovation and performance of firms while determining the moderating effect of green business model in 231 manufacturing firms in China. The green product innovation was conceptualized in terms of green market differentiated products, products from recycled materials, environmentally friendly products and product design modification. Performance was measured using market share and customer satisfaction. It was noted that performance was positively influenced by green product while green innovation model moderated the relationship. The study had various outstanding gaps: First, the study measured performance using only financial measures. Secondly, the study had contextual gaps as study was done in China which has different culture and regulatory framework thus limiting generalization of findings to Kenyan context.

Alsughayir (2017) conducted a survey on how performance was influenced by green product innovation among the 19 chemical processing firms in Saudi Arabia. Innovation was measured in terms of use of environmentally friendly material; packaging and recycling products. The results shown that firm performance was affected positively by green product innovation. The study has various limitation. First, the sample size was inadequate for statistical analysis thus lacking statistical rigor. Secondly, firm performance was measured using financial terms only. Lastly,

the study was done in single sector of manufacturing and contextually in Saudi Arabia which limits generalization of findings to the other sectors.

Adegboyega (2017) conducted a survey at Nestle Nigeria PLC on how product innovation had impacts on the performance. Performance was measured using profitability and market share. Questionnaires was used to collect data. The data was analysed using correlation and regression analysis. The study found that performance of firms was linked to product innovation. The study was limited as it was conducted in a single institution. Secondly, the study measured performance using financial terms and thus limiting generalization of study findings.

2.3.2 Green Process Innovation Strategy and Performance Sustainability

Xie, Hoang and Zhu (2022) conducted a survey on green process innovation and financial performance while exploring the role of green social capital and customers' tacit green needs among the manufacturing firms in China. The sample size for the study was 221 Chinese manufacturing firms. The data was collected using questionnaire via survey method. The study findings indicated green process innovation adoption had a U-shaped impact on firms' financial performance where at initial stage was a negative effect and as level of adoption increases it shifted to positive effects on firm performance. Green social capital and green needs' tacitness had a moderating effect on the relationship between green process innovation and financial performance of the firm. The study was limited in that it was done in Chinese manufacturing firms which limits generalizations of the findings to other sectors and contexts.

Khairani, Susetyo, Yusnaini and Yusrianti (2021) conducted a study on the effect of green process innovation on corporate sustainability and environmental performance as a mediation variable among SMEs in South Sumatera Province in Indonesia. The study was anchored on the stakeholder theory. The study employed a quantitative approach. The sample size of the study was 70 SMEs while respondents used during the study were the managers and owners of manufacturing firms. The data was analysed using partial least square structural equation technique (PLS3). It was found that green process innovation had no effect on corporate sustainability but had positive effect on environmental performance. Environmental performance mediated the relationship between green process innovation and corporate sustainability among SMEs in South Sumatera Province in Indonesia. The study was limited in terms of having too few respondents and few indicators of questions which are non-representative. Contextually, the study was done on SMEs and in one province in Indonesia making thus limiting generalization of findings.

Akpoviroro, Amos and Oladipo (2019) conducted a survey at Etisalat Telecommunications Company in NNPC-Ikoyi branch in Nigeria on how process innovation affects firm performance. Process innovation was operationalized in terms of internet technology usage, automation of service delivery system, use of toll-free communication and process service modification. Process innovation affected firm performance. The study was limited by using single firm in different sector of economy which invalidates generalizations of findings to manufacturing sector. Secondly, the sample size is small thus not amenable for statistical analysis which invalidates hypothesis testing.

Ma, Hou and Xin (2017) conducted survey linking innovation benefits with green process innovation while being mediated by firm image among 267 firms in China dealing with coal mining. Innovation benefits was conceptualized in terms of environmental and financial performance. Green process innovation had positive relationship with innovation benefits while firm image mediated the relationship. The study had various gaps: First, the sector was done in mining industry which is extractive industry limiting generalization to manufacturing sector. Secondly, the study was done in China which is contextually different from Kenya in terms of regulatory frameworks and cultural practices thus limiting generalization of findings to Kenyan context.

Xie, Huo, Qi and Zhu (2016) collected a panel data while investigating how performance was affected by green process innovation among 28 Chinese manufacturing industries with green subsidies and absorptive capacity moderating the relationship. The study used environmental index to measure environmental performance of firms. Green process innovation was related to firm performance at industry level with both absorptive capacity and government subsidies moderating the relationship. The study had various gaps; first, the study used convenient which is non-representative thus not effective to generalize findings. Secondly, the study was below the threshold for statistical analysis because sample size was small. Lastly, the study was done in China which is contextually different from Kenya limiting generalization of findings because of difference in culture and regulatory framework.

Osei, Yunsei, Appienti and Forkuoh (2016) did a survey on process innovation and SMEs growth among 300 shoe manufacturers in Ashanti region of Ghana. Process

innovation was viewed in terms of new processes, improved new processes and new and improved process. The adoption of process innovation was linked to positive performance of shoe manufacturers in Ashanti region of Ghana. The study however had the following limitations. First, the enquiry was conducted in a varied context unlike in Kenya. Secondly, the research was done in only one sector which limits generalization of findings to other sectors. Lastly, the study operationalized performance in to financial terms only unlike this study which used financial, social and environmental performance targeting ISO 14001 certified firms.

2.3.3 Green Marketing Innovation Strategy and Performance Sustainability

Sathana, Velnampy and Rajumesh (2019) conducted a survey among SMEs on how green marketing strategy and competitive advantage had impact on the development of SMEs in Jaffna district in Sri Lanka. Development of SMEs was operationalized using financial, customer and employee development. The study was underpinned to resource advantage theory. The study was quantitative in nature and involved 302 SMEs in Jaffna district in Sri Lanka. Respondents were sampled using simple random sampling for owners of SMEs. Data was collected using questionnaires. Data was analysed using Structural equation method (SEM). It was found that competitive marketing strategy significantly influenced SMEs development except employee development while green marketing strategy significantly influenced customer and employee development except on financial SME development. The study was limited in terms of methodology as it utilized only quantitative research methods. It was limited as it focused on SMEs and it was done in particular area in Sri Lanka which limit generalization of findings.

Fatoki (2019) conducted study on linking performance with Green Marketing Orientation (GMO) in South Africa based on hospitality firms. GMO was operationalized using green marketing mix. Environmental performance was measured using efficient material and energy consumption, level of recycling, cost of environmental compliance while social performance was measured using customer satisfaction, staff satisfaction and turn over, employee safety and contribution to community social issues. The study employed quantitative approach using cross-sectional survey methods involving 192 respondents. The findings indicated that in hospitality industry social and environmental performance was affected by GMO. The inquiry had various limitation: First, the study used convenience sampling which may be non-representative. Secondly, the study was done in hospitality industry which affect ability of the results to be generalized in other sectors like manufacturing. Thirdly the research did not capture financial performance which was captured in this study.

Maziriri (2018) conducted a quantitative research in manufacturing SMEs in Gauteng South Africa relating to how performance is linked to green marketing processes. The study operationalized green marketing practices in term of elements of green marketing mix. Green marketing mix had impact on firm performance with the relationship being mediated by competitive advantage. The study had various limitations: First, generalization of findings is challenged due to cultural and regulatory framework differences as the study was done in only one province in South Africa. The study did not capture environmental performance which the current study added during the study.

Mungai (2017) conducted a case study in Oserian Development Company on how performance was linked to green marketing strategies in flower firms in Kenya. Green marketing strategies were operationalized using green marketing mix. while performance was operationalized using profitability, market share and production efficiency. The findings indicated that green performance was positively influenced by green marketing except green distribution. The inquiry had various limitations. First, the study was conducted in only one firm in agricultural sector which cannot be generalized in manufacturing sector. Secondly, findings from a case study is difficult to generalize it on wider segments hence this research was done in multi-sectorial ISO 14001 certified manufacturing firms in Kenya.

Amegbe, Owino and Nuwasiima (2017) conducted a survey connecting performance of SMEs and GMO in 128 industries in Great Accra region in Ghana. Green marketing orientations influenced performance of SMEs positively. The study had various limitations: first the response rate was as low as 22% which does not support generalization of findings. Secondly the study was limited to one region in Ghana and can't be generalized in other areas outside Ghanaian context like Kenya where the current study was done due to difference in regulatory frameworks applied and cultural difference.

Pathak (2017) conducted a survey on green marketing and customer satisfaction and how it is linked to environmental safety in banking sector in India. The study operationalized green marketing innovation in terms of green marketing mix while customer satisfaction was viewed in terms of customer attitude and loyalty and consumption patterns. Data was collected through telephonic interactions, personal

interviews and structured questionnaires. Green marketing mix had positive link with customer's satisfaction. The research fell short because sample size was small and respondents were randomly sampled thus not being adequate representation of entire population. The respondents were sampled randomly thus researcher may have respondents who may give unfocused information. The data also lack inferences as data was analyzed using descriptive statistics.

2.3.4 Green Organizational Innovation Strategy and Performance Sustainability

Elshaer, Azazz and Fayyad (2023) carried out a study that linked green management practices and sustainable performance of small- and medium-sized hospitality businesses with employee's pro-environmental behavior moderating the relationship in Saudia. Sustainable performance was analysed using three aspects of sustainability that is economic, environmental and social performance aspects. The study was supported by institutional and stakeholder theories. The study was quantitative in nature and involved a sample size of 304 SMEs in hospitality sector which were sampled using convenient sampling. The data was collected using self -administered questionnaires and analysed using the Smart PLS-structural equation modelling technique. The results indicated that green management practices had effect on sustainable performance of firms. It was further realized that employee's pro-environmental behavior had moderating effect on the relationship on SMEs in hospitality sector. The study was limited as it was done in hospitality industry which cannot be generalized to sectors like manufacturing. The study also used convenient sampling which is no representative and may be biased.

Al-Shammari, Alshammrei, Nawaz and Tayyab (2022) conducted a study on green human resource management and sustainable performance with the mediating role of green innovation: a perspective of new technological era among SMEs in Kingdom of Saudia. Sustainable performance was operationalized using environmental, social, and economic performance dimensions. The study was anchored on tenets of triple bottom lines theory. The study involved 335 SMEs in Saudia. The study was quantitative in nature. The data was collected using questionnaires and analysed using structure equation modeling. The findings indicated that green human resource practices had positive effect on the sustainable performance of SMEs where green innovation was noted to be partially mediating the relationship between green human resource practices and sustainable performance of SMEs. The study was limited in that the study was done in SMEs in Kingdom of Saudia and cannot be generalized to other sectors.

Banyhamdan, Al-Ghdabi and Almomani (2019) conducted a survey on how green human resource practices affects green innovation performance in 47 industrial companies in Jordan. It was found that green human resource practices had significant positive effect performance among industrial companies in Jordan. The study had various gaps: First, the sample size was small and thus limiting adequate representation of the target population. Secondly, the study was done in Jordan which contextually different thus limiting generalization to economies like Kenya which are contextually different in terms of culture and regulatory frmaework.

Kneipp, Gomes, Bichueti, Frizzo and Perlin (2019) conducted a quantitative study on the linking performance and sustainable innovation practices among 51 Brazilian

manufacturing firms. Sustainable innovation practices are operationalized in terms waste management, green processes, as value creation and energy efficiency. Performance of firms was measured through financial, innovative, production, market and socio-environmental performance. The study findings indicated that performance was linked to sustainable innovation practices. The study was limited in that there was low response rate of 19.92% which invalidates generalization. Secondly, the study used only single approach (Quantitative) of collecting data.

Chukwuka and Eboh (2018) conducted a survey on how green business practices related to performance of 10 Nigerian manufacturing firms. The study operationalized green business practices as green business project, green business initiatives and eco-commitment of employees while organizational performance was operationalized using Employee job satisfaction and Environmental sustainability. The study found that green business practices positively affected firm performance in Nigeria. The study was limited by fact that sample size small thus its finding cannot be generalized to other firms and other contexts like Kenya.

2.3.5 Green Innovation Strategies, Competitive Advantage and Performance Sustainability

Nuryakin & Maryati (2022) conducted an inquiry trying to interrogate whether Green Marketing Orientation (GMO) had an effect green marketing performance and whether green innovation and green competitive advantage mediated the relationship among Batik SMEs in Yogyakarta, Indonesia. The study utilised quantitative research approach. Purposive sampling was used to sample 223 Batik SMEs in Yogyakarta, Indonesia. Questionnaires were used to collect data which were analysed using

Structural Equation Modelling (SEM). It was found that green marketing orientation significantly affected green innovation and competitive advantage which had impact on green marketing performance. It was found that competitive advantage had mediating effect on the relationship between GMO and green marketing performance. The study was limited in terms of methodology as it utilized only quantitative methodology and use of purposive sampling method which is non-representative and prone to biasness.

Buswari, Setiawan, Sumiati and Khusniyah (2021) conducted a study on the effect of green product innovation and green marketing on competitive advantage and business performance in 3 cities of Surabaya, Kota Batu and Kota Kediri in Indonesia. The study was anchored on resource-based view theory. The study employed an explanatory research design. The sample size was 95 businesses operating as SMEs. The data was collected using questionnaires assisted by PLUT East Java. Data was analysed using Partial Least Square (PLS) approach. The study finding indicated that that green marketing and green product innovation have a significant effect business performance. Competitive advantage mediated the relationship between green marketing and green product innovation on business performance among SMEs in Indonesia. Contextually, there was a gap as the study was done in SMES in three cities in Indonesia thus limiting generalization. Methodologically the study utilized only quantitative research methods while ignoring inputs that may be offered through combining both quantitative and qualitative research methods.

Wirda, Herri, Elfindri, Rivai, and Herizon. (2019) conducted a quantitative study on entrepreneurial competency and business performance with competitive advantage

playing mediation role in creative industries in West Sumatera-Indonesia. Competitive advantage was operationalized in terms of lower costs, product quality, managerial abilities, growth the company and company image. Through Structural Equation Modeling (SEM) analysis, it was found that entrepreneurial competency had positive effect business performance while competitive advantage mediated the relationship. The sample size was small; only 2.82% of entire target population thus limiting generalization of results. Contextually, there was a gap as the study was done in creative industries in Indonesia thus limiting generalization. This study assessed whether competitive advantage mediates the relationship between GIS and sustainable performance of firms in Kenya.

Pratono, Darmasetiawan, Yudiarso and Jeong (2019) conducted a survey on green entrepreneurial and market orientation can aid in attaining sustainable competitive advantage and determine the role played by inter-organizational learning among 280 manufacturing firms in Indonesia. The results of the inquiry indicated that green entrepreneurial and market orientation influenced performance of firms while inter-organizational learning was linked to competitive advantage. The study was limited in its context as it was done in Indonesian manufacturing industry without specifying various sectors.

Anwar (2018) conducted an exploratory study on how SMEs performance was influenced by Business Model Innovation (BMI) when mediated by competitive advantage among 303 manufacturing SMEs in Pakistan. Questionnaire was used to collect data. SEM was used to analyse data. It was found that BMI influenced performance of SMEs in Pakistan while competitive advantage partially mediated the

relationship. The study had outstanding gaps which include: the study was exploratory which limits hypothesis testing and generalization of findings. Secondly the study was done in different context that is it involved SMEs and was done in Pakistan unlike current study which was done in ISO 14001 certified manufacturing firms thus limiting generalization of the results.

Setyawati, Rosiana and Shariff (2017) conducted a study on how performance was influenced by innovation when mediated by competitive advantage in 125 SMES in Purwokerto province in Indonesia. SEM was used to analyse data. It was found that innovation affected performance of SMEs while competitive advantage did not mediate the relationship. The study had various limitation. First the study findings contradicted most studies that competitive advantage had mediating influence on innovation and firm performance. Secondly observation done in SMEs and in one province cannot be generalized in all areas and in all sectors of manufacturing.

2.3.6 Green Innovation Strategies, Regulatory Framework and Performance Sustainability

Eneizan, Matar, Al-Zawahreh, Alkhawaldeh and Eneizan (2019) conducted a study on effects of green marketing strategy on firm financial performance where government policy played a moderating role using car dealers in Jordan. Green marketing strategy was operationalized using green marketing mix while performance was measured using both financial and nonfinancial metrics. The government policy was operationalized using government regulations and tax incentives. The study was underpinned on stakeholder and resource-based view theories. The study was conducted among 386 green car dealers in Jordan. The data was collected using

questionnaires while analysis was done using structural equation modelling (SEM). The study findings indicated that green marketing strategy had significant effects on the firm performance while government policy moderated the relationship. The study was limited in that findings cannot be generalized as it was done in Jordan and in car dealing sector unlike the manufacturing sector where this study was carried.

Cao, Deng, Song and Zhong (2019) conducted a longitudinal study on how industrial enterprise technological innovation is affected by environmental regulation intensity among 30 Chinese municipalities with annual turnover of 20 million Yuan assessing both direct and moderating relationship of both variables. The data was collected from 2008 up to 2016. Panel regression was used to analyse data. It was found that environmental regulations and government regulation had direct effect on technological innovation and firm performance while environmental regulation moderated the relationship. The study was limited in that findings cannot be generalized as it was done in Chinese provinces for firms with turnover of 20 million. Secondly, the research utilized convenience sampling which may not be appropriate when testing hypothesis.

Saengchai, Rodboonsong and Jermsittiparsert (2019) conducted a survey in sports industry in Thailand linking performance with green product innovation and environmental regulation while examining role of environmental dynamics. The environmental regulations were operationalized in terms of environmental policies. The study was anchored on the contingency theory. SEM was used in analysing data. It was discovered that environmental regulations and green product innovation had effect on the performance of sports industry in Thailand while environmental

dynamism moderated the relationship. The study was limited in that findings cannot be generalized to manufacturing sector which deals with value addition and contextually Thailand id different from Kenyan context because the environmental policies are different.

Feng and Chen (2018) conducted a longitudinal study linking how industrial green development is affected by green innovation with environmental regulation as a moderator using the Spartial Durbin model among firms in 30 provinces in China. It involved panel data between 2007-2015. The study found that environmental regulation had both direct and moderating effect on the relationship between industrial green development performance and green product innovation. Despite insights in this research, the sample size was small meaning it isn't adequate representative of the entire population. Secondly, the study was done on provincial industrial panel data not specific sectors in manufacturing thus the study cannot be generalized to all manufacturing sector.

Ramanathan, He, Black, Ghobadian, & Gallear (2017) conducted a case study which was qualitative in nature on how environmental regulations moderated how performance is connected to innovation through re-examining Porter hypothesis in organizations in China and UK. The study involved 6 firms in UK and 8 firms in China. The paper operationalized environmental regulation as environmental regulation design (flexible and inflexible government regulations). The results indicated that resources and capabilities of firm depends on adoption of more environmental regulations innovatively in order for firms to perform. Inflexible regulations negatively affected the relation while flexible regulations played a

moderating role on how innovation was related to performance of firms. The study had various gaps. First, the sample size is small. Secondly, case study limits use of large sample limiting generalization of the findings. Lastly the study was qualitative which doesn't support statistical inferences.

Kousar, Sabri, Zafar and Akhtar (2017) conducted a survey on how adoption of green innovation and technological factors relate and how it was moderated by government intervention among 280 SMEs in Pakistan. Government interventions were measured in terms of policy and regulations. The study adopted positivism philosophy. The study found that technological factors had effects on the adoption of green innovation while government intervention moderated the green technology adoption was affected by technological factors. The research was limited in that it was done in SMEs and in Pakistan limiting generalization of the findings. The current study was done in manufacturing set up in Kenya examining how relationship between GIS and performance is moderated by regulatory.

2.4 Summary of Research and Knowledge Gaps

During the review of empirical literature, there were notable gaps noted while examining the relationship between GIS and performance sustainability of ISO 14001 certified manufacturing firms. First, there were methodological gaps where some studies used small sample size which inadequately represented the target population. The second methodological gap was on sampling where some studies used convenient sampling technique which is non-representative thus limiting generalization of the study finding to the entire population. To bridge these gaps, this study used census to

ensure there is representation of all sector and a larger sample size which allow statistical analysis so as to make inferences from the finding.

The study noted some gaps on how study variables were conceptualized. Some studies conceptualized GIS using a single or two perspectives depending on specific context of the inquiry which affect findings generalization. Sustainability was conceptualized narrowly and most studies did not tie the three aspects of sustainability together in one study that is financial, social and environmental performance limiting generalization of findings. The current study was based on OECD perspectives which had four perspectives of GIS which was linked to performance sustainability of firms. It was evident that there was no known study which used competitive advantage as mediator and regulatory framework as moderator but adopted varied moderators and mediators in their studies. The current study examined GIS (using the 4 paradigms proposed by OECD) and sustainability of ISO 14001 certified manufacturing firms where mediator was competitive advantage and moderator was regulatory framework.

Thirdly, the study had contextual gaps. Most studies were done in developed economies like Europe and Asia which are advanced in terms of greening their firms and their sustainability performance unlike Kenya which is developing economy. This limited generalization of findings because the firms had different cultural background and are regulated by different regulatory framework. Some studies were done in a single firm or sector of manufacturing or in other sector other than manufacturing. This limits generalization of findings because of variance of context and scope. This study was done on GIS and performance sustainability of ISO 14001 certified

manufacturing firms cutting across 12 sectors of manufacturing which deal with value addition.

Lastly, there were empirical gaps noted in the study where some findings contradicted other study findings. It is however noted that this might have emanated from the variance in methodology, conceptualization of the variables and the context. This study was conducted in Kenya to examine how GIS influence performance sustainability of firms based on all sectors of manufacturing dealing with value addition (Whose effects on the environment load is high). The summary of gaps for each study was presented in table 2.1

Table 2.1: Previous Studies and Knowledge Gaps Summary

Variable	Author	Topic	Results of the research	Gaps of the studies	Main Focus of this Study
Green product innovation strategy	Xiao, Hajar and Hutahayan (2022)	Influence of Product Innovation Strategy on Performance of Large Manufacturing Firms in China.	There was a positive relationship exists between product innovation strategy and performance of large manufacturing firms in Beijing China.	-Contextual gap as study was done in large manufacturing firms limiting generalization of results. -The study focused on quantitative data lacking some insights drawn from qualitative analysis.	The current study explored GIS and its effects on performance sustainability focusing on ISO 14001 certified manufacturing firms using mixed research methods.
	Zhang, Zeng and Tse (2021)	Examining the antecedents and consequences of green product innovation.	-Green product innovation adoption impact on both social and environmental performance. -The relation between GPI and financial performance was mediated by both environmental and social performance.	-Use of quantitative which makes it difficult to track the adoption process of GPI which is possible using qualitative approach. - The study focuses solely on the Chinese manufacturing industry and therefore has limited generalizability.	The current study examined how aspects of GIS including green products innovation strategy influenced performance sustainability while using mixed methods.
	Alsharif and Tong (2019)	How environmental sustainability is influenced by green product innovation in construction companies based in Saudi Arabia.	Green product innovation strategies had effect on the environmental sustainability of construction companies.	-Use of three companies which lack statistical rigor. -Used case study and qualitative research which lack statistical inferences thus limiting generalization of study findings.	The current study examined GIS and sustainability of ISO 14001 certified firms in Kenyan context using descriptive and explanatory designs.

	Ma, *et al.* (2018)	Link between performance of firms and green product innovation and the roles played business model design in manufacturing sector in China.	Green product innovation strategies had effect on how firms performed and it was moderated it was moderated by business model design.	-The study did not include environmental aspects while measuring performance. -Contextual gaps as study was done in China thus limiting generalization of findings to other areas since area has different regulatory frameworks and culture.	The current study was done in ISO 14001 certified manufacturing firms where sustainability was measured using financial, social and environmental measures.
	Alsughayir (2017)	Link between performance of firms and green product innovation in chemical industrial firms in Saudi.	The green product innovation affected performance of firms positively.	-Use of less than 30 firms has low level of statistical rigor which limited generalization. -The study was conducted in one sector - chemical industries and cannot be generalized to other sector of manufacturing.	The current study was done in ISO 14001 certified manufacturing firms drawn from 12 sectors of manufacturing in Kenya.
	Adegboyega (2017)	How product innovation influence performance of Nigerian Nestle PLC firm.	The organization's performance was affected by product innovation.	The study was conducted in a single institution thus limiting generalization of findings to other sectors.	The current study was done multi-sectorial manufacturing sector in Kenya.
Green process innovation strategy	Xie, Hoang and Zhu (2022)	Green process innovation and financial performance: The role of green social capital and customers' tacit green needs.	-Green process innovation adoption has a U-shaped impact on firms' financial performance - Green social capital and green needs' tacitness moderated the relationship between GPI and financial performance	- The study had contextual gaps because it was done in Chinese manufacturing firms which limits generalizations of the findings to other sectors and contexts.	The current study was done in Kenyan context on GIS and performance sustainability among ISO 14001 certified manufacturing firms.

	Khairani, Susetyo, Yusnaini and Yusrianti (2021)	The effect of green process innovation on corporate sustainability and environmental performance as a mediation variable.	Green process innovation had no effect on corporate sustainability but had positive effect on environmental performance. Environmental performance mediated the relationship between green process innovation and corporate sustainability.	-The study had few respondents and few indicators of questions which are non-representative. -Contextually, the study was done on SMEs and in one province in Indonesia making thus limiting generalization of findings.	The current study focused on studying ISO 14001 certified firms across all sector of manufacturing in Kenya on how GIS affects performance sustainability of firms.
	Akpoviroro, Amos and Oladipo (2019)	Process innovation on organizational performance in Nigeria.	Process innovation influenced performance of firms in Nigeria.	Use of a single firm and one sector invalidates generalizations.	This study focused in ISO 14001 certified firms across all sectors of manufacturing.
	Ma, Hou and Xin (2017)	How innovation benefits are influenced when mediated by firm image in coal mining firm in China.	Innovation benefits was influenced positively by green process innovation and mediated by firm image.	-The study was done in extractive industry and china which limits generalization of findings in Kenyan context.	This study was collected primary data while analysing GIS and performance of ISO 14001 certified manufacturing firms.
	Xie, Huo, Qi and Zhu (2016)	How financial performance is influenced by green process innovation in emerging economies in Chinese manufacturing industries.	-Green process innovation had significant positive relationship with firm performance while absorptive capacity and government subsidies moderated the relationship.	-Used of convenient which invalidates ability to generalize results. - use of small sample size which doesn't qualify threshold for statistical inferences.	The current study involved census sampling involving ISO 14001 certified manufacturing firms in Kenyan context.

	Osei, Yunsei, Appienti and Forkuoh (2016)	Process innovation and SMEs growth among shoe manufacturers in Ghana.	Adoption of process innovation affected firm performance positively.	Study was done in one sector and in different contexts invalidating generalization of finding in Kenyan context.	The current study was done in multi sectorial ISO 14001 certified firms in Kenyan context.
Green marketing innovation strategy	Sathana, Velnampy and Rajumesh (2019)	The effect of competitive and green marketing strategy on development of SMEs in Jaffna district in Sri Lanka.	-Competitive marketing strategy significantly influenced SMEs development except aspect of employee development while green marketing strategy significantly influenced on customer and employee development except financial development.	- Methodological limitation as the study utilized only quantitative research methods. –The study also focused on SMEs and it was done in particular area in Sri Lanka which limit generalization of findings.	The current study involved census sampling involving ISO 14001 certified manufacturing firms in Kenyan context.
	Fatoki (2019)	How performance is influenced by Green Marketing Orientation (GMO) in South African hospitality firms.	The organization performance positively influenced by GMO in hospitality firms.	-The study used convenience sampling which may be non-representative. -The study was done in hospitality industry and suffer from generalization inadequacy to other sectors.	The research utilized census sampling of all ISO 14001 certified manufacturing firms.
	Maziriri (2018)	How green marketing practices have impact on performance of manufacturing SMEs when mediated by competitive advantage in South Africa.	Green marketing practices had positive impact performance and the mediating role of competitive advantage.	-Conducting the inquiry in one province in South Africa limit generalization of results -The inquiry failed to capture environmental performance.	This study examined GIS and sustainability where all aspects of TBL was captured among ISO 14001 certified firms.

	Mungai (2017)	How performance of Oserian Development Company in Kenya is influenced by Green marketing strategies	Green marketing strategies influenced performance positively except green distribution	-Use of case study and single sector limits generalization of findings to other sectors	Descriptive and explanatory design was used to investigate ISO 14001 certified firms
	Amegbe, Owino and Nuwasiima (2017)	Linkage between performance of SMEs and Green Marketing Orientation (GMO) in Great Accra region in Ghana.	Performance was affected positively by green marketing orientations in SMEs.	-The response rate was low at 22% which does not support generalization of findings. -Studying one region limits generalization to other areas.	The current study was done in Kenyan context on ISO 14001 certified firms.
	Pathak (2017)	Green marketing and customer's satisfaction and its impact on environmental safety in banking sector in India.	-Green marketing mix have positive connection with satisfied customers.	-The study used small sample size - Use of descriptive data analysis only which lacks statistical inferences.	The current study was done in ISO 14001 certified firms and data analysed using regression analysis.
Green organiza-tional innovation strategy	Elshaer, Azazz and Fayyad (2023)	Green management and sustainable performance of small- and medium-sized hospitality businesses: moderating the role of an employee's pro-environmental behaviour in Saudia.	-Green management practices had effect on sustainable performance of firms. -Employee's pro-environmental behavior had moderating effect on the relationship on SMEs in hospitality sector.	-The study was done in hospitality industry which cannot be generalized to sectors like manufacturing. -The study also used convenient sampling which may be biased.	The current study was census involving all ISO 14001 certified manufacturing firms while exploring the relationship between GIS and performance sustainability of firms.
	Al-Shammari, Alshammrei, Nawaz and Tayyab (2022)	Green human resource management and sustainable performance with the mediating role of green innovation: a perspective of new technological era.	-Green human resource practices had positive effect on the sustainable performance of SMEs with green innovation partially mediating the relationship.	-Contextual gaps limiting generalization of findings.	- the study was done among all ISO 14001 certified manufacturing firms in Kenyan.

	Banyham-dan, Al-Ghdabi and Almomani (2019)	How innovation performance us affected by green human resource practices among industries in Jordan.	HR practices which are green had impact on innovation performance.	- The sample size was small -The study did not specify sectors which the study was carried out.	The study was done among all ISO 14001 certified manufacturing firms in Kenyan.
	Kneipp, Gomes, Bichueti, Frizzo and Perlin (2019)	How performance is associated with sustainable innovation practices of Brazilian industrial companies.	Performance is linked to sustainable innovation practices on Brazilian industrial companies.	- Low response rate of 19.92% which invalidates generalization - used of single approach of collecting data.	-This study used mixed approach collecting and analysing data on GIS and firm sustainability.
	Chukwuka and Eboh (2018)	Link between green business practices and performance of Nigerian manufacturing firms.	Green business practices, principles and processes influenced performance of firms.	-The sample size was small and thus limiting generalization of findings.	This study analysed GIS on performance of ISO 14001 certified firms in Kenyan context.
Competi-tive advantage	Nuryakin & Maryati (2022)	Do green innovation and green competitive advantage mediate the effect of green marketing orientation on SMEs' green marketing performance in Batik SMEs in Yogyakarta, Indonesia.	-Green marketing orientation had effect on green innovation which had impact on green marketing performance with competitive advantage having mediating effect on the relationship.	-The study was limited in terms of methodology as it utilized only quantitative methodology and use of purposive sampling method which is non-representative and prone to biasness.	The current study was census which involved all ISO 14001 certified firms in Nairobi city county in Kenyan context.
	Buswari, Setiawan, Sumiati and Khusniyah (2021)	The Effect Between Green Product Innovation and Green Marketing on Competitive Advantage and Business Performance.	Green marketing and product innovation had effect on business performance while competitive advantage mediating the relationship among SMEs in Indonesia.	-Methodological and contextual gaps as it involved only quantitative data analysis and it was done among SMEs limiting generalization of findings.	The current study utilized mixed methodology involving all ISO 14001 certified firms in Nairobi city county in Kenyan context.

	Wirda, Herri, Elfindri, Rivai, and Herizon. (2019)	Entrepreneurial competency and business performance: mediating role of with competitive advantage in West Sumatra-Indonesia.	Entrepreneurial competency had positive effect business performance while competitive advantage mediated the relationship.	The sample size was small; only 2.82% of entire target population thus limiting generalization of results. - The study was done in creative industries alone thus having industrial gaps.	This study examined if competitive advantage mediated the relation between GIS and performance sustainability.
	Pratono, Darmasetia-wan, Yudiarso and Jeong (2019)	Link between green entrepreneurial and market orientation on competitive advantage when it is mediated by inter-organizational learning.	Competitive advantage was connected to green entrepreneurial and market orientation while inter-organizational learning mediated the relationship.	By thus study being done Indonesian manufacturing sector poses a contextual gaps where various sectors were not clarified.	Current study was done among ISO 14001 certified manufacturing firms in Kenyan context.
	Anwar (2018)	BMI and SMEs performance: Mediating role of competitive advantage in manufacturing SMEs in Pakistan.	BMI had significant positive effect on SMEs performance in Pakistan while competitive advantage partially mediated the relationship.	-Exploratory study limits hypothesis testing and generalization of findings. - Contextual gaps involving SMEs in Pakistan limiting generalization of findings.	The current study used descriptive and explanatory design analysing effects of GIS on performance sustainability of firms.
	Setyawati, Rosiana and Shariff (2017)	Connection between innovation and performance of SMEs and mediation of competitive advantage in Indonesia.	Innovation had positive effects on performance of firms while competitive advantage failed to mediate the relationship.	- Study findings contradicted most studies that innovation has mediating influence on innovation and firm performance.	This study tried to clarify if competitive advantage relationship between GIS and sustainability of firms.
Regulatory Framework	Eneizan, Matar, Al-Zawahreh, Alkhawaldeh and Eneizan (2019)	Effects of green marketing strategy on financial performance. The moderating role of government policy in Jordan.	-Green marketing strategy had significant effects on the firm performance while government policy moderated the relationship.	-Contextual gaps as the study was done in car dealing firms in Jordan thus limiting generalization of findings to manufacturing sector.	Current study was done among ISO 14001 certified manufacturing firms in Kenyan context.

	Cao, Deng, Song and Zhong (2019)	How environmental regulation intensity is linked to technological innovation in China and how it moderates the relationship.	- Environmental regulation intensity have direct effect on technological innovation but it doesn't have moderating effect.	Use of convenience sampling which doesn't support hypothesis testing.	The study used census sampling to sample all ISO 14001 certified manufacturing firms during the study.
	Saengchai, Rodboonsong and Jermsittiparsert (2019)	How environmental dynamism mediate how green product innovation is linked to sports industry performance in Thailand.	Regulations relating to environment and green product innovation had impact on performance of sports industry in Thailand while environmental dynamism moderated the relationship.	The study was limited in that findings cannot be generalized to manufacturing sector as it is done in sports industry in Thailand.	This study was done in ISO 14001 certified manufacturing firms in Kenyan context while analysing GIS and firm sustainability.
	Feng and Chen (2018)	How industrial green development relate to green innovation and how environmental regulations mediate the relationship in China.	-Environmental regulations had both direct and moderating how green innovation related to industrial green development.	-The sample size was small meaning it isn't adequate representative of the entire population and did not specify sectors where data was collected.	This study was done in ISO 14001 certified manufacturing firms in Kenyan context while analysing GIS and performance of firm.
	Ramanathan, *et al*. (2017)	How innovation and environmental regulations relate performance among firms in both UK and China.	Depending on firms' resources and capabilities, adoption of more environmental regulations innovatively led to firm performance.	- Use of small sample size and case study limit generalization of the findings - use of qualitative study which does not support statistical inferences.	This study was use mixed research methods during data collections.

	Kousar, Sabri, Zafar and Akhtar (2017)	Link between technological factors and green innovation and how government intervention mediates the relationship among SMES in Pakistan.	Relative advantage and triability positively influenced adoption of green technology with government intervention moderating the relationship.	-Conducting study on only SMEs and in Pakistan limiting generalization of the findings.	The current study was done in ISO 14001 certified manufacturing firms to enquire on effects of GIS on the sustainability firms.

Source: Author, 2021

2.5 Conceptual Framework

This framework gives an overview of how variables of the study are conceptualized in the research and the relationship between the study variables. Green innovation strategy is the independent variable. Competitive advantage plays the intermediate (mediating) role while regulatory framework is the moderating variable and lastly performance sustainability is the dependent variable.

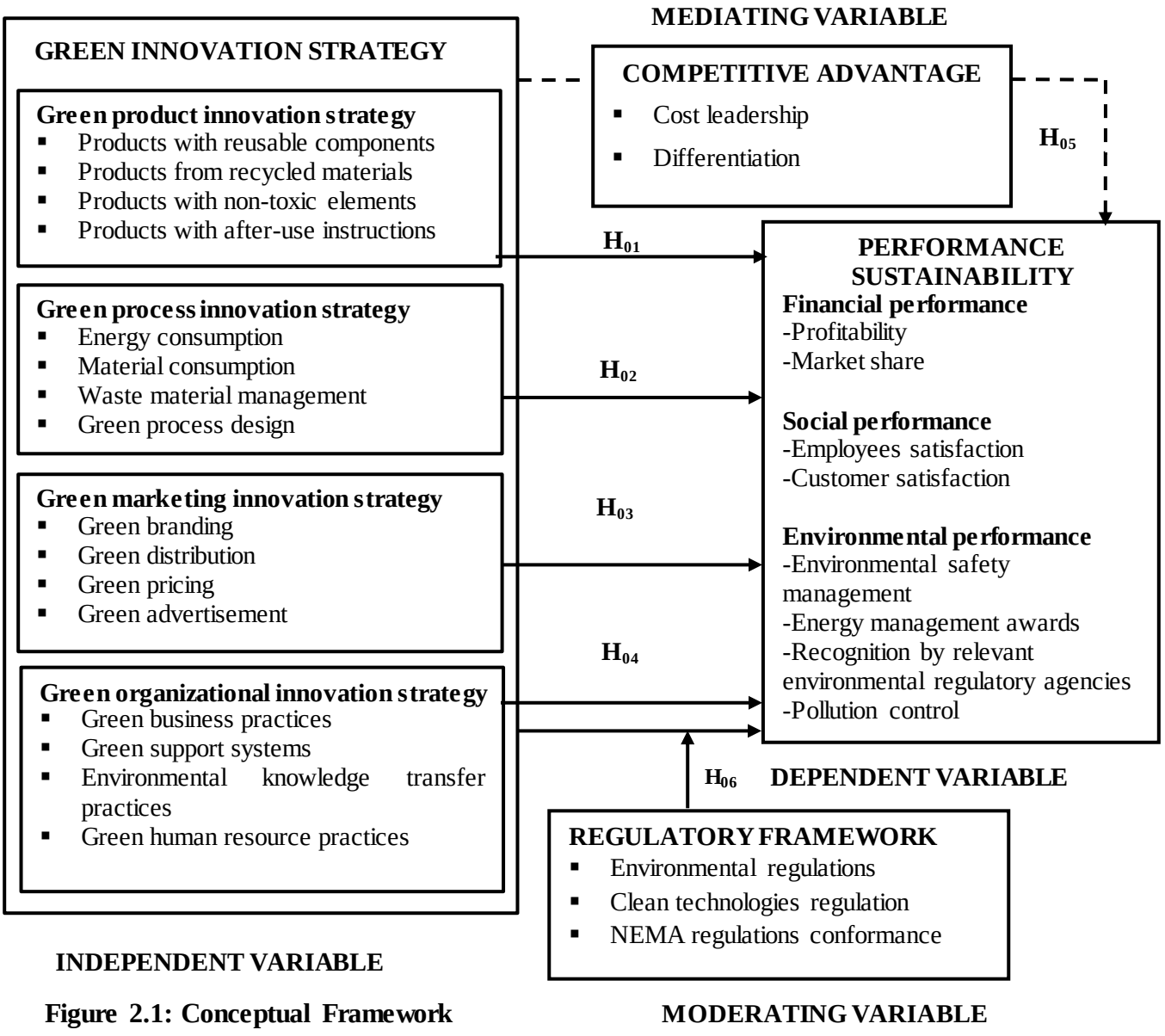

Figure 2.1: Conceptual Framework
Source: Author, 2023

Figure 2.1 show the relationship between green innovation strategy (Independent variable) and performance sustainability (Dependent variable). This relationship is moderated by regulatory framework while competitive advantage played a mediating role. GIS was operationalized using 4 dimensions that is: green product, process, marketing and green organizational innovation strategy. Indicators for competitive advantage were indicated by cost leadership and differentiation. Regulatory framework was conceptualized using environmental regulations, clean technologies regulation and NEMA regulations conformance. Performance sustainability was operationalized using financial, social and environmental performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents methodology used in data collection and analysis. The chapter comprise of research philosophy, research design, empirical model, study population, sampling design and procedure. The chapter further consist of data collection instruments, piloting, reliability and validity of the instrument, data collection procedure, operationalization of variables, diagnostic tests, data analysis and presentation and research ethics.

3.2 Research Philosophy

Research philosophy is linked to how various categories of knowledge are developed. It exhibits crucial assumptions on how scholars perceive the world (Saunders, Lewis & Thornhill, 2019). The choices of the paradigm form basis which guides the researcher on key philosophical propositions and on how study methods, paradigms, tools and respondents of the study are selected (Mertens, 2014). Academic research tends to cling towards either positivism or social constructivism philosophy (Murya, 2010). This study adopted positivism philosophy.

Positivism paradigm hold that researcher is external to the research and the results of the research are objective and not influenced by researcher (Saunders *et al*., 2019). The study is factual, impartial, valid, consistent and objective and it is based on observable social realities which can be generalized in to law which explains cause and effect relationship and has predictive and explanatory power (Furrer, Thomas & Goussevkaia, 2008;

Saunders *et al.,* 2019). It is also hypothesis based thus it can be scientifically tested (Saunders *et al.,* 2019).

This study sought to offer a coherent clarification relating to GIS and performance sustainability of firms. The Likert scale was used to obtain quantitative data where inference was drawn after statistical analysis. Open ended questions in the questionnaires were analysed using content analysis which was conducted per theme. The results were discussed in a narrative form. The study involved triangulation of quantitative data with qualitative data as per theme during analysis.

3.3 Research Design

According to Saunders, *et al.* (2019), research design is defined as general plan which answers study enquiry by specifying methods and processes utilized to obtain data and analyse it. The researcher adopted descriptive and explanatory research designs. Sekaran and Bougie (2016) recommends that an ideal study should incorporate more than one designs to enhance the study and deliver optimal results. Combining more than one research designs gives insights that may be overlooked by single research design. It also enables a researcher to be flexible and be in position to accommodate both qualitative and quantitative data. This helps in contributing more to knowledge, theory and practice (Niglas, 2008).

Descriptive research design looks for a clarification on the accuracy of people's profile, events or circumstances. Adoption of descriptive design offers researchers chance to explore problem broadly thus giving researcher novice ideas and insights about the concept under investigation (Sekaran & Bougie, 2016). Explanatory design on the other

hand aims at establishing causal and effect relationship between study variables. It looks for an explanation of the nature of certain relationships (Sekaran & Bougie, 2016). The two designs enabled researcher establish whether there exists a relationship between GIS and performance sustainability, how the relationship can be mediated by competitive advantage and moderated by regulatory framework.

3.4 Empirical Model

The multiple regression model was used to analyse data in this research. The model is often used the dependent variable is continuous (Field, 2009). Performance sustainability was considered as continuous variables thus making regression analysis model most suitable for this study. GIS (Independent variable) has four aspects which were linked to dependent variable (Performance sustainability). The empirical model for multiple regression analysis utilised was:

$$PS = \beta_{01} + \beta_1 GPIS + \beta_2 GPrIS + \beta_3 GMIS + \beta_4 GOIS + \varepsilon \quad \text{.....3.1}$$

Where: PS = Performance Sustainability

GPIS	=	Green Product Innovation Strategy
GPrIS	=	Green Process Innovation Strategy
GMIS	=	Green Marketing Innovation Strategy
GOIS	=	Green Organisational Innovation Strategy
β_0	=	Constant/Intersect (Sustainability of firm without including GIS)
β**i**	=	Beta Coefficient (Slope)
ε	=	Error Term

Composite index was computed using weighted mean approach. Composite index allowed combination of several variables or indicators so as to reflect overall status or assessment (Chakrabartty, 2017). It involved combining quantitative data for all

variables collected from Likert scale for hypothesis testing. The first step was identifying indicators of the variables (data) which were sorted thematically. The data was then be transformed (normalized) and lastly the data was combined by calculating the weight average of the indicators. When researcher use harmonic mean to compute composite index, it considers the reciprocal of individuals observation and utilise model proposed by Gupta (2008).

$$\mathbf{C}i=\Sigma fi\mathbf{w}i\div\Sigma fi$$

Where: **Ci** = Represent the composite index for variable**s** ***i***

f = The overall number of respondents

w*i* = Relative weight of every component in a particular variable

i = Overall number of components that consist a particular variable

3.4.1 Test for Mediation

The determination of whether the relationship between green innovation strategy (explanatory variable) and performance sustainability of a firm (dependent variable) was mediated by competitive advantage; researcher used path analysis as proposed by Baron and Kenny (1986) and as applied in research by Kinyua (2015) and Muraguri (2016). The model 3.2 established if there was a relationship that could be mediated between explanatory variable (Green innovation strategy) and outcome (performance sustainability).

The model 3.3 determined how the independent variable (GIS) and competitive advantage which acted as the outcome related. The model 3.4 established if competitive advantage (Mediating variable) related with dependent variable (PS) while acting as

independent variable. The model 3.5 was used to determine if competitive advantage played a mediating role on how the explanatory variable (GIS) and outcome (Performance sustainability of firms) related.

$PS = \beta_0 + \beta_1 GIS + \varepsilon$…….....3.2

$CA = \beta_0 + \beta_1 GIS + \varepsilon$…….....3.3

$PS = \beta_0 + \beta_1 CA + \varepsilon$…….....3.4

$PS = \beta_0 + \beta_1 GIS + \beta_2 CA + \varepsilon$…….....3.5

Where:

PS = Performance Sustainability

GIS = Green Innovation Strategy

CA = Competitive Advantages.

β_0 = Constant (Intersect)

β_i = The slope (Beta Coefficient)

ε = The error term

To make decision on mediation, model by Baron and Kenny (1986) was adopted as demonstrated in table 3.1

Table 3.1: Criteria for Mediation Decision

	Outcomes	Conclusions
1.	If β_1 in model 3.2 is significant	There is a relationship that can be mediated
2.	If β_1 model 3.2 is not significant	There is no relationship that can be mediated
3.	If β_1 in model 3.2 is significant If β_1 in model 3.3 is significant If β_1 in model 3.4 is significant If β_1 in model 3.5 is not significant but β_2 in the same model is significant	Total Mediation
4.	If β_1 in model 3.2 is significant If β_1 in model 3.3 is significant If β_1 in model 3.4 is significant If β_1 in model 3.5 is significant but less than β_1 in model 3.2 and β_2 in model 3.5 is significant	Partial Mediation
5.	If β_1 in model 3.2 is significant If β_1 in model 3.2 is not significant If β_1 in model 3.4 is significant If β_1 in model 3.5 is not significant or equal to β_1 in model 3.2 and β_2 in model 3.5 is not significant	No Mediation

Source: Baron and Kenny (1986)

3.4.2 Test for Moderation

Path analysis model was used to determine whether regulatory framework moderates the relationship between green innovation strategy (explanatory variable) and dependent variable (Performance sustainability) of firms. The direction and strength of how the explanatory variable relate to the outcome is affected by moderating variable. It enhances, reduce or change how the explanatory variable may affect the outcome (Muathe, 2010).

The model proposed by Baron and Kenny (1986) was utilised in testing how relationship between GIS and performance sustainability of a firm is moderated by regulatory framework as applied in research by Mwangi (2016) and Muraguri (2016). Whisman and McClelland (2005) observed that moderation test involves establishing if statistical there

is difference between the coefficient for the interaction and zero. The models 3.6 and 3.7 illustrate the two-step approach of testing moderation. Model 3.7 gave direction on the significance of the interaction term.

$PS = \beta_0 + \beta_1 GIS + \beta_2 RF + \varepsilon$…….....3.6

$PS = \beta_0 + \beta_1 GIS + \beta_2 RF + \beta_3 GIS*RF + \varepsilon$…….....3.7

Where;

PS = Performance Sustainability

GIS = Green Innovation Strategy

RF = Regulatory Framework

GIS*RF = Interaction factor between GIS (Predictor) and RF (moderator)

$\boldsymbol{\beta_0}$ = Constant (Intersect)

$\boldsymbol{\beta_i}$ = Beta coefficients (slope)

$\boldsymbol{\varepsilon}$ = The error term

The study adopted the following decision criteria: First, there is no relation to moderate when β_1 in model 3.6 is not significant. If it is found that β_1 in model 3.6 is significant but β_2 in the same model is not significant we conclude that the variable is an explanatory variable but not a moderator. When β_1, β_2 and β_3 in model 3.7 are significant, the moderator variable has a moderating effect. The direction and strength of the moderating effect is determined by interaction term that β_3 in model 3.7.

3.5 Target Population

This research targeted the 60 ISO 14001 certified manufacturing firms located in Nairobi City County as indicated in appendix II. It specifically dealt with firms which were ISO

certified by any of the three Kenyan certifying bodies that is: Bureau Veritas (K) Ltd, KEBS and Société Générale de Surveillance (SGS) - Kenya Ltd and which got certification before December 2019. The 60 ISO 14001 certified firms were drawn from 12 sectors of manufacturing which deals with value addition.

3.6 Sampling Procedure and Sample Size

The research utilised census to study all ISO 14001 certified manufacturing firms. Census was used because ISO 14001 certified manufacturing firms are few and in case of non-response it may affect data analysis. The sample size was the 60 firms located in Nairobi City County. These firms were chosen because they are certified on EMS which relates to sustainability of the firms. The key informants for this study were the heads of finance, marketing, operations, ICT and HRM departments in each firm totalling to 300 respondents. The five departments were selected because they had relevant information on GIS and performance sustainability of firms. The sampling factor was the five functional areas. Table 3.2 shows how respondents were distributed.

Table 3.2: Distributions of the Respondents

Number of sampled firms (N)	**Sampling factor (N x 5)**	**Number of respondents (n)**
60	5	300

Source: Author (2021)

3.7 Data Collection Instruments

The study collected primary data from respondents using semi - structured questionnaires. Research respondents were drawn from the corporate heads of the five section that is: finance, marketing, ICT, HRM and operations departments. The main advantage of using questionnaires was there was freedom of respondents to give their opinions independently and freely without collusion. It was additionally anonymous which helped to produce more candid answers.

The tool has eight parts. General information is addressed in question 1 up to 7 of the questionnaires. Part B up to Part H contains Likert scale with subsection concerning the variable under investigation. Each Likert scale is followed by open ended questions to test the respondents on the variables. Part B comprise of question 8 to 10 concerning green product innovation strategy. Part C is addressed in question 11 to 13 regarding green process innovation strategy. Part D consist of question 14 and 15 dealing with green marketing innovation strategy while Part E is addressed in question 16 and 18 dealing with green organizational innovation strategy.

The mediator variable (Competitive advantage) is addressed in Part F with question 19 and 20. The moderating variable (Regulatory framework) is addressed in part G with question 21 and 22. The last section is part H which is addressed in question 23 addressing performance sustainability of ISO certified manufacturing firms using a Likert scale.

3.8 Instruments Validity and Reliability

Before carrying out the actual study, the reliability and validity of tools was assessed. The research instruments were piloted among 15 respondents in 3 ISO certified manufacturing firms in Nairobi City County. Firms used during piloting of research instrument were not included in the final study as recommended by Field (2009).

3.8.1 Validity of Research Instruments

According to Liu (2010), validity refer to level at which study instruments assess what it is supposed to measure and estimates how accurate data to be measured is to be. Face, construct and content validity was evaluated to determine the instrument's validity. The content validity assessed whether the content is representative sample of content that was measured. Content validity was done through seeking opinion of supervisor and expert opinion in strategic management. It involved rational evaluation of the contents of the instruments using five raters who were familiar with constructs of interest where areas which needs modifications were identified and recommendation on changes to be made.

Face validity assessed the level at which the investigator believes the research tools are suitable. The researcher subjectively assessed the instrument by relying on previously developed instruments in other related studies and from the knowledge obtained from diverse related literature (Wheelan, 2014). Construct validity on other hand assessed if the instrument measured the desired construct (variable) adequately (McGrath, 2005; Rosenthal, 2006). It examines whether operationalization of the variable reflect the theoretical base of the variable. This was done by also involving five raters who are specialist and who is familiar with the construct of interest and their input added in the final instruments as recommended by Diskiene, Galiniene and Marčinskas (2008)

3.8.2 Reliability of the Instruments

Sekaran and Bougie (2016) defines reliability as the degree at which scores are without random errors. Researcher used Cronbach's Alpha to determine how consistency the items of the questionnaire were. Reliability of each item of questionnaire was realised by computing Cronbach's alpha coefficient. The study used test retest technique where questionnaires were administered twice to the selected respondent after 14 days. Pearson's Product Moment formula was used to get correlation coefficient. The score range between 0 and 1 where any coefficient above 0.7 was accepted and conclusion made that instrument was reliable (Hair, *et al.,* 2010; Tavakol & Dennick, 2011). Any item with coefficient below 0.5 was unreliable and discarded while items with coefficient between 0.5 and 0.7 were modified or improved. Table 3.3 presents the results obtained from the reliability test.

Table 3.3: Reliability Test results

Variable	Cronbach's Alpha	Number of items
Green Product Innovation Strategy	0.817	14
Green Process Innovation Strategy	0.821	13
Green Marketing Innovation Strategy	0.819	13
Green Organizational Innovation Strategy	0.818	12
Competitive Advantage	0.822	15
Regulatory Framework	0.819	13
Performance Sustainability	0.831	28
Overall Reliability Coefficient	**0.821**	**108**

Survey: Pilot study 2021

The Cronbach's Alpha coefficient for the variables determined in table 3.3 results were as follows: green product innovation strategy (α=0.817), green process innovation strategy (α=0.821), green marketing innovation strategy (α=0.819), green organizational innovation strategy (α=0.818), competitive advantage (α=0.822), regulatory framework (α=0.819) and performance sustainability (α=0.831). The findings indicated that all variables had values which were greater than 0.7. Field (2013) proposed that when the value is greater than 0.7 the item is reliable and can be adopted as an item of the research tool. The aggregated value of all 108 items of the seven variables was 0.821 implying that all items jointly were reliable.

3.9 Data Collection Procedures

Semi structured questionnaire was used to collect data for this study. The National Commission for Science, Technology and Innovation (NACOSTI) gave the researcher licence after being introduced by graduate school of Kenyatta University. The researcher anticipated to collect information from 60 ISO 14001 certified manufacturing firms. The questionnaires were distributed using drop and pick and mail survey methods. Researcher engaged an informed research assistant who dropped the questionnaires to firms and picked them after they were filled manually. Firms with restricted entry of visitors during this COVID -19 pandemic, researcher used mail survey where questionnaires were mailed to the respondents in each firm. Researcher obtained details of each firm from KAM directory. Researcher then contacted each firm to inform the respondents on the expectation of the intended study and guidance on how to fill the questionnaires. After sending or dropping the questionnaires, researcher gave respondents three weeks before

making follow up. The researcher assistant helped the researcher in collecting filled questionnaires. The researcher was expected to take 3-4 month to collect the data.

3.9.1 Operationalization and Measurement of Variables

Green innovation strategy in this study is the explanatory variable while the outcome or dependent variable is performance sustainability. The competitive advantage was to play the intermediator role on the relationship between GIS and performance sustainability while the moderator of the relationship was regulatory framework. Table 3.4 describes how each variable was operationalized and their indicators in this study.

Table 3.4: Variables Operationalization

Name of the Variable	Type	Operationalization	Indicators of Each Variable	Criteria of Measurement in Questionnaire
Green Product Innovation Strategy	Independent Variable	Having products which are harmless to both consumers and environment and which have instructions on how to use and dispose them	-Products with reusable components -Products from recycled materials -Products with non-toxic elements -Products with after-use instructions	Appendix I: **Part B** Questions 8 to 10
Green Process Innovation Strategy	Independent Variable	Having technology, processes and designs that utilizes materials and energy efficiently and have products which are harmless to consumers and the environment	- Energy consumption - Material consumption -Waste material management -Green process design	Appendix I: **Part C** Questions 11-13
Green Marketing Innovation Strategy	Independent Variable	Utilizing methods that was enabled firm introduce its products to the market in an environmentally sustainable manner	-Green branding -Green distribution -Green pricing -Green advertisement	Appendix I: **Part D** Questions 14-15

Green Organizational Innovation Strategy	Independent variable	Firms having new management system, practices and operations which are user and environmentally friendly	-Green business practices -Green support systems -Environmental knowledge transfer practices -Green human resource practices	Appendix I: **Part E** Questions 16-18
Competitive Advantage	Mediating variable	Internal distinct attributes which firm possesses which enable it perform better than its competitors	-Cost leadership - Differentiation	Appendix I: **Part F** Questions 19-20
Regulatory Framework	Moderating variable	These are regulations, policies, standards, guidelines and laws that govern how firms should operate in an environmentally sustainable manner	-Environmental regulations -Clean technologies regulation -NEMA regulation compliance	Appendix I: **Part G** Questions 21-22
Performance Sustainability	Dependent variable	Extent at which firm is able to achieve its financial, social and environmental targets	- Financial performance -Social performance -Environmental performance	Appendix I: **Part H** Questions 23

Source: (Author, 2021)

3.10 Diagnostic Tests

To make appropriate inferences and draw correct conclusion, it is important for diagnostic test to be conducted. Diagnostic test helps reduce violation of assumptions of multiple regression analysis which can make results to be biased or lead to poor decision making while testing hypothesis if the researcher should reject null or fail to reject null hypothesis (Malhotra & Dash, 2011; Chatterjee & Hadi, 2012). The researcher conducted the following diagnostic tests which include normality, linearity, multi-collinearity and homoscedasticity tests before engaging in the data analysis.

3.10.1 Normality Test

To confirm if distribution of data is normal, normality test was conducted (Kothari, 2009). Ghasemi and Zahediasl (2012) proposes use of Shapiro-Wilk test for normality test. The tests evaluated whether the sample was taken from a population which was normally distributed against null hypothesis (H_0) that the sample follows a normal distribution. In the Shapiro-Wilk test, the threshold is if p-value is greater than 0.05 it is concluded that data has normal distribution while on the other hand if the p-value is less than 0.05 the data strays away from the normal distribution as proposed by Razali and Wah (2011). The remedy for violating normality of data was setting less alpha level than 0.05 for instance 0.01. This helped address challenge of rough approximation of the beta coefficient resulting from lack of normality.

3.10.2 The Linearity Test

The linearity test checks whether there is a linear relationship between the independent variable and the dependent variable. To test linearity, Pearson product-moment correlation was adopted where correlation coefficient determined how strong the linear

relation was between the variables (Dancey & Reidy, 2004). The null hypothesis (H_0) was there was no linear relationship between the variables. The range of coefficients of correlation test are between -1 and 1. When the score is above -0.5 it indicates a strong negative relationship while when score is above 0.5 it indicates a strong positive relationship as proposed by Bewick, Cheek and Ball (2005). The remedy for violation of linearity of data was data transformation which involved squaring the variable.

3.10.3 Multi-Collinearity

Multi-collinearity identifies whether the predictor variables have a linear relationship. This is where the predictor variables can be used to predict the other variable. The regression coefficient lies between 1 and -1 and if it is 1 or -1 that is perfect multi-collinearity. The null hypothesis state that the coefficient of the variable is zero meaning the variable does not contribute to the model. Field (2009) recommends in testing multicollinearity we should utilize Variance Inflation Factor (VIF) and tolerance. It is recommended that if tolerance value is less than 0.20 or 0.10 or VIFs of at least 10 it indicates multi-collinearity (O'Brien & Robert, 2007). The remedy to multi-collinearity in this research was using large sample which gave more data thus producing more precise parameter estimates with lower standards errors.

3.10.4 Homoskedasticity/ Homogeneity

Homoskedasticity is evident when the variance of error term is equal. If error term vary; this is referred as heteroskedasticity which has biased standard errors thus leading to biased inferences (Machado & Silva, 2013). Levene test was used to test homoskedasticity where the statistics measure whether or not the variance across samples or groups is equal. Null hypothesis stated that across the groups variance is equal. When

the p-value is greater than 0.05 it is recommended that we should not reject null hypothesis thus concluding there is homoskedasticity and it is okay to subject the regression model for an additional analysis as recommended by Gastwirth *et al.* (2009). To deal with heteroscedasticity where there is misleading and incorrect standard error ordinary least regression using robust standard error was to be used as proposed by White (1980). This doesn't change the predictor but remove the incorrect standard error.

3.11 Data Analysis and Presentations

The researcher started analysis of data by sorting and collating data collected thematically as per research objectives and hypothesis. The data was then run using Statistical Package for Social Sciences (SPSS) version 22.0 software to generate both descriptive and inferential statistics. Descriptive statistics aided researcher to get insights on attributes of the respondents and variables in terms of mean, frequencies, percentage and standard deviations (Hair, *et al*., 2010).

Inferential statistics utilized multiple regression model to assess whether there is relation between GIS and performance sustainability and test hypotheses at 95% level of confidence. Responses made on research variables was combined using SPSS to come up with composite scores which utilised for multivariate analysis. To determine how performance sustainability was explained by GIS, adjusted coefficient of determination (R^2) was used (Variation of performance sustainability due to GIS) at 0.05 significance level. Unstandardized beta coefficient (The Beta values) indicated how the variable related and how performance sustainability changed if GIS was changed by a single unit. Analysis of Variance (ANOVA) that is F- test evaluated if the overall models were statistically significant. The condition that if p-value on the ANOVA test was below 0.05,

the model was deemed to be significant statistically at 0.05 significance level. Content analysis was adopted to analyse qualitative data where common themes were used to draw inferences and presented in a narrative form as recommended by Cooper and Schindler (2014). The summary of statistical test of the hypotheses was presented in table 3.5.

Table 3.5: Statistical Tests of Hypotheses

Study Objective	Study Hypothesis	Models	Interpretation
To determine effect of green product innovation strategy on the performance sustainability	*Ho_1:* Green product innovation strategy has no significant effect on the performance sustainability	Multiple regression model $FP = \beta_{01} + \beta_1 GPIS + \beta_2 GPrIS + \beta_3 GMIS + \beta_4 GOIS + \varepsilon$	Adjusted r^2 β_i F-value Level of significant 0.05 $P \leq 0.05$ Reject null hypotheses
To establish effect of green process innovation strategy on the performance sustainability	*Ho_2:* Green process innovation strategy has no significant effect on the performance sustainability		
To find out effect of green marketing innovation strategy on the performance sustainability	*Ho_3:* Green marketing innovation strategy has no significant effect on the performance sustainability		
To determine effect of green organizational innovation strategy on the performance sustainability	*Ho_4:* Green organizational innovation strategy has no significant effect on the performance sustainability		

To establish the mediating effect of competitive advantage on the relationship between green innovation strategies and performance sustainability	*Ho_5:* Competitive advantage has no significant mediating effect on the relationship between green innovation strategies and performance sustainability	Path analysis $FP = \beta_0 + \beta_1 GIS + \varepsilon$ $CA = \beta_0 + \beta_1 GIS + \varepsilon$ $FP = \beta_0 + \beta_1 CA + \varepsilon$ $FP = \beta_0 + \beta_1 GIS + \beta_2 CA + \varepsilon$	Adjusted r^2 β_i F-value Level of significant 0.05 $P \leq 0.05$ reject null hypotheses
To determine the moderating effect of regulatory framework on the relationship between green innovation strategies and performance sustainability	*Ho_6:* Regulatory framework has no significant moderating effect on the relationship between green innovation strategies and performance sustainability	Path analysis $FP = \beta_0 + \beta_1 GIS + \beta_2 RF + \varepsilon$ $FP = \beta_0 + \beta_1 GIS + \beta_2 RF + \beta_3 GIS*RF + \varepsilon$	Change in adjusted R2 Change in F value Change in βi Level of significant 0.05 $P \leq 0.05$ reject null hypotheses

Source: Author (2021)

3.11.1 Control of Type I and Type II Errors

The errors emanate from poor interpretation of empirical results during hypothesis testing. When researcher rejects null hypothesis when one should not have rejected null type I error occurs. However, type II error occurs when researcher fails to reject null hypothesis which one should have rejected (Cooper & Schindler, 2016).

Type I error is connected to significance level when testing hypothesis and is more serious when you compare it with type II error which is mostly set at $P<0.05$ (Nachmias & Nachmias, 2009). To eliminate chances of making an error, scholars are encouraged to set a very low threshold. Type II error relates to sample size and this can be addressed statistically by having large sample size. This study had a sample size of 60 firms involving 300 respondents which were higher than the threshold of 30 respondent as recommended by Mugenda and Mugenda (2003).

3.12 Research Ethics

Ethics are the norms regulating people conduct and which are important to their welfare (Minja, 2009). This study strived to comply with various research ethics. These research ethics include: First, during the study confidentiality of information was assured as no specific individual or firm was mentioned in the study and where specific firms was involved the data was coded.

Secondly, the study sought informed consent from the respondents and firms before involving them in the study. The research conducted briefing to respondents relating to relevance of the study and no one was forced to take part in the study. Respondents was allowed to exempt themselves at any level of the study.

Thirdly, the researcher sought permit from NACOSTI and other relevant authorities during data collections. During the study, all containment measures against COVID-19 were adhered to and the respondents were reached through mail survey and on cases where hard copies were used they were sanitized before distribution. Lastly, the study acknowledged all sources referenced in this study.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This research chapter addresses data analysis and discussion of research findings. The chapter is organized in to three sections which include: descriptive statistics, inferential statistics and lastly qualitative data analysis. It also discusses the study results based on theoretical and empirical literature reviewed in this study.

4.2. Descriptive Analysis

This section entails the analysis of response rate, characteristics of respondents and firms which participated in the study which were summarized using percentage, mean and standard deviation. The section further discusses descriptive statistics of all thematic areas based on the variables of the study.

4.2.1 Analysis of Response Rate

The study targeted to interact with 300 respondents during the study. The researcher distributed questionnaires to respondents who were supposed to fill and returns with aid of research assistance. Some respondents were emailed questionnaires to fill and return back especially those who were not accessible by the researcher. The respondents who filled the questionnaires and returned were two hundred and twenty-eight while seventy-two questionnaires were not returned. Figure 4.1 presents the summary of analysed response rate.

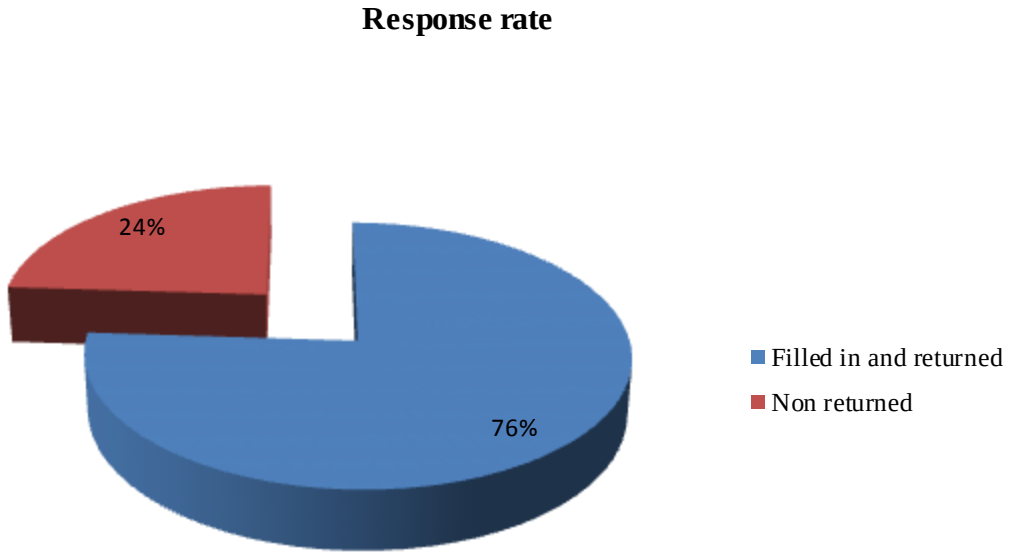

Figure 4.1: Response Rate

Source: Survey data (2022)

Figure 4.1 presents results on response rate which indicate that seventy six percent of all respondents filled-in and returned their questionnaires. According to Mugenda and Mugenda (2003), when the rate of response is over fifty percent its adequate and when it is beyond seventy percent it is good enough and adequate for coming up with inferences and making conclusion based on the study findings.

4.2.2 Demographic Characteristics of Respondents

The demographic characteristics of the participants in this research were organized in terms of gender, age, education level, years of experience in the firm and position in the firm. The findings for each attribute was discussed separately. Table 4.1 presents how the demographic characteristics of respondents were analysed.

Table 4.1: Demographic Characteristics of Respondents

Category	Sub-category	Frequency	Percentage
Gender	Male	152	66.7
	Female	76	33.3
	Total	**228**	**100.0**
Age	Below 35 years	31	13.6
	35 to 40 years	45	19.7
	41 to 45 years	80	35.1
	Above 45 years	72	31.6
	Total	**228**	**100.0**
Education level	Professional certificate	15	6.6
	Diploma	43	18.9
	Bachelor's degree	110	48.2
	Master's degree	47	20.6
	PhD	13	5.7
	Total	**228**	**100.0**
Years worked	1 to 3 years	30	13.2
	4 to 5 years	92	40.4
	Above 5 years	106	46.5
	Total	**228**	**100.0**
Position	Finance manager	30	13.2
	Marketing manager	62	27.2
	Human resource manager	45	19.7
	Operations manager	45	19.7
	ICT manager	46	20.2
	Total	**228**	**100.0**

Source: Survey data (2022)

Table 4.1 indicated that most participants in this research were men representing 66.7% of all respondents while 33.3% of the respondents were female. This indicated that the one third gender rule was adhered to in appointment of management in most institutions as per the dictates of Kenyan constitution 2010. The biggest percentage of respondents were aged between 41-45 which represented 35.1% of the respondents which was trailed by 31.6% of the participants whose age were above 45 years. The remaining participants of the study were above ages between 35 to 40 years which represented 19.7% while

respondents aged less than 35 years were least representing 13.6% of all respondents. Age is critical as it helped in understanding respondents of the study as we move to analysing the thematic areas of the study.

Results from this inquiry confirmed that the biggest percentage of participants in this study comprised of holders of Bachelor's degree which represented 48.2% of the respondents while those with second degree (Master's degree) were 20.6% of all respondents. Diploma holders were 18.9% of the respondents while Professional certificate and Doctorate degree represented 6.6% and 5.7% of all respondents respectively. This means that most of the respondents were educated and knowledgeable. The level of education of respondents was necessary in this study in that it assured the researcher the data obtained was from informed respondents and could be relied on all variables of the study.

The bigger percentage that is 46.5% of the participants in this study had experience of working in their organisation for length exceeding 5 years with those who served the firms for 4-5 years represented 40.4%. Respondents who had worked in their firm for 1-3 years represented least percentage of 13.2 percent. This implies that most of the respondents had adequate experience on the operations of the company. The experience on the operation of the firm assured the researcher that informants were fully acquainted with operations of firms and the results can be relied on during analysis.

Table 4.1 further indicated that most of the participants in this research (managers) were drawn from marketing department which formed 27.2% of the entire team with the smallest group being represented by finance managers at 13.2%. The percentage of

respondents in charge of ICT department were 20.2% with those charged with heading human resource and operations departments tying at 19.7%. Generally, it can be concluded that respondents were fairly distributed among management of all major departments of the firms. The fair distribution of respondents from various department would assure that the data obtained was balanced as it was derived from major operations departments of the firms meaning that the data can be heavily relied on.

4.2.3 Firm's Characteristics

The characteristics of firms engaged during the research were examined. The section addressed two areas which included the years since the firm got ISO certification and the type of GIS adopted by the firm. The analysis was presented as shown in table 4.2.

Table 4.2: Firm's Characteristics

Category	Sub-category	Frequency	Percentage
Years ISO certified	1-2 Years	31	13.6
	3 to 4 years	75	32.9
	5 to 6 years	76	33.3
	Above 6 years	46	20.2
	Total	**228**	**100.00**
GIS adopted by firm	1, 2	50	21.9
	1, 2, 3	51	22.4
	1, 2, 4	26	11.4
	2,3	50	21.9
	2,3,4	51	22.4
	Total	**228**	**100.0**

NB: 1= Green product innovation strategy 3= Green marketing innovation strategy
2= Green process innovation strategy 4= Green organizational innovation strategy

Source: Survey data (2022)

The results in table 4.2 indicated that the bigger percentage of firms that is 33.3 percent attained ISO 14001 certification between 5-6 years followed by 32.9 percent of the firms which attained ISO 14001 certification between 3-4 years. The firms which attained ISO 14001 certification on EMS for over 6 years were represented by 20.2 percent. The smallest number of firms represented by firms ISO certified between 1 to 2 years were representing 13.6 percent of all firms. The knowledge on the age of firm since attaining ISO 14001 certification is critical in that enables researcher whether the respondents in those firms have adequate knowledge on going green and on environmental management system which is big beacon as firm go green. Colceag et al. (2015) observed that attaining ISO 14001 is a process involving 4 step cycle popularized as PDCA cycle which takes time thus having knowledge on the age of ISO 14001 certification is prudent. Evangelos and Psomas (2013) observed that ISO certifications links well with firm performance thus the age of certification is critical.

The results were clear that 22.4 percent of all institutions studied had adopted green product, green process and green marketing innovation strategies with another 22.4 percent of the firms adopting green process, green marketing and green organizational innovation strategy. Of all firms, 21.9 percent adopted green product and process innovation strategies which tied with another 21.9 percent of the firms which adopted both green process and green marketing innovation strategies. The least number of firms that is 11.4 percent adopted green product, green process and organizational innovation strategies. The results indicated that most firms had adopted more than two categories of the green innovation strategies which are adequate for choosing respondents of the study.

4.2.4 Green Product Innovation Strategy

This study operationalized green product innovation strategy using four indicators. These indicators include: Products with reusable components, products from recycled materials, products with non-toxic elements and products with after-use instructions. Table 4.3 presented descriptive statistics on green product innovation strategy.

Table 4.3: Descriptive Statistics on Green Product Innovation Strategy

Green product innovation strategy	n	SD %	D %	NS %	A %	SA %	Mean	Std. Dev.
Products with reusable components								
This company produce products with reusable components	228	0	1.3	1.8	70.2	26.8	4.22	0.538
The products of this company have instruction on how they can re-used	228	0	0.9	13.2	72.4	13.5	3.99	0.551
The firm's product can be used in another way after use	228	0	0	6.6	73.7	19.7	4.13	0.497
Aggregate mean scores for products with reusable components							**4.11**	**0.529**
Products from recycled materials								
This firm recycles returned and used products	228	0	0	20.2	60.1	19.7	4.00	0.633
This firm collects its products waste from end user for recycling	228	0	1.8	27.2	70.6	0.4	3.70	0.506
Through recycling, the cost of production has reduced	228	0	1.3	13.6	71.5	13.6	3.97	0.570
Aggregate mean scores for products from recycled materials							**3.89**	**0.570**
Products with non-toxic elements								
This firm produce non-toxic products	228	0	0.4	6.6	60.5	32.5	4.25	0.589
The company's products are non-toxic to the end user	228	0	0	7.9	72.4	19.7	4.12	0.513
The firm's products are not harmful to the environment	228	0	0.9	6.6	72.8	19.7	4.11	0.535
The products have guide on what the end user in case of any effects	228	0	0.9	6.1	65.8	27.2	4.19	0.577
Aggregate scores for products with non-toxic elements							**4.17**	**0.554**
Products with after-use instructions								
The firm's products have instructions on how to recycle after use	228	0	1.3	7.5	71.9	19.3	4.09	0.560
The firm's products have disposal instruction after use	228	0	1.3	27.6	71.1	0	3.70	0.488
The firm's products have guidelines on how to treat by-product after use	228	0	0.4	13.2	73.2	13.2	3.99	0.531
The company's products have instruction on health issues for end user	228	0	0.4	10.1	57.0	32.5	4.21	0.631
Aggregate scores for products with after-use instructions							**4.00**	**0.553**
Aggregate scores for green products innovation strategy							**4.04**	**0.552**

Source: Survey data (2022)

The findings in table 4.3 show that combined mean score for dimensions of green product innovation strategy was 4.04 while the standard deviation of 0.552. This mean score is close to 4.0 which implies that green product innovation strategies had been adopted among the ISO 14001 certified firms. The standard deviation indicates low variability among the responses given by respondents on whether green product innovation strategies had been adopted by the firms thus confirming the position. This is relevant in addressing objective one of this study which sought to determine whether green product innovation strategy was linked to sustainable performance of the firm.

The study findings indicate that the aggregate mean score for product with reusable components was 4.11. The mean score is skewed towards 4.00 (agree) on a Likert scale of 5 points which this research adopted. It was also noted that the variability of responses from the respondents was low as indicated by low standard deviation of 0.529. This means that firms in the manufacturing sector produce products with reusable components. Respondents specifically agree that most companies produced products with reusable components, the products have instruction on how they can be reused and on various ways the products can be reused after use.

Moreover, the research findings denoted that most ISO 14001 certified manufacturing firms produced products from recycled materials with aggregate mean of 3.89 which on 5point Likert scale is near to 4.0 (agree) and standard deviation of 0.570 which implies there is minimal variance amongst the responses by the respondents. It was confirmed from the responses that there was agreement that most firms recycle returned and used products and through recycling cost of production had reduced. It was however noted that there was over a quarter of respondents who dissented that ISO 14001 certified

manufacturing firms collect product waste from the end user for recycling. It can therefore be concluded that most firms produce products from the recycled materials which is key in adoption of green product innovation strategy by firms.

Results in table 4.3 further indicated that there was overall mean score of 4.17 while the deviation was 0.554 on whether firms produce products which are non-toxic. Since the mean score was slightly above 4.0 (agree) when gauged on a 5-point Likert scale which was utilised in this research, this clearly indicate ISO 14001 certified manufacturing firms produce products with non-toxic elements. The results confirm that the company's products are non-toxic to the end user and environment with products having guidelines to the end users on what to do in case of any effect as demonstrated by responses which had mean above 4.00 and low standard deviation of below 0.6 confirming that firms produce products with non-toxic elements.

There is evidence that products had after-use instructions which was critical in adoption of green product innovation strategy by manufacturing firms as demonstrated by low standard deviation of 0.533 and average score of 4.00 indicating an agreement. It was noted that most firm's products had instructions on how to dispose waste, had guidelines on how to treat by-product after use and had instruction on health issues for the end users as their mean score in a Likert scale was skewed towards 4.00 (agree) and low standard deviation of below 0.6 on variability of the responses. This show how imperative product with after-use instruction were in adoption of green product innovation strategy among the ISO 14001 certified firms operating in manufacturing sector in Nairobi, Kenya.

The results from descriptive statistics indicate there were evident that ISO 14001 certified manufacturing firms had adopted on green product innovation strategy. It was evident that most firms had adopted aspects of green product innovation strategy which included having product with reusable components, producing products from recycled materials, producing products which are non-toxic and products with after-use instructions. The proposition of green business model innovation (2012) advocate for coming up with new products which leverage on green and clean technology to come up with substitute products which use green inputs which allow reusing and recycling of materials thus promoting greenness. Thus, the operationalization of indicators of green product innovation strategy aid in advancing the GBMI model as they inform the key tenets of the theory.

4.2.5 Green Process Innovation Strategy

Descriptive statistics on green process innovation strategy helped in addressing objective two on how green process innovation strategy had effect on sustainable performance of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. Green process innovation strategy was operationalized using indicators which include: energy consumption, material consumption, waste material management and green process design. Table 4.4 show how descriptive statistics of all indicators of green process innovation strategy were presented.

Table 4.4: Descriptive Statistics on Green Process Innovation Strategy

Green process innovation strategy	n	SD %	D %	NS %	A %	SA %	Mean	Std dev.
Energy consumption								
The company use processes which utilize energy efficiently	228	0	0.9	7.5	30.3	61.4	4.52	0.673
Machines consumes low power during production	228	0	0.9	12.7	80.7	5.7	3.91	0.461
Efficient energy consumption has reduced cost of production	228	0	0.4	6.6	76.3	16.7	4.09	0.493
Aggregate scores for energy consumption							**4.17**	**0.542**
Material consumption								
The firm's processes use materials efficiently	228	0	0.9	11.8	72.8	14.5	4.01	0.547
The machines used in this company utilizes raw material efficiently	228	0	1.8	6.1	87.7	4.4	3.95	0.416
Efficient material consumption has reduced cost of production in this firm	228	0	0.9	11.4	75.9	11.8	3.99	0.518
Aggregate scores for material consumption							**3.98**	**0.494**
Waste material management								
This firm uses processes that produces little waste	228	0	7.0	13.6	75.9	3.5	3.76	0.629
The firm treats its waste before disposal	228	0	0.9	5.7	72.4	21.1	4.14	0.534
The waste from this firms are used as raw materials by other firms	228	0	1.8	17.1	71.9	9.2	3.89	0.567
Firm collects its by-products from end users for recycling after use	228	0	0.9	11.4	72.8	14.9	4.02	0.547
Aggregate scores for waste material management							**3.95**	**0.569**
Green process design								
The firm production design considers user and environmental safety	228	0	0.9	17.5	72.4	9.2	3.90	0.542
This firm uses process designs that releases of little waste	228	0	2.2	16.2	64.5	17.1	3.96	0.649
Utilization of green process design by this firm has reduces cost of production	228	0	1.8	13.6	71.9	12.7	3.96	0.577
Aggregate scores for green process design							**3.94**	**0.589**
Aggregate scores for green process innovation strategy							**4.01**	**0.549**

Source: Survey data (2022)

Table 4.4 indicated that overall mean response for all items on green process innovation strategy was 4.01 which is closer to 4.0 (agree) on the 5-point Likert scale adopted in this study. This affirms that respondents were in conformity that green process innovation strategy had been adopted by ISO 14001 certified manufacturing firms in Nairobi City County, Kenya which was key to sustainability performance of the firm. The variability of responses was noted to be low averaging at aggregate standard deviation of 0.549 confirming that sample mean response for green process innovation strategy is a stable estimator of the population mean.

The aggregate mean score for energy consumption was 4.17. The standard deviation of energy consumption was 0.542. This implied there was acceptability by respondents that energy consumption inter-relate well with green process innovation strategy. There is agreement that efficient energy consumption and low power consuming machines could reduce cost of production among ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

In addition, the aggregate mean score for material consumption was rated at 3.98 while the standard deviation is 0.494. This aggregate mean index was skewed towards 4.00 implying that respondents agreed as per index in the Likert scale utilized in this study meaning efficient material consumption was imperative in green process innovation strategy in the ISO 14001 certified manufacturing firms. It was noted that efficient utilization of materials and engaging machines which utilized materials efficiently led to reduced cost of production which was an impetus for performance sustainability of the firms. The low overall variability of responses confirmed the conformity among

respondents on link between efficient material consumption and green process innovation strategy among the ISO 14001 certified manufacturing firms in Nairobi, Kenya.

It was also found from study that aggregate mean score and standard deviation for waste material management was 3.95 and 0.569 respectively. This confirms that respondents were in tandem that there was high level of waste materials management among ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. There was assertion among respondents that firms used process that produced little waste, firms treated their waste before disposal plus some firms used waste as raw materials and lastly firms collected it's by products for recycling as evident in their mean scores which were close to 4.00 denoting they agreed with the statements.

Respondents further agreed that green process design had been adopted by ISO 14001 certified manufacturing firms as indicated the aggregate mean scores of 3.94 and standard deviation of 0.589. The aggregate mean index tended to 4.00 which translates to agree on the Likert scale utilized in this study. The variability of the responses was low as the standard deviation was 0.589 confirming agreement that green process design was paramount. It was noted that the process design was user and environmentally safe, the process design released little waste and in long run reduced cost of production.

From the descriptive results, it was succinct that most firms had adopted green process innovation strategy. The tenets of GBMI model by Bisgaard et al (2012) is that sustainability can be attained if firms shifts their processes to adopt processes which allow coming with new production design which advocate for user efficient utilization of raw materials, water energy and which are environmentally conscious and friendly by

reducing waste and GHG emissions. Based on these propositions of GBMI it helped researcher conceptualize the indicators of green process innovation strategy using energy consumption, material consumption, waste material management, green process design.

4.2.6 Green Marketing Innovation Strategy

Green marketing innovation strategy was measured using green branding, green distribution, green pricing and green advertisement. It should be noted that descriptive statistics for green marketing innovation strategy helped in addressing objective three of the study on how green marketing innovation strategy related to performance sustainability among ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The results of the descriptive statistics for every dimension of green marketing innovation strategy were verified in table 4.5

Table 4.5: Descriptive Statistics on Green Marketing Innovation Strategy

Green marketing innovation strategy	n	SD %	D %	NS %	A %	SA %	Mean	Std dev.
Green branding								
The product of this firm has simple green labels	228	0	3.1	16.2	63.2	17.5	3.95	0.678
The firm's products are packed using unique biodegradable materials	228	0	3.1	12.7	70.2	14.0	3.95	0.624
Green branding of products has made products of this firm unique	228	0	4.4	18.0	61.0	16.7	3.90	0.717
Green branding has attracted more clients thus improving the sales	228	0	2.6	17.5	57.9	21.9	3.99	0.709
Aggregate scores for green branding							**3.95**	**0.682**
Green distribution								
The firm has adopted green distribution criteria for its product to reach the market	228	0	2.6	15.4	58.3	23.7	4.03	0.705
Green distribution criterion makes products reach markets faster	228	0	2.6	19.3	65.4	12.7	3.88	0.643
Green distribution has improved penetration of product to new market	228	0	4.5	14.0	65.8	15.4	3.92	0.694
Aggregate scores for green distribution							**3.94**	**0.681**
Green pricing								
The firm offer discounts for green products	228	0	7.9	30.3	53.1	8.8	3.63	0.755
The price of firm's green products is low	228	0	3.9	16.7	59.6	19.7	3.95	0.722
Discounts for green products leads to increased volume of sales	228	0	1.3	16.2	71.9	10.5	3.92	0.561
Aggregate scores for green pricing							**3.83**	**0.679**
Green advertisement								
The firms have advertisement programs on its green products	228	0	2.2	4.8	78.5	14.5	4.05	0.528
The firm's advertisement contents contain green information	228	0	1.8	7.0	77.2	14.0	4.04	0.530
Advertisements of firm's green products has increased sales volume	228	0	1.8	6.6	76.3	15.4	4.05	0.537
Cumulative scores for green advertisement							**4.05**	**0.532**
Cumulative scores for green marketing innovation strategy							**3.94**	**0.644**

Source: Survey data (2022)

Table 4.5 shows that the aggregate mean scores and standard deviation for items of green marketing innovation strategy were 3.94 and 0.644 respectively. The mean score was close to 4.00 on 5point Likert scale as adopted in this study implying that respondents agreed that ISO 14001 certified manufacturing firms in Nairobi City County had adopted green marketing innovation strategy. It can also be observed that the overall standard deviation was low meaning that responses were clustered around the mean response thus the sample mean is reliable estimator of the true mean.

It was found respondents had concurred that ISO 14001 certified manufacturing firms in Nairobi City County had adopted green branding as confirmed by results in table 4.5 where aggregate mean score stand at 3.95 with standard deviation of 0.682. This aggregate mean index is close to 4.00 (agree) on the Likert scale which means most respondents agree there was green branding as noted by small variability of results because of low standard deviation. Respondents further opined that products had green labels, the products were packed in unique biodegradable materials and had firms had unique products which attracted more clients thus improving the firm sales.

Green distribution aggregate mean score was 3.94 with standard deviation of 0.681. The mean score tends to 4.00 (agree) as per 5-point Likert scale meaning respondents agreed that firms had adopted green distribution criteria as it was confirmed by low standard deviation. The respondents agreed products reached market through green distribution criterion which allowed goods to reach market faster and enabled products penetrate new markets.

The study findings indicate that ISO 14001 certified firms had adopted green pricing as witnessed by aggregate mean score of 3.83 and standard deviation of 0.679. This mean score of 3.83 is close to 4.00 (agree) as per the 5-point Likert scale where the variability of responses was noted to be low. The findings confirmed that firms offered discounts on green products and green discounts on green products had increased volume of sales.

Additionally, the aggregate mean scores and standard deviation for green advertisement was 4.05 and 0.532 respectively. The aggregate mean scores of 4.05 tends to 4.00 (agree) on the 5-point Likert scale meaning most respondents agreed that firms had adopted green advertisement. There was agreement as noted by small variance of responses that firms had advertisement on green products which had green information and advertisement of green products had increased volume of sales. This was confirmed by findings where each of the sub indicator had mean score close to 4.00 (agree) and low variance with standard deviation of around 0.500 which is low.

From the descriptive results, most firms had adopted green process innovation strategy. The GBMI by Bisgaard et al (2012) advocate for coming up with new strategic alternatives in the entire supply chain management and firm operations which acts as trigger to green client responsiveness, chase for competitive advantage and reduced cost of inventory. The supply chain management cut across the products, logistics, pricing and even promotions which ought to be green and which are key components upon which variable of green marketing innovation strategy were coined.

4.2.7 Green Organizational Innovation Strategy

Green organizational innovation strategy was measured using indicators like green business practices, green support system, environmental knowledge transfer practices and

green human resource practices. The descriptive statistics on green organization strategy helped address the objective four on determining whether green organizational innovation strategy had effect on performance sustainability of firms. The descriptive statistics was presented in table 4.6.

Table 4.6: Descriptive Statistics on Green Organizational Innovation Strategy

Green organizational innovation strategy	n	SD %	D %	NS %	A %	SA %	Mean	Std dev.
Green business practices								
The firm has adopted green business practices in its operations	228	0	2.6	7.5	74.1	15.8	4.03	0.582
The firm has on going green business project and initiatives	228	0	1.3	6.6	86.4	5.7	3.96	0.418
Green business practices have helped the firm operate in an environmentally sustainable way	228	0	1.3	16.7	75.4	6.6	3.87	0.520
Aggregate scores for green business practices							**3.95**	**0.507**
Green support systems								
The firm has adopted green support system	228	0	1.3	6.1	71.1	21.5	4.13	0.560
There is an internal policy supporting green system in the firm	228	0	0	7.0	65.4	27.6	4.21	0.553
The green support systems have helped firm in going green	228	0	2.6	11.0	70.6	15.8	4.00	0.612
Aggregate scores for green support systems							**4.11**	**0.575**
Environmental knowledge transfer practices								
The firm share green knowledge with their peers in the industry	228	0	0.9	8.8	73.7	16.7	4.06	0.536
Environment knowledge transfer has helped in flow of information among firms going green	228	0	3.1	14.5	66.2	16.2	3.96	0.656
Employees has been able to address sustainability issues through environment knowledge transfer practices	228	0	4.8	16.2	57.9	21.1	3.95	0.752
Aggregate scores for environmental knowledge transfer practices							**3.99**	**0.648**
Green human resource practices								
The firm has adopted green human resource practices	228	0	4.4	14.5	67.5	13.6	3.90	0.670
The firm has adopted green recruitment, training and development of employees	228	0.4	5.3	16.7	60.5	17.1	3.89	0.760
The firm has adopted green reward system for its employees	228	0	3.5	26.3	54.4	15.8	3.82	0.730
Aggregate scores for green human resource practices							**3.87**	**0.720**
Aggregate scores for green organizational innovation strategy							**3.98**	**0.613**

Source: Survey data (2022)

Table 4.6 indicate that ISO 14001 certified manufacturing firms had adopted green organizational innovation strategy. This was confirmed by the results where aggregate mean score was 3.98 and standard deviation was 0.613. The mean score of 3.98 was close to 4.00 (agree) on the 5point Likert scale implying that respondents agreed with the statement as there was low variation of responses as indicated by low standard deviation of 0.613.

The results observed show that firms had adopted green business practices in their operations. This assertion was supported by the findings where mean score of responses was 4.03 which is agree as per 5point Likert scale adopted in this study with little variance of 0.582. The findings further indicate that there was agreement by respondents that ISO 14001 certified manufacturing firms in Nairobi City County had initiated green business projects and through green business practices firms were in position to operate in an environmentally sustainable manner as evident from the mean scores which were skewed towards 4.00 (agree) and low variability of responses as evident in the low standard deviation.

It was realized from the study that ISO 14001 certified manufacturing firms had adopted green support systems. This was supported by aggregate scores of 4.11 which was close to 4.00 (agree) and low variability of responses of 0.575. It was further observed that respondents had agreed that ISO 14001 certified manufacturing firms had internal policy supporting green support systems and these green support systems had helped firms while going green.

The study findings as evidenced in table 4.6 indicated that ISO 14001 certified manufacturing firms had adopted environmental knowledge transfer practices as evidenced aggregate mean score of 3.99 and standard deviations of 0.648. The mean score tends to 4.00 (agree) indicating that respondents agreed environmental knowledge transfer was practiced by ISO 14001 certified manufacturing firms in Nairobi City County with low variability of responses evident from the low standard deviation. There is agreement that environmental knowledge transfer had helped in sharing of green knowledge, flowing of information among firms and helped in addressing environment sustainability issues. This was confirmed by all mean score being close to 4.00 which was agree as per the 5point Likert scale.

Lastly, the study found that ISO 14001 certified manufacturing firms in Nairobi City County had adopted green human resource practices as evidenced in findings in table 4.6 where aggregate mean score was 3.87 with low variability of the responses as noted by low standard deviations of 0.720. The study findings further indicate that firms had adopted green recruitment, training and development of employees plus green reward systems with most respondents agreeing with that.

GBMI model by Bisgaard et al (2012) formed basis upon which this variable was conceptualized. The model calls for substituting operations of the firms by picking operations practices which are environmentally conscious. These practices cut cross from the production processes and coming up with good ecological practices. These include green business practices, green systems and green human resources which are elements upon which indicators of the green organizational innovation strategy were operationalized.

4.2.8 Competitive Advantage

Competitive advantage was operationalized using two main indicators which were cost leadership and differentiation. The descriptive statistics in this section addressed objective five of the study which was to establish whether competitive advantage mediated the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The descriptive statistics for competitive advantage was presented in table 4.7

Table 4.7: Descriptive Statistics on Competitive Advantage

Competitive advantage	n	SD %	D %	NS %	A %	SA %	Mean	Std dev.
A. Cost leadership								
Economies of scale								
Energy consumption per unit has reduced after increasing volume of production thus reducing cost of the firm's products	228	0.4	6.1	13.2	59.2	21.1	3.94	0.792
Raw materials consumption per unit has reduced after increasing volume of production hence reducing cost of firm's products	228	0	3.5	19.3	61.4	15.8	3.89	0.694
The cost of research and marketing of products have gone down after expanding production	228	0	4.4	14.9	60.5	20.2	3.96	0.726
Aggregate scores for economies of scale							**3.93**	**0.737**
Operational efficiency								
The production process has been efficient	228	0	3.9	14.9	58.3	22.8	4.00	0.733
There is reduced waste production thus reducing cost of products in this firm	228	0	2.6	19.3	61.8	16.2	3.92	0.675
The promotion of products has been efficient thus reducing cost of products	228	0	4.4	22.8	57.5	15.4	3.84	0.730
Aggregate scores for operational efficiency							**3.92**	**0.713**
Aggregate scores for cost leadership							**3.93**	**0.725**
B. Differentiation								
Green technology automation								
The firm has automated its systems	228	0	4.4	16.9	57.0	19.7	3.92	0.747
The technology automation is unique and inimitable	228	0	3.9	20.1	53.1	22.8	3.95	0.767
Automation has improved firm's efficiency thus reducing cost of products	228	0	6.1	25.0	47.4	21.5	3.84	0.830
Aggregate scores for green technology automation							**3.90**	**0.781**
Green office synergies								
The firm has a department that supports going green	228	0.4	7.0	20.6	53.1	18.9	3.83	0.830
Green office synergies have improved how the firm coordinates its activities on going green	228	0.4	3.9	21.9	48.7	25.0	3.94	0.816
Green office synergy has led to firm's efficiency thus reducing cost of products	228	0	6.5	15.8	59.2	18.4	3.89	0.773
Aggregate scores for green office synergies							**3.87**	**0.806**
Intellectual capacity utilization								
Human intellectual capacity is utilized well in the firm	228	0	3.5	17.1	46.9	32.5	4.08	0.795
Managers in this firm are knowledgeable and skilled on firm greening and are able to come up with inimitable green products and systems	228	0	3.5	24.1	53.5	18.9	3.88	0.747
Utilization of intellectual capacity enable this firm use resources efficiently thus reducing cost of products	228	0	5.7	17.1	54.	22.4	3.94	0.789
Aggregate scores for intellectual capacity utilization							**3.97**	**0.777**
Aggregate scores for differentiation							**3..91**	**0.788**
Aggregate scores for competitive advantage							**3.92**	**0.757**

Source: Survey data (2022)

Results in table 4.7 confirms that ISO 14001 certified manufacturing firms had adopted competitive advantage which enhances sustainability performance of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. This was confirmed by the results where aggregate mean score was 3.92 and standard deviation was 0.757. The mean score of 3.92 is close to 4.00 (agree) on the 5point Likert scale implying that respondents agree with low variation of responses as indicated by low standard deviation of 0.757.

The aggregate mean scores and standard deviation of cost leadership were 3.93 and 0.725 respectively. The mean score of 3.93 was near 4.00 (agree) as per 5point Likert scale indicating members had agreed firms had adopted cost leadership. This was confirmed by low level of variability of responses as indicated by standard deviation of 0.725. Respondents agreed that economic of scale was evident where aggregate mean scores are 3.93 with low standard deviation of 0.737. There was agreement that through economics of the scale, energy consumption per unit, raw material consumption per unit and cost of research and marketing of products had reduced thus reducing cost of production. This was further supported by mean scores which tended towards 4.00 (agree) and low variability of the responses as noted by the findings in table 4.7.

It was further observed from the findings that ISO 14001 certified manufacturing operated efficiently as supported by the aggregate mean score of 3.93 which score tends to 4.00 (agree) meaning they support the statement. The standard deviation was 0.725 which indicated there was low variability of responses by the respondents. Respondents further agreed that waste production was low and promotion of products is efficient thus reducing cost of the products.

Results in table 4.7 was evident that differentiation as an aspect of competitive advantage had been adopted by ISO 14001 certified manufacturing firms in Nairobi City County. This was confirmed by aggregate mean score of 3.91 which is close to 4.00 (agree) and standard deviation of 0.788 meaning there was low variability of the responses. Green technology automation as differentiation strategy was adopted by the firms such that it was unique and inimitable hence improving efficiency and reducing cost of products. This was confirmed by aggregate mean score of respondents of 3.90 indicating that they had agreed with the statement and low variability of responses as noted by standard deviation of 0.781.

The aggregate mean scores and standard deviation for green office synergies were 3.87 and 0.806 respectively. The mean score of 3.87 was near 4.00 (agree) as per 5point Likert scale indicating that respondents had agreed firms had input green office synergies. This was confirmed by low level of variability of responses as indicated by standard deviation of 0.806. There was an agreement by respondents that there was office (departments) supporting going green with good coordination of its activities in going green which had led to improved firm's efficiency and reduced cost of products.

Lastly, the study found that ISO 14001 certified manufacturing firms utilized intellectual capacity as evidenced in findings in table 4.7 where aggregate mean score was 3.97 with low variability of the responses as noted by low standard deviations of 0.777. The study findings further indicated that firm's managers are knowledgeable and skilled on issues of going green and had helped firms use resources efficiently thus reducing cost of products.

The results indicated clearly that ISO 14001 certified manufacturing firms in Nairobi City County had competitive advantage leading to sustainable performance of firms. The Competitive advantage variable was anchored on resource-based view theory by Penrose (1959). The theory enumerated the key role played by resources and competences a firm hold in realising competitive advantage and firm performance. To gain competitive advantage it was noted that the resources ought to be valuable, rare, non-substitutable and imitable. The theory advocate for proper combination of varied resources and aligning them with strategies to achieve competitive advantage. Based on these premises of the theory researcher was able to advance competitive advantage using two paradigms that is cost leadership and differentiation which most firms had adopted.

4.2.9 Regulatory Framework

Regulatory framework was operationalized using three indicators which include: environmental regulations, clean technological regulations and NEMA regulation compliance. The descriptive statistics sought to address objective six which determined whether regulatory framework had moderating effect on the relationship between green innovation strategy and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The descriptive statistics for each of these indicators were presented in table 4.8.

Table 4.8: Descriptive Statistics on Regulatory Framework

Regulatory framework	n	SD %	D %	NS %	A %	SA %	Mean	Std dev.
Environmental regulations								
The government has instituted environmental regulation to regulate production of firms	228	0	3.1	23.2	51.3	22.4	3.93	0.759
The environmental regulations are flexible to the firm	228	0	17.1	50.9	25.9	6.1	3.96	0.823
The environmental regulations are stringent to the firm	228	0	4.8	20.2	54.8	20.2	3.90	0.768
Environmental regulations enable this firm to operate with minimum effect on the environment	228	0	6.6	18.9	52.6	21.9	3.90	0.815
The environmental regulation stipulates action to be taken against firms if they violate sustainability issues in production	228	0	6.1	18.0	49.6	26.3	3.96	0.831
Aggregate scores for environmental regulations							**3.93**	**0.799**
Clean technological regulation								
The firm adheres to clean technological regulations	228	0	7.0	14.9	50.4	27.6	3.99	0.842
The firm has been utilizing clean technology in production	228	0	18.3	14.0	58.3	19.3	3.89	0.810
The firm has not been penalized on failure to use clean technology	228	0	52.6	19.7	25.0	2.6	4.00	0.745
Clean technological regulations have enabled the firm to operate efficiently	228	0	6.6	15.8	57.5	20.2	3.91	0.786
Aggregate scores for clean technological regulation							**3.95**	**0.796**
NEMA regulation compliance								
NEMA has clear guidelines guiding manufacturing firms	228	0	5.7	16.2	52.2	25.9	3.98	0.807
NEMA has conducted environmental audit for last 3 years	228	0.4	4.8	17.5	58.5	16.4	3.90	0.765
The firm has complied completely with NEMA regulations	228	0	3.9	18.4	44.7	32.9	4.07	0.818
NEMA has once penalized firm for non-compliance to its guidelines	228	0	7.9	21.1	53.5	17.5	3.81	0.817
Aggregate scores for NEMA regulation compliance							**3.94**	**0.802**
Aggregate scores for regulatory framework							**3.94**	**0.799**

Source: Survey data (2022)

Table 4.8 show that the aggregate mean score for regulatory framework was 3.94 with standard deviation of 0.799. The aggregate mean score was close to 4 which implied that respondents agreed that there is regulatory framework which regulate how ISO 14001 certified manufacturing firms operate in Nairobi City County, Kenya. The standard deviation denotes low variability among the responses meaning there were regulatory framework regulating operations of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

There was common view among respondents that there were environmental regulations by government regulating operations of ISO 14001 certified manufacturing firms. This was evident from the aggregate mean score of 3.93 which tends towards 4.00 (agree) and standard deviation of 0.799 meaning there was low variability of responses. The respondents negated that environmental regulation were flexible with bigger percentage (75 percent) agreeing that the environmental regulations were stringent as supported by mean of 3.90 which is close to 4.00 (agree). Results further indicated that respondents agreed that environmental regulation enabled firms to operate with minimal effect on the environment and there was clarity on action to be taken when firms violate sustainability issues in production.

The aggregate mean scores of 3.95 and standard deviation of 0.796 confirmed that firms were adhering to clean technological regulations and were utilizing it in productions. It was realized from study findings in table 4.8 that most respondents declined that firms were not penalized for failing to use clean technology as demonstrated by 55.2 percent of respondents who did not support that. It was further realized that clean technology had enabled firms to operate in an efficient way as supported by 77.7% of the respondents.

Actually, the mean score for respondents on same was 3.91 which was close to 4.00 (agree) and standard deviation of 0.786 denoting a low variability of the responses.

Results in table 4.8 was evident that ISO 14001 certified manufacturing firms complied with NEMA regulations. This was confirmed by aggregate mean score of 3.94 which tended to 4.00 (agree) and standard deviation of 0.802 meaning there was low variability of the responses. Study findings also found that NEMA had conducted environmental audit for ISO 14001 certified firms in last three year. It was however found that most respondents did not agreed that NEMA had penalized the firm once for non-compliance with guidelines although 21.1 percent of the respondents were not sure on the same.

Regulatory framework variable was operationalized based on key tenets of GBMI model, institutional theory and stakeholder's theory. GBMI model by Bisgaard et al (2012) advocate for policy guidelines to regulate adoption of green growth both locally and globally. This call for negotiation between stakeholders, regulatory bodies and investors. Institutional theory by Scott (1995) call for firms to adhere to rules, norms and believes which are acceptable and responsible in order to attain competitive advantage. Stakeholders theory by Ansoff (1965) further acknowledge how paramount the interest and welfare of stakeholders and stockholders in an organization are most pivotal for firm to realize its superior performance. There was need to align all practices with practices of stakeholders for maximum gains of the firms which call for establishment of rules and regulation to govern the operation of a firm.

4.2.10 Performance Sustainability of ISO 14001 Certified Manufacturing Firms

Performance sustainability was measured using financial performance, social performance and environmental performance. Financial performance was operationalised using profitability and market share. Social performance was operationalized using employee's satisfaction and customer's satisfaction while environmental performance was operationalized using environmental related awards, energy awards, recognitions by relevant bodies like KAM and NEMA and pollution control. The descriptive statistics for each of these indicators were presented in table 4.9.

Table 4.9: Descriptive Statistics on Performance Sustainability

Performance sustainability of ISO 14001 certified manufacturing firms	n	SD %	D %	NS %	A %	SA %	Mean	Std dev.
A. Financial performance								
Profitability								
Rate firm's average profitability ratio after ISO 14001 certification	228	11.6	17.1	17.1	42.1	12.7	3.29	1.210
Firm's profitability has improved after adoption of green innovation	228	0	7.0	18.0	47.4	27.6	3.96	0.859
The firm's cost of doing business has gone down after going green	228	0.4	5.3	17.1	56.6	20.6	3.92	0.789
Firm's profitability has been consistently improved after attaining ISO certification	228	0.4	7.0	16.7	46.1	29.8	3.98	0.888
Aggregate scores for profitability							**3.95**	**0.937**
Market share								
Demand for firm's green products has increased in existing market in the after going green	228	0	7.5	15.8	56.6	20.2	3.89	0.806
Firm's products have penetrated new market after going green	228	0	4.4	19.7	52.2	23.7	3.95	0.781
The volume of sales has improved after the firm going green	228	0	6.6	18.0	51.8	23.7	3.93	0.823
Aggregate scores for market share							**3.92**	**0.803**
Aggregate scores for financial performance							**3.94**	**0.870**
B. Social performance								
Employees satisfaction								
The staff safety has improved after firm attaining ISO certification	228	0	3.9	18.9	50.4	26.8	4.00	0.785
Employees have been covered health insurance	228	0	3.1	17.5	50.9	28.5	4.05	0.764
The employees complain have gone down after going green	228	0	7.5	15.8	51.8	26.8	3.98	0.842
Employees accidents at work has gone down after going green	228	0	7.9	15.8	44.7	31.6	4.00	0.890

The staff turnover has gone down with adoption of green innovation	228	0.4	6.1	20.2	51.9	21.5	3.88	0.830
Aggregate scores for employee's satisfaction							**3.98**	**0.822**
Customer satisfaction								
The customer base has improved after firm going green	228	0	6.6	25.0	48.2	20.2	3.82	0.828
The number of customer referrals have increased after going green	228	0	5.7	17.5	47.4	29.4	4.00	0.837
The customer's loyalty has improved after firm going green	228	0	5.7	20.6	53.1	20.6	3.89	0.794
Customers approving company's products have improved after firm going green	228	0	5.7	23.7	46.7	21.9	3.87	0.818
Aggregate scores for customer satisfaction							**3.90**	**0.819**
Aggregate scores for social performance							**3.94**	**0.821**
C. Environmental performance								
Environmental safety management								
Firm has viable programs relating to occupational safety and health	228	0	5.3	22.4	43.9	26.5	3.96	0.849
The firm has environment control mechanism for proper disposal of pollutants and waste from the firm	228	0	6.6	21.1	42.1	30.3	3.96	0.882
The firm has mechanism for properly storing, using and disposing hazardous chemicals	228	0	3.9	25.0	45.5	24.6	3.92	0.806
Aggregate scores for environment related awards							**3.95**	**0.846**
Energy management awards								
The firm has implemented energy efficient measures and technology in their processes	228	0	7.0	18.9	48.7	25.4	3.93	0.849
The firm's energy efficient practices have been recognized during energy management awards	228	0	5.3	25.4	49.1	20.2	3.84	0.803
Aggregate scores for energy management a							**3.89**	**0.826**
Recognition by relevant environmental regulatory agencies								
The firm has been recognized for its environmental conservation efforts	228	0	7.0	18.0	48.7	26.3	3.94	0.851
The firm has been recognized for leading green growth in the sector	228	0	8.3	17.5	46.5	27.2	3.93	0.883
The firm has been recognized for its conformance with environmental regulations by relevant environmental regulatory agencies	228	0	6.6	22.4	51.8	19.3	3.84	0.810
Aggregate scores for recognition by relevant environmental regulatory agencies							**3.90**	**0.848**

Pollution control								
Pollution has scaled down with adoption of green production	228	0	5.3	16.7	49.1	28.9	4.02	0.818
The firm frequently conducts pollution and waste emission audits	228	0	6.6	22.8	51.3	19.3	3.83	0.812
The waste and emissions intensity have gone down after going green	228	0	7.0	18.0	56.1	16.9	3.87	0.797
Waste and emissions treatment have improved after attaining ISO 14001	228	0	6.6	21.9	50.0	21.5	3.86	0.826
Aggregate scores for pollution control							**3.90**	**0.813**
Aggregate scores for environmental performance							**3.91**	**0.833**
Aggregate scores for performance sustainability							**3.93**	**0.841**

Source: Survey data (2022)

The results in Table 4.9 indicate that the aggregate mean score for performance sustainability of ISO 14001 certified manufacturing in Nairobi City County, Kenya was 3.93. This mean score approximated to 4.0 (agree) on the 5point Likert scale that was adopted for the study implying respondents agree with that. The standard deviation of 0.841implied that most of the items of performance sustainability had low variability implying there was agreement amongst respondents.

Results on financial performance of ISO 14001 certified manufacturing firms show that aggregate mean scores and standard deviation were 3.95 and 0.937 respectively. The score of 3.94 was close to 4.00 (agree) on the 5 -point Likert scale used in this study confirming that financial performance was achieved by firms since the variability of responses was low as indicated by small standard deviation. Specifically, on profitability most firms achieved a profitability ratio of 0.6 to 0.8 as indicated by 42.1% of all responses. It was further found that after adoption of green innovation profitability had consistently improved and cost of doing business had gone down among ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

It was also observed that market share had improved with adoption of green innovation. Results indicate that the mean score for market share was 3.92 and standard deviation of 0.803 implying that respondents had agreed since the score approximating close to 4.00 (agree) on the 5point Likert scale which means they agree and the variability of the responses was low. The study found that with adoption of green innovation; demands for green products had increased, products had penetrated new markets and volume of sales had increased among ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

Results in table 4.9 indicate that the aggregate mean scores and standard deviation for social performance is 3.94 and 0.821 respectively. The results signify that respondents had agreed that ISO 14001 certified manufacturing firms were performing well socially as confirmed by low variability of responses as indicated by standard deviation of 0.821. Additionally, the results indicated that there was high level of employee satisfaction as confirmed by aggregate mean score of employee satisfaction 3.98 and standard deviation 0.822. The score tends to 4.00 (agree) in the 5-point Likert scale meaning most respondents agreed with the statement plus the low variability of responses as evidenced on the standard deviations. Respondents further agreed that after ISO 14001 certification of manufacturing firms; staff safety improved, staff were covered by health insurance with employee's complains, accidents and staff turnover going down.

Moreover, customer satisfaction was noted to have improved as indicated by results in table 4.9 where aggregate mean score for customer satisfaction was 3.90 with low variability of responses as indicated by low standard deviation of 0.819. The study findings indicated that most respondents had agreed that customer base and loyalty had

improved with adoption of green innovation with number of customer's referrals and customer's approval of company's products also improving.

Results in table 4.9 noted that the aggregate mean scores for environmental performance was 3.91 and standard deviation of 0.833. The mean score of 3.91 which approximates to 4.00 which was agree as per 5-point Likert scale meaning the ISO 14001 certified manufacturing firms in Nairobi City County were performing. The low variability of responses confirmed the same with low standard deviation of 0.833. There was congruent by respondents that firms had adopted programs relating to environmental safety management. It was noted by 70.4 percent of respondents that firms had programs relating to occupational health and safety which is an aspect of environmental safety management. It was also observed that 72.4 percent of the respondents that firms had environment control mechanism for proper disposal of pollutants and waste from the firm. It was further noted by 80.1 percent of the respondents that firm had mechanism for properly storing, using and disposing hazardous chemicals.

Additionally, the results indicated that there were energy management awards and the firm had been awarded for managing energy efficiently as indicated by aggregate mean score of 3.89 which is close to 4.00 that is agree as per 5-point Likert scale. The variability of responses was low which stood at standard deviation of 0.826 confirming the results. It was noted that the firm had implemented energy efficient measures and technology in their processes and the firm's energy efficient practices had been recognized during energy management awards.

The aggregate mean scores on whether ISO 14001 certified firms are recognized by relevant environmental regulatory agencies stood at 3.90 with standard deviation of 0.848. This implied that respondents agreed with that as they recorded average score of 3.90 which was close 4.00 which is agree as per the 5-point Likert scale with low variability of responses as witnessed from the standard deviation scores. It was realized firms were recognized for environmental conservation efforts, conformance with environmental regulations and being on lead in green growth in the manufacturing sector.

Lastly, the aggregate mean scores for pollution control was 3.90 and standard deviation of 0.813. The score of 3.90 was close to 4.00 (agree) meaning respondents agreed that the firms exercised pollution control which was confirmed by the low variability of the responses noted by standard deviation of 0.813. It was realized that waste and emissions had scaled down, firms were conducting waste emission audits and waste and emissions treatment had improved after firms attaining ISO 14001 certification in Nairobi City County in Kenya.

The performance sustainability of firms is deeply anchored on the key tenets of triple bottom lines theory by Elkington (1994). The theory notes that for firm to be sustainable it ought to attain the three bottoms which encompass the financial, social and environment aspects. It is based on these premise that the indicators of the variable on performance sustainability was operationalized which are financial performance, social performance and environmental performance of ISO 14001 certified manufacturing firms.

4.3 Inferential Statistics

Regression analysis was adopted to test research hypotheses. However, before the regression analysis was carried out, it was prudent to conduct various diagnostic tests to examine whether the data met threshold and assumptions laid for regression analysis. This also helped in determining how suitable the data was when making inferences and making any conclusions.

4.4 Diagnostic Test

Regression analysis assumptions ought to be tested before analysing data. This helps in identifying and curing any violation of the assumption of multiple regression analysis which can lead to biased estimation of relations, poor estimation of precision level of regression coefficient and poor choice of confidence level (Chatterjee & Hadi, 2012). The researcher conducted normality, linearity, multi-collinearity and homoskedasticity tests before analysing data.

4.4.1 Normality Test

Shapiro-Wilk test was used to assess whether the data was normality distributed. Through Shapiro -Wilk test researcher was in position to identify if there was deviation from the normality due to either skewness or kurtosis or both (Korkmaz, Goksuluk & Zararsiz, 2014). The null hypothesis (H_0) was that the data was normally distributed. The statistics lies between zero and one and if the P-value is less than 0.05 then null hypothesis is rejected meaning the data is not normally distributed. If P> 0.05 then the data is normally distributed as recommended by Razali and Wah (2011).

Table 4.10: Shapiro-Wilk Statistics

Variable	Statistics	Df	Sig.
Green product innovation strategy	.953	228	.455
Green process innovation strategy	.912	228	.367
Green marketing innovation strategy	.915	228	.391
Green organizational innovation strategy	.876	228	.417
Competitive advantage	.924	228	.438
Regulatory framework	.933	228	.416
Performance sustainability	.948	228	.297

Source: Survey data (2022)

Table 4.10 shows that the P-value for the seven research variables were greater than the chosen alpha level of 0.05. The results realized for the seven variables were: green product innovation strategy (0.455 > 0.05), green process innovation strategy (0.367 > 0.05), green marketing innovation strategy (0.391 > 0.05), green organizational innovation strategy (0.417 > 0.05), competitive advantage (0.438 > 0.05), regulatory framework (0.416 > 0.05) and performance sustainability (0.297 > 0.05). From the above results, we should not reject null hypothesis. It can therefore be concluded that the calculated probability values were greater than 0.05 and therefore at 95% confidence level data was normally distributed and was amenable for further data analysis (Saunders, *et.al*, 2019). When data is normally distributed it means it doesn't deviate much from the mean and its good enough for data analysis.

4.4.2 The Linearity Test

This study adopted Pearson product-moment correlation to test whether there existed linear relationship between independent and dependent variables. Correlation coefficient was used to determine the strength and direction of linear relationship (Dancey & Reidy, 2004). The null hypothesis (H_0) was that the linear relationship does not exist between the variables. The correlation coefficient range between -1 and 1 and the greater the absolute

value of the correlation coefficient, the stronger the linear relationship is between the variables (Garson, 2012). Table 4.11 shows the results for the linearity test.

Table 4.11: Linearity Test

Items		**Performance sustainability**	**Conclusion**
Green product innovation strategy	Pearson Correlation	.609	Linear
	Sig. (2-tailed)	.007	
	N	228	
Green process innovation strategy	Pearson Correlation	.517	Linear
	Sig. (2-tailed)	.019	
	N	228	
Green marketing innovation strategy	Pearson Correlation	.583	Linear
	Sig. (2-tailed)	.047	
	N	228	
Green organizational innovation strategy	Pearson Correlation	.317	Linear
	Sig. (2-tailed)	.049	
	N	228	
Competitive advantage	Pearson Correlation	.577	Linear
	Sig. (2-tailed)	.028	
	N	228	
Regulatory framework	Pearson Correlation	.378	Linear
	Sig. (2-tailed)	.017	
	N	228	

***. Correlation is significant at the 0.01 level (2-tailed).
Source: Survey data (2022)

Table 4.11 indicate that all independent variables had positive correlation coefficient which was also significant as it had a p-value which was less than 0.05. It should be noted by having a p value of less than 0.05, null hypothesis should be rejected meaning there exist a linear relationship between independent variables and the dependent variable (Bewick, Cheek & Ball, 2005). The results for correlation were as follows: green product innovation strategy ($r = 0.609$, $p < 0.05$), green process innovation strategy ($r = 0.517$, $p < 0.05$), green marketing innovation strategy ($r = 0.583$, $p < 0.05$), green organizational innovation strategy ($r = 0.317$, $p < 0.05$), competitive advantage ($r = 0.577$, $p < 0.05$) and

regulatory framework ($r = 0.378$, $p < 0.05$). This implies that when performance sustainability is regressed against all other variable it had a positive and significant linear relationship with all the other variables.

4.4.3 Multi-Collinearity

Multicollinearity was explored and tested by calculating the Variance Inflation Factor (VIF) and tolerance as recommended by Field (2009). The null hypothesis (H_0) stated that the coefficient of the variable is zero meaning the variable does not contribute to the model. The rule of thumb was if tolerance value was more than 0.20 or 0.10 or VIFs was less than 10 this indicates that the level of multi-collinearity could be tolerated or no multi-collinearity. These results are presented in Table 4.12.

Table 4.12: Collinearity Statistics

Variable	Tolerance	VIF	Comment
Green product innovation strategy	.963	1.039	No multicollinearity
Green process innovation strategy	.909	1.100	No multicollinearity
Green marketing innovation strategy	.912	1.097	No multicollinearity
Green organizational innovation strategy	.989	1.011	No multicollinearity
Competitive advantage	.969	1.032	No multicollinearity
Regulatory framework	.960	1.041	No multicollinearity

Source: Survey data (2022)

Table 4.12 indicate that the tolerances and VIFs were greater than 0.2 and less than 10 respectively. Green organizational innovation had the highest tolerance of 0.989 with green process innovation strategy having the lowest tolerance of 0.909. On the other hand, green process innovation strategy had highest VIF of 1.100 with competitive advantage having the lowest VIF of 1.032. Based on the results, we should reject the null hypothesis. It can therefore be concluded that there was no multicollinearity among all

variables thus it was in order to maintain all predictor variables in the regression model as recommended by Field (2009).

4.4.4 Homoskedasticity/ Homogeneity

Homoskedasticity occurs when there is equal variance of error term. When there is variance of error terms; this is referred as heteroskedasticity which has biased standard errors thus leading to biased inferences (Machado & Silva, 2013). Levene test was used to test homoskedasticity where the statistics measured whether or not the variance across samples or groups is equal. It tested null hypothesis that the variance is equal across the groups. The rule of thumb was if P>0.05, do not reject null hypotheses meaning that the homoskedasticity assumption is met and the two variances are not significantly different thus the data can be used for further analysis (Gastwirth, et al, 2009). The results for Levene test was presented in table 4.13.

Table 4.13: Levene Statistics

Variable	Levene statistics	df1	df2	Sig.
Green product innovation strategy	.587	17	204	.899
Green process innovation strategy	1.798	17	204	.060
Green marketing innovation strategy	1708	17	204	.053
Green organizational innovation strategy	1.278	17	204	.209
Competitive advantage	1.166	17	204	.295
Regulatory framework	1.634	17	204	.058

Source: Survey data (2022)

Table 4.13 indicate that the calculated probability for all study variables was greater than 0.05. The results indicated the greatest p-value was 0.899 for green product innovation strategy with the lowest p-value being 0.53 for green marketing innovation strategy. It is okay therefore not to reject null hypothesis that the variance is equal across the groups/variables. The results imply that among all variables the variances were

significantly equal and is amenable for further analysis because it has an equal standard error which cannot lead to biased inferences of the results.

4.5 Test of Hypotheses

This study utilized multiple regression model analysis to empirically test the six hypotheses for this study. Hypotheses one to four investigated the direct effect of aspects of green innovation strategy that is green product innovation strategy, green process innovation strategy, green marketing innovation strategy and green organization innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. Hypotheses five and six tested how relationship between green innovation strategy and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya when it is mediated by competitive advantage and moderated by regulatory framework respectively.

The hypotheses were tested at 95% confidence level (α=0.05) as statistical threshold for drawing conclusions. The study sought to find the extend at which independent variables explained variation on the performance sustainability of ISO certified manufacturing firms (adjusted R^2). Additionally, the study conducted ANOVA test to establish whether the relationship was significant by computing F statistics and its corresponding P-values. Significance value was set at 0.05 that is if P-value is less than 0.05, the conclusion is that the model is significant. The coefficient of predictor values regressed against the dependent values was also computed. The summary of regression analysis for testing hypotheses for direct relationship was summarized in table 4.14.

Table 4.14: Regression Results for Direct Relationship

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.748[a]	.560	.512	.22709	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression Residual Total	6.588 5.177 11.765	4 223 227	1.647 0.023	71.609	0.000b
a. Predictors: (Constant), green product innovation strategy, green process innovation strategy, green marketing innovation strategy and green organizational innovation strategy b. Dependent Variable: Performance sustainability					

Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	2.604	.655		3.975	0.007
Green product innovation strategy	.111	.125	.059	.886	0.003
Green process innovation strategy	.062	.078	.055	.801	0.042
Green marketing innovation strategy	.026	.070	.026	.371	0.017
Green organizational innovation strategy	.132	.073	.121	1.813	0.020
Dependent Variable: Performance sustainability					

Source: Survey data (2022)

Regression results in table 4.14 indicate that the adjusted coefficient of determination was 0.512. This means that the independent variables (aspects of green innovation strategy) joints explains 51.2% of the changes in the variable that is performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The F statistics was F (4, 223) =71.609 and P-value of 0.000 which means that the regression model was statistically significant as the level of significance was less than 0.05 threshold adopted in this study. The estimated regression model for direct relation was:

Performance Sustainability = 2.604 + 0.111Green Product Innovation Strategy + 0.062Green Process Innovation Strategy + 0.026Green Marketing Innovation Strategy + 0.132Green Organizational Innovation Strategy……..……Model 4.1

The regression model indicated that holding green innovation strategy constant at zero, the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya was at 2.604. This implied that by adding aspects of green innovation strategy the performance sustainability was to be enhanced positively and would improve.

4.5.1 Green Product Innovation Strategy and Performance Sustainability

The first specific objective explored by this study was to determine effect of green product innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. It's corresponding null hypothesis was: *Ho_1: Green product innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.* The regression model estimated in table 4.14 reveal that green product innovation strategy was statistically significant at β=0.111; t = 0.886; p = 0.003 since the p value was less than 0.05. The results translated that a unit change in green product innovation strategy would results to 0.111 increase in performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

Based on the results in table 4.14, we should reject the null hypothesis and conclude that green product innovation strategy had significant positive effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The study conforms with study by Xiao, Hajar and Hutahayan (2022), Zhang, Zeng and

Tse (2021), Alsharif and Tong (2019), Ma, et al. (2018) and Alsughayir (2017) which indicated that green product innovation strategy had significant effect on the performance of firms in manufacturing firms. The studies confirm that various aspects of green product innovation strategy were linked to enhanced performance sustainability of firms. Study by Adegboyega (2017) further indicated that product innovation had significant positive impact on the performance of firms.

Study by Eiadat et al. (2008) noted that green product innovation enhances efficient utilization of raw materials resulting to lower cost of inputs where firms convert waste in to products providing additional revenue and reducing load on the environment. Ar (2012) further notes that through green product innovation, firms come up with new products which are not harmful (non-toxic) to both user and environments, guiding users on how the components may be reused and how by products may be recycled to reduce cost.

The findings in this study corroborate with the proposition of Green Business Model Innovation (GBMI) by Bisgaard et al. (2012). The model is based on tenets that for firm to be competitive, it needs to bring forth new model of performance sustainability which infuse green innovation as key ingredient in coming up with green product. These new products ought to reduce environmental load, be safe for the users and ought to manage waste from the firm as it increases revenue for the firm (Horbach, Rammer & Rennings, 2012). Resource based view theory by Penrose (1959) expounds how organization resources are key in achieving competitive advantage thus leading to performance sustainability. By adopting green product innovation strategy firms come up with green products and if they exhibit inimitable attributes lead to competitive advantage. These

attributes may include product which in market can't matched up in terms of responsiveness to environmental and social aspects as well being able to gain good market share and improving even financial performance of a firm.

4.5.2 Green Process Innovation Strategy and Performance Sustainability

The second specific objective sought to establish effect of green process innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The null hypothesis proposed was: *Ho_2: Green process innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.* Regression analysis results in table 4.14 reveal that coefficient for green process innovation strategy was 0.062 with the t-statistics and corresponding p-value of 0.801 and 0.042 respectively. This means if you change green process innovation strategy by single unit performance sustainability would increase by 0.062.

The results reveal that the relationship between green process innovation strategy and performance sustainability is significant at 95% confidence level since the p-value is less than 0.05 thus rejecting the null hypothesis. It can therefore be concluded that green process innovation strategy had significant positive effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The findings in this study corroborated with study findings by Xie, Hoang and Zhu (2022), Khairani, Susetyo, Yusnaini and Yusrianti (2021) Ma et al. (2017) and Xie et al (2016) whose studies concluded that green process innovation strategy had influence on the performance of manufacturing firms.

Study by Akpoviroro, Amos and Oladipo (2019) although done in telecommunication sector further confirms that green process innovation strategy had positive effect on performance of firms. This assertion was further supported by study by Osei, Yunsei, Appienti and Forkuoh (2016) who studied SMEs in manufacturing sector. On the other hand, Kenfac, Nekoumanesh and Yang (2013) advanced their study in Swedish municipalities which are non-profit making and concluded that green process innovation had impact on the performance of institutions. OECD (2009) observed that green process innovation strategy revolves around using new and enhanced manufacturing methods and machinery which reduce negative environmental burden and has positive social, human and economic impacts while promoting performance of a firm.

The postulates of green business model innovation agreed with findings of this study in that it recognizes that firm ought to modify their business operations and processes and substitute its inputs to green inputs which incorporate aspects of reusing, recycling resources (Bisgaard et al., 2012). The advocate for shifting of operations and systems by modifying and redesigning alternatives that create value to the firm. GBMI should have benefits which include: good ecological effects, coming up with environmentally friendly products and efficiency in utilization of raw materials and energy, and reducing waste and emissions (Jawahir, Badurdeen & Rouch, 2014).

4.5.3 Green Marketing Innovation Strategy and Performance Sustainability

The third specific objective sought to determine the relationship between green marketing innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms. The study proposed null hypothesis from this objective that: *Ho_3: Green marketing innovation strategy has no significant effect on the performance*

sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. Regression analysis in table 4.14 confirmed that the relationship between green marketing innovation strategy and performance sustainability was statistically significant at β=0.026; t = 0.371; p = 0.017, since significance was less than 0.05 thus rejecting null hypothesis. It was noted that unit increase in green marketing innovation strategy increases performance sustainability by 0.026.

From the study findings, it can be concluded that there is significant positive effect of green marketing innovation strategy on performance sustainability of ISO 14001 certified manufacturing firms. The findings are consistent with finding by researchers such as Sathana, Velnampy and Rajumesh (2019), Fatoki (2019) and Maziriri (2018) who had found that green marketing innovation strategy was liked to sustainability performance of firms. Mungai (2017) although he conducted study in a flower company at Oserian also found green marketing strategy had impact on performance of firms. Amegbe, Owino and Nuwasiima (2017) while studying SMEs equally found that green marketing innovation strategy had positive impact on the performance of firms.

Pathak (2017) agreed that green marketing had impact on customer satisfaction which is an aspect of performance sustainability. It is noted by Chamorro & Bañegil (2006) that the green innovation marketing should be geared towards lessening the impact on the natural environment during the process of planning and implementations of products or services, price, place and promotion. Mourad & Ahmed (2012) noted that green marketing innovation need to create profit and maintain the social responsibility.

The key propositions of model by Bisgaard et al. (2012) on green business model innovation was that the new model of performance sustainability ought to recognize green innovation as key for business to be competitive. This entails coming up with green products, processes and practices which reduce ecological burden as firm gain both economic and social performance. The entire product life cycle of products ought to substitute old procedures to greener inputs which encourage reusing and recycling of resources. The product's brand should promote greenness and ensure all other aspects of marketing mix include pricing, distribution and advertisement should promote aspects of greenness (Osterwalder & Pigneur, 2010).

4.5.4 Green Organizational Innovation Strategy and Performance Sustainability

The fourth objective sought to determine the relationship between green organizational innovation strategy and performance sustainability in ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. To this end, the null hypothesis was: *Ho_4: Green organizational innovation strategy has no significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.* The regression results in table 4.14 revealed that the beta coefficient for green organizational innovation strategy was 0.132 with t-statistics and corresponding p-value of 1.813 and 0.02 respectively. Since the p-value was less than 0.05, we reject the null hypothesis and conclude that there is significant positive effect of green organizational innovation strategy on performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. From the beta coefficient of 0.132 it means unit change of green organizational innovation strategy improves performance sustainability by 0.132 among the ISO 14001 certified manufacturing firms.

The findings of this study were consistent to hitherto studies although they operationalized green organizational innovation strategy using a single indicator. For instance, Elshaer, Azazz and Fayyad (2023) operationalized green organizational innovation strategy in terms of green management practices which had impact on sustainable performance of firms although the study was done in hospitality industry. Studies by Al-Shammari, Alshammrei, Nawaz and Tayyab (2022) and Banyhamdan, Al-Ghdabi and Almomani (2019) noted that green human resource practices had positive effect performance of firms while Kneipp, Gomes, Bichueti, Frizzo and Perlin (2019) linked sustainable innovation practices with performance of firms. Chukwuka and Eboh (2018) operationalized green organizational innovation strategy in terms of green business practices which had impact on the performance of firms.

The postulates of green business model innovation paradigm by Bisgaard et al. (2012) advocate for firms coming up with practices and daily procedures which advocates for proper and sustainable utilization of resources which leads to less ecological burden and improved financial gains. It encourages shifts in operations and planning of business in a manner that promotes green growth on a firm.

4.5.5 Green Innovation Strategy, Competitive Advantage and Performance Sustainability

The fifth specific objective sought to establish the mediating effect of competitive advantage on the relationship between green innovation strategy and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The corresponding research null hypothesis was: *Ho_5: Competitive advantage has no significant mediating effect on the relationship between green innovation strategy and the*

performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The study used path analysis involving four steps as recommended by Baron and Kenny (1986). The first step was regressing green innovation strategy on performance sustainability as indicated in table 4.15.

Table 4.15: Regression Results for GIS on Performance Sustainability

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.481[a]	.231	.226	.22623	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression Residual Total	2.199 9.566 11.765	1 226 227	2.199 .042	52.357	0.000b
a. Predictors: (Constant), GIS b. Dependent Variable: Performance sustainability					
Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	2.807	.571		4.917	0.000
GIS	.281	.143	.130	1.970	0.050
Dependent Variable: Performance sustainability					

Source: Survey data (2022)

Table 4.15 indicated that the adjusted R squared was 0.226 meaning green innovation strategy explains 22.6 percent of the variation of performance sustainability at 95 percent level of significance in ISO 14001 certified manufacturing firms. It was revealed that the regression model was statistically significant at F (1, 226) = 52.357 and the calculated probability is 0.000 meaning the regression model fitted the data well. Since the calculated probability value was below 0.05 (the threshold), it can be concluded that the data is ideal for making inferences and conclusions. The summary for model 4.2 was:

Performance Sustainability = 2.807 + 0.281Green Innovation Strategy …Model 4.2

The estimated regression model clearly indicated that green innovation strategy was statistically significant at β=0.281; t = 1.970; p = 0.050. This means that there is a significant relationship that can be mediated between green innovation strategy and performance sustainability. Additionally, the model translated that if green innovation strategy remained constant at zero, performance sustainability would be 2.807 and a unit change in green innovation strategy would affect performance sustainability by 0.281. The second step was regressing green innovation strategy on competitive advantage as indicated in table 4.16.

Table 4.16: Regression Results for GIS and Competitive Advantage

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.375[a]	.141	.136	.26990	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	2.035	1	2.035	31.797	0.000b
Residual	14.464	226	.064		
Total	16.499	227			
a. Predictors: (Constant), GIS b. Dependent Variable: CA					
Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	3.462	.681		5.082	0.000
GIS	.119	.170	.046	.677	0.000
Dependent Variable: Competitive advantage					

Source: Survey data (2022)

Results from table 4.16 showed that the adjusted coefficient of determination was 0.136 translating to 13.6 percent of changes in competitive advantage being explained by green innovation strategy at 95 percent level of significance among ISO certified manufacturing firms in Nairobi City County, Kenya. The estimated regression model was found to be statistically significant as revealed by F statistics (1, 226) = 31.797 at a calculated probability of 0.000 which is below threshold of 0.05. The summary for model 4.3 was:

Competitive Advantage = 3.462 + 0.119 Green Innovation Strategy……. Model 4.3

The estimated regression model revealed that green innovation strategy was statistically significant at β=0.119; t = 0.677; p = 0.000. The model indicates that when green innovation strategy remains constant at zero, competitive advantage would be 3.462 and a unit change in green innovation strategy would affect competitive advantage by 0.119. The third step was regressing competitive advantage on performance sustainability as indicated in table 4.17.

Table 4.17: Regression Results for Competitive Advantage and Performance Sustainability

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.460[a]	.212	.204	.22756	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression Residual Total	2.062 9.703 11.765	1 226 227	2.062 .043	47.953	0.000b
a. Predictors: (Constant), CA b. Dependent Variable: Performance sustainability					
Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	3.691	.221		16.698	0.000
CA	.061	.056	.072	1.090	0.000
Dependent Variable: Performance sustainability					

Source: Survey data (2022)

It was evident as indicated in table 4.17 that the adjusted R squared was 0.204 meaning competitive advantage explains 20.4 percent of the variation of performance sustainability at 95 percent level of significance. The model was statistically significant at F (1, 226) = 47.953 and the calculated probability is 0.000 making the data ideal for making inferences and conclusions. The summary for model 4.4 was:

Performance Sustainability = 3.691 + 0.061Competitive Advantage…….Model 4.4

The model indicate that competitive advantage was statistically significant at β=0.061; t = 1.090; p = 0.000. This means that performance sustainability would be 3.691 if competitive advantage would be zero and a unit change in competitive advantage would change performance sustainability by 0.061. In the last step, green innovation strategy

and competitive advantage were regressed on performance sustainability as shown in Table 4.18.

Table 4.18: Mediation Results

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.535[a]	.286	.279	.22622	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	4.251	2	2.125	64.393	0.000b
Residual	7.514	225	.033		
Total	11.765	227			
a. Predictors: (Constant), GIS, CA b. Dependent Variable: Performance sustainability					
Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	2.613	.603		4.336	0.000
GIS	.275	.143	.127	1.922	0.005
CA	.056	.056	.066	1.006	0.028
Dependent Variable: Performance sustainability					

Source: Survey data (2022)

Table 4.18 indicate that the adjusted R squared was 0.279. This means that 27.9 percent of the variation in performance sustainability can be explained by green innovation strategy and competitive advantage combined at 95 percent level of significance. The model was statistically significant at F (2, 225) = 64.393 and the calculated probability is 0.000. The summary for model 4.5 was:

Performance Sustainability = 2.613 + 0.275Green Innovation Strategy + 0.056Competitive advantage……. Model 4.5

The model indicated that both green innovation strategy and competitive advantage are statistically significant at β=0.275; t = 1.922; p = 0.005 and β=0.056; t = 1.006; p = 0.028

respectively. Performance sustainability would be 2.613 if both green innovation strategy and competitive advantage were zero. It was concluded that both green innovation strategy and competitive advantage has positive relationship with performance sustainability.

The total effect of green innovation strategy on performance sustainability was represented by β_1 of 0.281in model 4.2. The direct effect of green innovation strategy on performance sustainability after gaining competitive advantage was represented by β_1 of 0.275 in model 4.5. The effect of green innovation strategy on competitive advantage (mediating variable) was represented by $\beta_1 = 0.119$ in model 4.3. The effect of competitive advantage on performance sustainability was represented by $\beta_1 = 0.119$ in model 4.4. The decision criteria for mediation was shown in table 4.19.

Table 4.19: Decision Criteria for Mediation

Model 4.2	**Model 4.3**	**Model 4.4**	**Model 4.5**	**Test**	**Conclusion**
$\beta_1 = 0.281$ ($p = 0.050$)	-	-	-	-	There was an overall relationship to be mediated
$\beta_1 = 0.281$ ($p = 0.050$)	$\beta_1 = 0.119$ ($p = 0.000$)	$\beta_1 = 0.061$ ($p = 0.050$)	$\beta_1 = 0.275$ ($p = 0.050$) $B_2 = 0.056$ ($p = 0.028$)	$\beta_{21} - \beta_{51} =$ 0.281-0.275 =0.006 β_1 in model 4.5 is less that β_1 in model 4.2	There was partial mediation

Source: Survey data (2022)

Table 4.19 confirms that β_1 coefficient in model 4.2 is statistically significance thus meaning there was a relationship that could be mediated. It was further confirmed that β_1

coefficients in model 4.3, 4.4 and 4.5 were statistically significant at 95 percent level of confidence. Additionally, β_2 coefficient in model 4.5 was noted to be statistically significant. Since β_1 coefficients in model 4.5 is less than β_1 coefficients in model 4.2, it can be concluded that competitive advantage had partial mediating effect on the relationship between green innovation strategy and performance sustainability thus rejecting the null hypothesis.

The findings of this study links well with hitherto studies by Nuryakin and Maryati (2022), Buswari, et al (2021) and Anwar (2018) which found that competitive advantage partially mediated the relationship green innovation strategy and performance although Nuryakin and Maryati (2022) operationalized green innovation strategy using one dimension that is green marketing innovation strategy while Buswari, et al. (2021) used two dimensions of green innovation strategy that is green product and marketing innovation strategy. Studies by Wirda, et al. (2019), Pratono, et al. (2019) and Setyawati et al. (2017) further observed that competitive advantage mediated the relationship between green innovation strategy and performance of firms. It was however noted scholars operationalized variables in either one or two indicators of green innovation strategy and some studies were done in different context for instance Wirda, et al. (2019) was done in creative industries unlike this study which was done in manufacturing sector.

The postulates of RBV dictates that organizational resources and capabilities when pooled together are key in realizing competitive advantage which lays foundation for performance sustainability of firms (Barney, 1991). The green resources and capabilities ought to be effectively combined and often modified to come up with novice, unique and distinctive resources and capabilities. The pool of resources and capabilities should fit the

external variations thus making the green innovation strategy success and maintain its competitive advantage.

4.5.6 Green Innovation Strategy, Regulatory Framework and Performance Sustainability

The sixth specific objective for this study sought to determine the moderating effect of regulatory framework on the relationship between green innovation strategy and performance sustainability in Nairobi City County, Kenya. The null hypothesis proposed was: *Ho_6: Regulatory framework has no significant moderating effect on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.* The hypothesis was assessed by utilizing two step regression models. The first step involved regressing green innovation strategy and regulatory framework on performance sustainability to determine if there was significant relation to be moderated. The results were summarized in table 4.20.

Table 4.20: Regression Results for GIS, RF and Performance Sustainability

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.486[a]	.236	.229	.22604	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	2.269	2	1.135	27.024	0.000b
Residual	9.496	225	.042		
Total	11.765	227			
a. Predictors: (Constant), GIS, RF b. Dependent Variable: Performance Sustainability					
Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	2.537	.615		4.125	0.007
GIS	.281	.143	.130	1.969	0.050
RF	.069	.059	.077	1.174	0.042
Dependent Variable: Performance sustainability					

Source: Survey data (2022)

Table 4.20 indicated that that the adjusted R squared was 0.229 implying that both green innovation strategy and regulatory framework explains 22.9% of the variation of performance sustainability at 95% level of significance. The model was statistically significant at F (2, 225) = 27.024 and the calculated probability is 0.000. The summary for model 4.6 was:

Performance sustainability = 2.537 + 0.281Green Innovation Strategy + 0.069Regulatory Framework……. Model 4.6

The model indicate that green innovation strategy and regulatory framework was statistically significant at β=0.281; t = 1.969; p = 0.050 and β=0.069; t = 1.174; p = 0.042 respectively. This suggest that there was a significant relationship which can be moderated by regulatory framework. The second step involved regressing green

innovation strategy, regulatory framework and interaction term on performance sustainability. The results were summarized in table 4.21.

Table 4.21: Regression Results for Moderation

Model summary					
Model	**R**	**R square**	**Adjusted R^2**	**Standard error of estimate**	
1	.456[a]	.208	.204	.22647	
ANOVA					
Model	**Sum of squares**	**df**	**Mean square**	**F**	**Sig.**
Regression	3.277	3	1.092	28.737	0.000b
Residual	8.488	224	0.038		
Total	11.765	227			
a. Predictors: (Constant), GIS, RF, Moderator (GIS*RF) b. Dependent Variable: Performance Sustainability					
Model	**Unstandardized coefficients**		**Standardized coefficient (beta)**	**t**	**Sig.**
	Beta	**Std error**			
Constant	2.525	.617		4.092	0.000
GIS	.283	.143	.131	1.979	0.049
RF	.071	.059	.080	1.200	0.031
Moderator (Interaction term)	-.083	.216	-.026	-.386	0.010
Dependent Variable: Performance Sustainability					

Source: Survey data (2022)

Table 4.21 indicated that the adjusted R squared was 0.204 implying that both green innovation strategy, regulatory framework and moderator explains 20.4% of the variation of performance sustainability at 95 percent level of significance. The model was statistically significant at F (3, 224) = 28.737 and the calculated probability is 0.000. It can be concluded that regulatory framework has negative moderating effects on the relationship between green innovation strategy and performance sustainability on ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. This was realized in that the variation on performance sustainability had reduced from 22.9% to 20.4% after

introducing moderator (Interaction between GIS and RF) in the model. The summary for model 4.7 was:

Performance sustainability = 2.525 + 0.283Green Innovation Strategy + 0.071Regulatory Framework + -0.083Green Innovation Strategy*Regulatory Framework.……Model 4.7

The model indicated that green innovation strategy, regulatory framework and moderator (Green Innovation Strategy*Regulatory Framework) were statistically significant at β=0.283; t = 1.979; p = 0.049, β=0.071; t = 1.200; p = 0.031 and β= -0.083; t = -0.386; p = 0.010 respectively because the p-value was less than 0.05 which was the threshold. This suggest that there was a significant relationship between green innovation strategy and performance sustainability which can be moderated by regulatory framework. It was however confirmed that regulatory framework had negative moderating effect on the relationship between green innovation strategy and performance sustainability as noted by reduction in variation of performance sustainability and the negative β_3 as noted in model 4.7. The decision criteria for moderation was presented in table 4.22.

Table 4.22: Decision Criteria for Moderation

Model 4.6	**Model 4.7**	**Total effect**	**Conclusion**
β_1 = 0.281, (p = 0.050) β_2 = 0.069, (p = 0.042)	-	-	There was an overall effect to moderate
β_1 = 0.281, (p = 0.050) β_2 = 0.069, (p = 0.042)	β_1 = 0.283, (p = 0.049) β_2 = 0.071, (p = 0.031) β_3 = -0.083, (p = 0.010)	β_3 = -0.083, (p = 0.010)	There was evidence of significant negative moderating effect of the moderating variable

Source: Survey data (2022)

Table 4.22 indicated that regulatory framework negatively moderates the relationship between green innovation strategy and performance sustainability. It was noted for each unit increase in regulatory framework, the performance sustainability reduced by 0.083. It was therefore concluded that at 95 percent level of confidence, regulatory framework had negative moderating effect on the relationship between green innovation strategy and performance sustainability in ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

The study findings are inconsistent with study by Eneizan, et al. (2019), Cao et al. (2019), Saengchai, et al. (2019), Feng and Chen (2018), Ramanathan, et al. (2017) and Kousar, et al. (2017) who found that regulatory framework had positive moderating effect on the performance of manufacturing firms. It is however noted various studies operationalized regulatory framework in varied ways for instance, Eneizan, et al. (2019) operationalized regulatory framework as government policies while Cao et al. (2019) viewed regulatory framework in terms of environmental regulations. Regulatory frameworks may be in form of policies, regulations and guides that governs operations of manufacturing firms (Hunters, 2014). Regulatory framework is observed to be imperative in enhancing green innovation in manufacturing (Walker & Wan, 2012; Ma, et al., 2017).

Results in this study observed a negative moderating effect which was in tandem with findings by Ramanathan, et al. (2017) who indicated that inflexible and rigid environmental regulations had negative moderating effects on relationship between green innovation strategy and performance of the firms. Studies by Feng and Chen (2018) and Kousar et al. (2017) indicated as a contradictory result of positive moderating effect of regulatory framework on the relationship between green innovation strategy and

performance sustainability of firms. These studies pegged their argument of adverse effect of regulatory framework on the relationship between green innovation strategy and performance sustainability on flexibility of the regulatory framework which determines whether the moderation would be positive or negative. The contradiction that by enforcing regulatory framework to firms which have already complied with environmental standards (ISO 14001 certified firms) will depress the relationship between GIS and performance sustainability opens a lacuna where the government. This call for government and all key players to review the existing standards and regulations and work together with all actors in the industry in instituting regulatory framework which promote sustainable performance of firms as well as improving compliance with all environmental standards.

The results corroborate with postulates of Green Business Model Innovation (GBMI) which hype policy guidelines and regulations (regulatory framework) in promoting green growth of firms where flexibility and certainty of regulations is key (OECD, 2012). Institutional theory by Scott (1995) further connected the organization to its contextual setting they are operating in where they should be conscious of market demands, institutional pressure and regulations which boast firm's effort in operationalizing certain strategy. The theory was connected to policy which guide lawful and prescribed aspects of the authority.

The postulates of stakeholder's theory by Ansoff (1965) places interests and welfare of both stakeholders and stockholders as paramount for firm to realise superior and sustainable performance. The theory identifies government as key stakeholder as they influence regulatory framework which govern operations of the firms. Leadership of

firms play very imperative position in ensuring the firm's value system and practices doesn't conflict with stakeholder's interests. The stakeholders' theory linked with this study in that the firm leadership ought to come up practices which conforms well with the policies and regulations that have been set out by the government and its agencies in order to avoid conflicts and penalization which may affect the performance of firms.

4.6 Qualitative Data Analysis

The study derived qualitative data from open-ended questions contained in the research instrument. The study sought the opinion of the respondents on various state of green product, green process, green marketing and green organizational innovation strategy and how they influence performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County. It further sought opinion on whether competitive advantage and regulatory framework enhanced and affected how green innovation strategy was linked to performance sustainability of firms respectively. The data was pieced together and analysed on the basis of common themes and patterns which were reported in narrative form.

4.6.1 Green Product Innovation Strategy

The study sought the opinion on the state of green product innovation strategy. Most of the respondents opined that firms had adopted practices linked to green product innovation strategy. Major activities adopted included producing products which could be recycled after use, having non-toxic products and producing products which have components that can be recycled. Most respondents opined green product innovation strategy had influence on the performance sustainability of the firms. Producing green

products would increase firm's sales and market share unlike their competitors. The analysis matches with descriptive statistics which indicated that firms had adopted green product innovation strategy. The results further corroborated with quantitative analysis which indicated that adoption of green products innovation strategy had significant positive effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

4.6.2 Green Process Innovation Strategy

The study sought opinion of the respondents whether firms had adopted green process innovation strategy. Most respondents were of the opinion that most firms had activities that supported green process innovation strategy. Most respondents opined that most machines used by firms were utilising both raw materials and energy efficiently and produce little or no waste. There was conformance of responses that most firms treated waste before releasing it to the environment. There was agreement that green process innovation strategy was linked to performance sustainability of their firms. These findings backed up the findings of quantitative data which concluded that green process innovation strategy had positive significant effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

4.6.3 Green Marketing Innovation Strategy

Most respondents were of the opinion that firms had adopted activities related to green marketing innovation strategy. Major activities related to green marketing innovation strategy adopted included green packaging using biodegradable materials, discounts related to green products and there was green information through advertisement related

to green products. There was assertion by bigger percentage of the respondents that green marketing innovation strategy was linked to performance sustainability of the firms. These observations did not deviate from quantitative data analysis which had concluded that green marketing innovation strategy had significant positive effect on the performance sustainability of the 14001 certified manufacturing firms in Nairobi City County, Kenya.

4.6.4. Green Organizational Innovation Strategy

The study sought opinion whether firms had adopted activities related to green organizational innovation strategy and if it was linked to performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. There was agreement by most respondents that most firms had adopted green human resource practices related to green organizational innovation strategy which include green training, green recruitment, green knowledge transfer and there were systems to support green system in most firms. Most respondents concurred that to green organizational innovation strategy was linked to performance sustainability of firms. The results are in tandem with quantitative results which indicated that green organizational innovation strategy had positive influence on the performance sustainability of the ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

4.6.5 Competitive Advantage

The study sought opinion of the respondents on whether ISO 14001 certified manufacturing firms in Nairobi City County had attained competitive advantage and its role in enhancing relationship between green innovation strategy and performance sustainability of the firms. Most respondents agreed that there were activities to enhance

competitive advantage among ISO 14001 certified manufacturing firms. Competitive advantage was achieved by firms through offering green products at relatively lower prices compared to their competitors. The respondents opined that firmed had gained competitive edge than their competitors through uniquely automating their systems and ensuring their had departments which coordinated activities as firms green their activities. There was agreement by most respondents that when firms attain competitive advantage it will enhance how firms go green and performance sustainability of the firms. The findings marry well with quantitative data analysis which found that competitive advantage had partial mediating effect on the relationship between green innovation strategy and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

4.6.6 Regulatory Framework

The study sought opinion whether regulatory framework affected the relationship between green innovation strategy and performance of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. Respondents were of the opinion that regulatory framework affect the level at which firms operated in a sustainable manner. Respondents opined that firms that follow regulatory framework perform well while firms that violate the regulations were penalized. Firms which complied well with environmental regulations set by regulating organizations like NEMA were noted to perform in a sustainable manner unlike noncompliant firms which risk penalization or even closure if they pose great risk to the end users and the environment. These observations coincide with conclusion from quantitative data analysis which noted that regulatory framework negatively moderated the relationship between green innovation

strategy and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. It is however noted that results from quantitative data adversely affected the relationship which call for policy makers to come up with flexible regulatory framework and involve all team players in the sector to be involved in coming up with the regulations to govern their operations.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter presents the summary of findings, conclusion drawn from the study findings and contribution of the study to the knowledge. The chapter further highlights recommendation made from the study to policy and practice and suggestions for further research in relation to green innovation strategies and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County in Kenya. The presentation in each section was done thematically according to the specific objectives of the study.

5.2 Summary

Manufacturing firms across the world are in quest for sustainable manufacturing which consider environmental and social concerns on top of the traditional quest for economic growth of a firm. This has been triggered by increased consumption of energy and raw materials, increased waste & emission resulting to climatic changes and environmental degradation which has prompted need for sustainable manufacturing. The move towards sustainable manufacturing is mother to the concept of green innovation and green circular economy.

Kenya being the most industrialized country in Eastern and Central Africa has prioritized manufacturing as one of the key pillars to drive economic development in the county. Manufacturing sector has been advocated for in the Vision 2030 and the famous "The big four Agenda" as key driver of the economy in the country. Kenya is also in move for clean production where regulatory framework has been enacted to control firms due to

heavy environmental load associated with manufacturing activities. This has prompted need for consideration of economic, societal and environmental impact of manufacturing in the entire product life cycle which is paramount step towards green innovation. Every firm is working towards achieving ISO 14001 on EMS which deals with environmental sustainability.

It is based on this argument that it is necessary to investigate how green innovation strategy relate to performance sustainability while exploring how competitive advantage and regulatory framework mediate and moderate the relationship respectively among ISO 14001 certified manufacturing firms Nairobi City County in Kenya. The summary of the study was drawn as per research objectives. The first objective of the study sought to determine effect of green product innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The key parameters for operationalizing for green product innovation strategy were products with reusable components, products with recycled materials, products with non-toxic elements and products with after use instructions. It should however be noted that these indicators of green product innovation strategy were expected to variedly contributed to performance sustainability of firms.

The second objective established whether green process innovation strategy had effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The indicator for the variable were energy consumptions, material consumptions, waste materials management and green process design which were noted to be substantially practiced although at varied level by firms. Inferential statistics

indicated that green process innovation strategy had a positive contribution to performance sustainability which confirmed the expectations of this objective.

The third objective of the study sought to establish effect of green marketing innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The key indicators enumerated for green marketing innovation strategies included green branding, green distribution, green pricing and green advertisement which had varied effect on performance sustainability of the firms. Nevertheless, it was discovered that green marketing innovation strategies among the aspects of green innovation strategies had least effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

The fourth objective of the study sought to determine the effect of green organizational innovation strategy on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. Practices of green organizational innovation strategy included green business practices, green support system, environmental knowledge transfer practices and green human resource practices and had influence on performance sustainability of firms although at a varied level. It was noted that green organizational innovation strategy had the greatest effects on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi city county in Kenya.

The fifth objective determined whether competitive advantage had mediating effect on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The study

focused on cost leadership and differentiation aspects of competitive advantage which enhanced the relationship between green innovation strategy and performance sustainability. Cost leadership was operationalized using economies of scale and operational efficiency. Differentiation was operationalized uniquely in terms of green technology automation, green office synergy and intellectual capacity utilization which enhanced the relationship between green innovation strategy and performance sustainability in varied manner. Statistical analysis confirmed the expectation of this objective that competitive advantage had partial mediating effect on the relationship between green innovation strategy and performance sustainability of firms.

The sixth objective sought to find whether regulatory framework had moderating effect on the relationship between green innovation strategy and the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The study focused on how environmental regulations, clean technological regulations and NEMA regulation compliance moderated the relationship between green innovation strategy and performance sustainability of firms. Statistical analysis for moderation confirmed the expectation of this objective to the effect that regulatory framework negatively moderated the relationship between green innovation strategy and performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya.

5.3 Conclusion

Performance sustainability has been a major concern as manufacturing firms transit towards sustainable manufacturing and green growth. This study investigated how green innovation strategy influenced performance sustainability of ISO 14001 certified

manufacturing firms in Nairobi City County, Kenya. Therefore, major conclusions were made based on the study findings.

In relation to the first objective, it can be concluded that green product innovation strategy had significant positive influence on the performance sustainability. In regard to objective two, green process innovation strategy was statistically significant thus there had a significant effect on the relationship between green process innovation strategy and performance sustainability of firms. Additionally, green marketing innovation strategy was found to be statistically significant thus concluding that green marketing innovation strategy had effect on performance sustainability of firms. Moreover, green organizational innovation strategy was statistically significant therefore drawing a conclusion that green organizational innovation strategy had significant positive effect on the performance sustainability among the ISO 14001 certified manufacturing firms in Nairobi City County in Kenya.

Furthermore, in regards to objective five which sought to determine if competitive advantage had mediating effect on the relationship between green innovation strategy and performance sustainability. The researcher concluded that competitive advantage partially mediates the relationship between green innovation strategy and performance sustainability of ISO certified manufacturing firms. Lastly, the sixth objective sought to find if regulatory framework had moderating effect on the relationship between green innovation strategy and performance sustainability. It was concluded that regulatory framework had significant negative mediating effect on the relationship between green innovation strategy and performance sustainability of ISO14001 certified manufacturing firms in Nairobi City County in Kenya.

5.4 Contribution of the Study to Knowledge

Green innovation is taking a center stage in the conversation relating to sustainability performance of manufacturing firms. The vision 2030 and 'The big four agenda' reaffirms the key role played by manufacturing sector in promoting economic development of the country. However, with increasing challenges relating to climatic changes and environmental degradation quest for sustainable manufacturing which is a precursor for performance sustainability has been an ongoing debate. The contribution of this study is therefore directed towards both the theory and practice which emanates from exploration of green innovation strategy as key trigger for performance sustainability of ISO 1400 certified manufacturing firms.

Previous studies advanced one or two perspective of green innovation strategy and how it related to firm performance. This study on the other hand incorporated aspects of sustainability and advanced performance in a broader perspective addressing the three corner stones of performance sustainability that is financial, social and environmental performance of the firm. The study further incorporated competitive advantage as a mediating variable on the relationship between green innovation strategy and performance sustainability where it advanced the scope of competitive advantage using cost leadership and differentiation. In this case differentiation was advanced using generic dimensions like green technology automation and green office synergy which helped in advancing the new conceptual framework. It was additionally observed that the study introduced regulatory framework as moderating variable on the relationship between green innovation strategy and performance sustainability. This would bring in new frontier of knowledge as no known study was advanced on the relationship between

green innovation strategy and performance sustainability of ISO 14001 certified manufacturing firms when it is mediated by competitive advantage and moderated by regulatory framework.

The previous studies had limitation relating to methodology, context and conceptualization of the research variables and models. Some studies employed only qualitative approaches where inferences on the results could not be made. Some sampling procedures were non-representative like convenience sampling while others studies used few respondents who were not amenable for statistical analysis. This study approached the study using a broader lens which combined both qualitative and quantitative approach. Most of the previous studies on green innovation strategy and performance sustainability was done in developed economies and different sectors unlike this study which was built in a local context and specifically in ISO 14001 certified manufacturing sector which is offer a repertoire of new insights relating to green innovation strategy and performance sustainability thus contributing to new body of knowledge.

The study also contributes to the theoretical literature by providing foundation on which theoretical prepositions used to formulate hypotheses of the study were tested empirically in this study. The study supports the tenets of green business model innovation which accentuate that firms ought to properly and sustainably utilize resource in a manner that reduce environmental burden while achieving its set goals. The study brings forth the four dimensions of green innovation as key ingredient for firm to increase its competitiveness through shifting its operations to green technology and processes so that they may realize its performance sustainability agenda. The call for modification of

processes and designs in order to create value is inevitable thus improving on the GBMI theory.

The study further supported RBV theory where it was noted that competitive advantage enhanced performance sustainability of firms. It focused on firms holding unique resources and capabilities like unique intellectual capacity utilization of managers, automation of green technology and green office synergy to aid firms in achieving their competitive advantage hence realizing optimal performance sustainability. On practical basis, this study has helped coin and propose a model of green innovation which if utilized by manufacturing firms would help firms in manufacturing sector operate in a more sustainable manner thus improving performance sustainability.

5.5 Recommendations for Policy and Practice

The findings of this research have provided insights which are paramount while formulating policy and in practice in relation to how green innovation strategy can be operationalized and enhanced in the manufacturing sector and to realize performance sustainability. It was evident from the study that green product innovation strategy had positive effect on performance sustainability of ISO 14001 certified manufacturing firms in Kenya. It was therefore recommended to the operations managers to ensure their firms produce products that can be recycled, have products with components that can be reused, recycled and are non-toxic to both end users and the environment. There is need in their productions to ensure each product have clear instructions to the end users on how to dispose used products or the best way of reusing and recycling.

Green process innovation strategy had positive influence on performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The ICT and operations managers should ensure they come up with technology, design and processes which ensure efficient consumption of raw materials and zero waste and emissions. Operations managers need to initiate reverse processes where waste materials can be reused, by products recycled and together with finance manager come up with token economy principle where those who collect their by-products and bring them to the firm for recycling are rewarded and their activities financed.

The study found that green marketing innovation strategy had positive effect on the performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The marketing managers of the firms should ensure that they incorporate aspects of sustainability in entire supply chain. The marketing managers in liaison with operations managers should ensure they brand products with aspects of greenness like packaging using decomposable and bio gradable materials. The marketing managers should ensure they offer discounted green products and ensure together with ICT manager ensure the advertisement message encompass the aspects of greenness of the products.

Green organizational innovation strategy had positive effect on performance sustainability of ISO 14001 certified manufacturing firms in Nairobi City County, Kenya. The human resource managers should come up with green human resources practices which include green training, recruitment, appraisal system and ensure there is clear environmental knowledge transfer practices among the peer firms which drive firms towards sustainable manufacturing and green growth.

Competitive advantage partially mediated the relationship between GIS and performance sustainability of firms. The operations managers together with finance managers should ensure firms advance efficient manufacturing processes which lead to lower cost of production methods. The human resource managers should utilize tacit knowledge and expertise of its employees while ICT managers of the firm should automate technology to support green growth in each firm in order to pursue agenda of performance sustainability effectively. The human resource managers should ensure all staff are trained to gain adequate knowledge which is a precursor for firms gaining competitive advantage as they grow green and attain performance sustainability of manufacturing firms.

The relationship between green innovation strategy and performance sustainability of firms was moderated negatively by regulatory framework. It is therefore imperative for government of Kenya in consultation with all other stakeholders like NEMA and KAM to come up with flexible regulatory frameworks which all firms can effectively comply as they address their performance sustainability issues. The government of Kenya through its agencies like NEMA, KEBS and KAM need to constantly training management of firms on issues related to environmental sustainability and conduct regular audits of the firms to ensure compliance with regulatory framework. The government of Kenya should finance green growth initiatives among firms and hold annual conferences to jointly address sustainability challenges. There is also need for the government to introduce incentives related to compliance of firms like energy related awards, environmental safety awards and recognition of firms operating in a sustainable manner. The executives of firms should ensure they come up with proactive internal policies and programs which

are guided by the existing regulatory framework to reduce non-compliance or penalization of the firm or even suspension of their operations by the regulating bodies. There is need for human resource managers to train all staff on existing regulatory framework so that firms ensure high rated level of compliance with regulatory framework.

5.6 Recommendations for Further Studies

This study sought to investigate the relationship between green innovation strategy and performance sustainability of ISO14001 certified manufacturing firms in Nairobi City County in Kenya. It also featured how the relationship between green innovation strategy and performance sustainability is mediated by competitive advantage and moderated by regulatory framework. These findings were limited to manufacturing sector and specifically ISO 14001 certified manufacturing firms. This suffer limitation of generalization of findings to all sectors since it addressed one sector calling for need for study in other sectors of the economy using the same study variables.

The study further did not capture the gains made as firm attain ISO 14001 certification as the study was a cross sectional study. This call for future research to be conducted using longitudinal approach for 10 years capturing the trends as firm attain ISO certification and also capture the trend as firms grow green in their operations as that is not a one stop events. This includes infusing aspects which were not captured in this study including firm size which keep on changing and firm's operations environment as time changes.

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APPENDICES

Appendix I: Introductory Letter

James Kimuli Nzomo
Kenyatta University,
P.O Box 43844 – 00100,
NAIROBI.
15th November, 2021

Dear Participant,

RE: PERMISSION FOR COLLECTING DATA

My name is James Kimuli Nzomo, ID number 22721088 and Phone number +254708969768. Currently, I am undertaking a PhD course in Business Administration (Strategic Management) at Kenyatta University at the School of Business. My Doctoral Thesis is on **"Green Innovation Strategy and how it is linked to Performance Sustainability among the ISO 14001 Certified firms in the Manufacturing Sector operating in Nairobi City County, Kenya".**

To achieve the academic goal, you have been identified as a respondent in the study. I humbly request you to help me in collecting the data by answering to all questions in the provided research questionnaire. I wish to clarify that all information provided during the research utilized for scholarly purpose only and the data handled with respect and secrecy of the highest order. Upon your request, the final copy of the study would be provided to you. Looking forward for positive consideration. Thanks in advance.

Yours faithfully

James Kimuli Nzomo
Email: jakinz4reva@gmail.com

Appendix II: Questionnaire

This questionnaire used to collect information from ISO 14001 certified firms in Nairobi City County, Kenya. The tool provided information based on **'Green innovation strategy and performance sustainability of 14001 certified manufacturing firms in Nairobi City County, Kenya'.** The information helped the researcher accomplish an academic goal. You are requested to provide as accurate information as possible. The questionnaire has eight parts. Please, answer all questions in each part appropriately.

Part A: Demographic Characteristics

Kindly chose the appropriate choice by ticking (√)

1. Indicate your gender.
   Male [ ] Female [ ]
2. Indicate your age?
   Below 35 years [ ] 35 to 40 years [ ]
   41to 45 years [ ] Above 45 years [ ]
3. Indicate your education level?
   High school certificate [ ] Professional Certificate [ ]
   Diploma certificate [ ] Bachelor's Degree [ ]
   Master's Degree [ ] PhD Degree [ ]
   Any others _____
4. Your working experience in the organization?
   1 to 3 years [ ]
   4 to 5years [ ]
   Above 5 years [ ]
5. What management position do you hold in the organization?
   Finance [ ] Marketing [ ]
   Human resource [ ] Operations/Production [ ]
   ICT [ ] Others (specify) …….

6. How long has this firm been ISO 14001 certified on Environmental Management System?

   1-2 years [ ] 3-4years [ ]

   5-6years [ ] Above 6 years [ ]

7. Which type of green innovation strategy has your firm adopted? (Tick where possible)

Green product innovation strategy [ ] Green process innovation strategy [ ]
Green marketing innovation strategy [ ] Green organizational innovation strategy [ ]

Part B: Green Product Innovation Strategy

8. Please tick (√) one box to indicate how as respondent you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	Green product innovation strategy	1	2	3	4	5
a	**Products with reusable components** The firm produce products with components that can be reused					
	The firm's products have instruction on they can be reused					
	The firm's product can be used in another way after use					
b	**Products from recycled materials** The firm recycles returned and used products					
	The firm collects product's waste from end user for recycling					
	Recycling products have reduced cost of products					
c	**Products with non-toxic elements** The firm's produce non-toxic products					
	The firm's products are non-toxic to the end user					
	The firm's products are not harmful to the environment					
	The products have guide on what the end user in case of any effects					
d	**Product with after-use instructions** The firm's products have instructions on how to recycle after use					
	The firm's products have disposal instruction after use					
	The products have guidelines on how to treat by-product after use					
	The firm's products have instruction on health issues for end user					

9. What is the state of adoption of green product innovation strategy in your own opinion on this company?

……

……

10. How do you think green product innovation strategy influence performance sustainability of your company?

.....

.....

Part C: Green Process Innovation Strategy

11. Please tick (√) one box to indicate how you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	**Green process innovation strategy**	**1**	**2**	**3**	**4**	**5**
a.	**Energy consumption** The company use processes which utilises energy efficiently					
	Machines consumes low power during production					
	Efficient energy consumption has reduced cost of production					
b.	**Material consumption** The firm's processes use materials efficiently					
	Machines used utilizes raw material efficiently					
	Efficient material consumption has reduced cost of production					
c.	**Waste material management** Firm's processes produce little waste					
	Firm treated its waste before disposal					
	Waste from the firm are used as raw materials by other firms					
	Firm collects its by-products from end users for recycling after use					
d.	**Green process design** The firm production design considers user and environmental safety					
	The firm's process design has improved efficiency of the firm					
	The designs used allow release of little waste					
	Green process design utilised reduces cost of production					

12. What is the state of the adoption of green process innovation strategy in your firm?

……

……

13. How would you describe the connection between green process innovation strategy and performance sustainability of this firm?

.....

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Part D: Green Marketing Innovation Strategy

14. Please tick (√) one box to indicate how you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	Green marketing innovation strategy	1	2	3	4	5
a	**Green branding** Firm's products have simple green labels					
	Firm's products are packed using biodegradable materials					
	Green branding of products by firm has made the products unique					
	Green branding has attracted more clients to firm's products					
b	**Green distribution** The firm has adopted green distribution criteria to reach the market					
	Green distribution criterion makes products reach markets faster					
	Green distribution has improved penetration of products to new market					
c	**Green pricing** The firm offer discounts for green products					
	The price of firm's green products is low					
	Discounts for green products leads to increased volume of sales					
d	**Green advertisement** The firm has advertisement programs on its green products					
	The firm's advertisement contents contain green information					
	Advertisements of firm's green products has increased sales volume					

15. How do you describe the state of green marketing innovation strategy and its link performance sustainability of this company?

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……..…

Part E: Green Organizational Innovation Strategy

16. Please tick (√) one box to indicate how you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	Green organizational innovation strategy	1	2	3	4	5
a	**Green business practices** The firm has adopted green business practices in its operations					
	The firm has ongoing green business project and initiatives					
	Green business practices have helped the firm operate in an environmentally sustainable way					
b	**Green support systems** The firm has adopted green support system to help firm in going green					
	There is an internal policy supporting green systems as firm go green					
	The green support systems have helped firm in going green					
c	**Environmental knowledge transfer practices** The firm share green knowledge with their peers in the industry					
	Environment knowledge transfer has helped in flow of information among firms going green					
	Employees have been able to address sustainability issues through environmental knowledge transfer practices					
d	G**reen human resource practices** The firm has adopted green human resource practices					
	The firm has adopted green recruitment, training and development of employees					
	The firm has adopted green rewards system for its employees					

17. What is the state of adoption of green organizational innovation strategy in your firm?

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18. How does green organizational innovation strategy relate to performance sustainability of this firm?

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Part F: Competitive Advantage

19. Please tick (√) one box to indicate how you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	Competitive advantage	1	2	3	4	5
a	**Cost leadership**					
	Economies of scale Energy consumption per unit has reduced after increasing volume of production thus reducing cost of the products					
	Raw materials consumption per unit has reduced after increasing volume of production hence reducing cost of products					
	The cost of research and marketing of products have gone down after expanding production thus reducing cost of products					
	Operational efficiency The production process has been efficient thus reducing cost of products					
	There is reduced waste production thus reducing cost of products					
	The promotion of products has been efficient thus reducing cost of products					
b	**Differentiation**					
	Green technology automation The firm has automated its systems					
	The firm's technology automation is unique and inimitable					
	Automation has improved efficiency thus reducing cost of products					
	Green office synergies The firm has a department that supports going green					
	Green office synergies have improved how the firm coordinates its activities on going green					
	Green office synergy leads efficiency thus reducing cost of products					

	Intellectual capacity utilization Human intellectual capacity is utilized well in the firm					
	Management of this firm are knowledgeable and skilled on greening and are able to come up with inimitable green products and systems					
	Utilization of intellectual capacity of managers enable this firm to use resources efficiently thus reducing cost of products					

20. What is your take on whether competitive advantage can enhance the relation between green innovation and sustainable performance of this company?

……

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Part G: Regulatory Framework

21. Please tick (√) one box to indicate how you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	Regulatory framework	1	2	3	4	5
a	**Environmental regulations** The government has instituted environmental regulation to regulate production of firms					
	The environmental regulations are flexible to the firm					
	The environmental regulations are stringent to the firm					
	Environmental regulations enable this firm to operate with minimum effect on the environment					
	The environmental regulation states action against firms if they violate sustainability issues in production					
b.	**Clean technological regulation** The firm adheres to clean technological regulations					
	The firm has been utilising clean technology in production					
	The firm has not been penalised on failure to use clean technology					
	Clean technological regulations have enabled firm to operate efficiently					

c	**NEMA regulation compliance** NEMA has clear guidelines guiding manufacturing firms					
	NEMA has conducted environmental audit for last 3 years					
	The firms have complied completely with NEMA regulations					
	NEMA has once penalised the firm for non-compliance to its guidelines					

22. Regulatory framework affect green innovation and performance sustainability in this company? Yes [ ] No [ ]

If YES, briefly explain how

……

……

……

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Part H: Performance Sustainability

23. Please tick (√) one box to indicate how you agree or disagree with the statement in the scale below where: 1 =Strongly Disagree 2 = Disagree 3 = Not sure 4 = Agree 5 = Strongly Agree

No.	**Firm Sustainability**	**1**	**2**	**3**	**4**	**5**
a	**Financial performance**					
	Profitability Rate firm's average profitability ratio after ISO 14001 certification (Use scale given below and tick appropriate on the Likert scale) 1 =(0.1- 0.2) 2 = (0.3 - 0.4) 3 = (0.5- 0.6) 4= (0.7-0.8) 5= (0.9-1.0)					
	Firm's profitability has improved after adoption of green innovation					
	The firm's cost of doing business has gone down after going green					
	Firm's profitability has been consistently improved after attaining ISO 14001 certification					
	Market share Demand for firm's products has increased in existing market in the after going green					
	Firm's products have penetrated new market after going green					
	The volume of sales has improved after this firm going green					

b.	**Social performance**					
	Employees satisfaction The staff safety has improved after firm attaining ISO certification					
	Employees with health insurance has increased after firm going green					
	The employees complain have gone down after going green					
	Employees accidents at work has gone down after going green					
	The staff turnover has gone down with adoption of green innovation					
	Customer satisfaction The customer base has improved after firm going green					
	The number of customer referrals has increased after going green					
	The customer's loyalty has improved after firm going green					
	Customer's approval of company's products has improved					
c.	**Environmental performance**					
	Environment safety management Firm has viable programs relating to occupational safety and health					
	The firm has environment control mechanism for proper disposal of pollutants and waste from the firm					
	The firm has mechanism for properly storing, using and disposing hazardous chemicals					
	Energy management awards The firm has implemented energy efficient measures and technology in their processes					
	The firm's energy efficient practices have been recognized during energy management awards					
	Recognition by relevant environmental regulatory agencies The firm has been recognized for its environmental conservation efforts					
	The firm has been recognized for leading green growth in the sector					
	The firm has been recognized for its conformance with environmental regulations by environmental regulatory agencies					
	Pollution control Pollution has scaled down with adoption of green production					
	The firm frequently conducts pollution and waste emission audits					
	The waste and emissions intensity have gone down after going green					
	Waste and emissions treatment have improved after attaining ISO 14001					

THANK YOU

Appendix III: Research Approval Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 8TH June, 2021

TO: Mr. James K. Nzomo
C/o Department of Business Administration
KENYATTA UNIVERSITY

REF: D86/CTY/38612/16

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting 2nd June, 2021 approved your Ph.D. Research Proposal entitled "Green Innovation Strategy and Performance Sustainability of ISO 14001 Certified Manufacturing Firms in Nairobi City County, Kenya".

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking and Progress Report Forms. The forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you.

REUBEN MURIUKI
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Department of Business Administration
Registrar (Academic) Att; Mr. Richard Chweya

Supervisors:

1. Dr. Godgfrey Kinyua
   C/o Department of Business Administration
   KENYATTA UNIVERSITY
2. Dr. Evans Mwasiaji
   C/o Department of Business Administration
   KENYATTA UNIVERSITY

RM/cao

Appendix IV: Graduate School Research Authorization Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: D86/CTY/38612/16 Date: 8th June, 2021

The Director General,
National Commission for Science, Technology & Innovation,
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR.JAMES K. NZOMO - REG. NO. D86/CTY/38612/16

I write to introduce Mr. Nzomo who is a Postgraduate Student of this University. He is registered for a Ph.D. degree programme in the Department of Business Administration in the School of Business.

Mr. Nzomo intends to conduct research for Ph.D. thesis entitled, "Green Innovation Strategy and Performance Sustainability of ISO 14001 Certified Manufacturing Firms in Nairobi City County, Kenya".

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
DEAN, GRADUATE SCHOOL

RM/cao

Appendix V: NACOSTI Research Authorization Licence

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 968912

Date of Issue: 15/November/2021

RESEARCH LICENSE

This is to Certify that Mr.. JAMES kimuli NZOMO of Kenyatta University, has been licensed to conduct research in Nairobi on the topic: GREEN INNOVATION STRATEGY AND PERFORMANCE SUSTAINABILITY OF ISO 14001 CERTIFIED MANUFACTURING FIRMS IN NAIROBI CITY COUNTY, KENYA for the period ending : 15/November/2022.

License No: NACOSTI/P/21/14225

968912

Applicant Identification Number

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.

Appendix VI: ISO 14001 Certified Manufacturing Firms in Nairobi City County

1. Allpack industries Ltd
2. ASL LTd
3. Associated Battery Manufacturers (E.A.) Ltd
4. Athi River Mining (ARM) Cement PLC
5. Aucma Digital Technology Africa LTD
6. Azuri Technologies Kenya Limited -
7. Bamburi Special Product Ltd
8. Beta Health Care
9. British American Tobacco (BAT) Kenya Ltd
10. Central Glass Industries Ltd
11. Chandaria Industries Ltd
12. Coca-Cola Juices (K) Ltd
13. Consol Glass Kenya Limited
14. Crown –Berger (K) PLC
15. Diversey Lever Ltd
16. East Africa Packaging Industries Ltd
17. East Africa Portland Cement PLC
18. East African Breweries Ltd
19. East African Maltings Ltd
20. Eli-Lilly (Suisse) SA
21. Evonik East Africa
22. Fosroc Kenya limited
23. Frigoken Ltd
24. General Printers Limited
25. GlaxoSmithKline Beecham
26. Glenn Investment Ltd C/O The Mehta Group Ltd
27. Guala Closures East Africa Ltd
28. H.B. Fuller Kenya Limited
29. HenkeL Kenya Ltd
30. Huawei Technologies (Kenya) Co. Ltd
31. Isuzu East Africa Ltd (General motors Kenya Ltd)

32. Kansai Plascon (Pty) Ltd
33. Kenafric Industries Limited
34. Kenya Breweries Ltd
35. Kenya Electricity Generating Company Ltd (KENGEN)
36. Koko Networks Limited
37. Laxmanbhai Construction Limited
38. Mabati Rolling Mills Limited (Nairobi)
39. Manhar Brothers Kenya Ltd
40. Mather and Platt Kenya Ltd
41. Metsec Cables Ltd
42. Mustek East Africa
43. Nairobi Bottlers Kenya Ltd
44. Nestle Kenya Limited
45. Novelty Manufacturers Ltd
46. Pfizer Corp (Agency)
47. Protea Chemicals Kenya Ltd
48. Regal Pharmaceutical Ltd
49. Sadolin Paint Ltd
50. Scania East Africa Ltd
51. Schneider Electric Ltd
52. Siera Cables East Africa
53. Sogea Satom Kenya
54. Tetra Pak (K) Ltd
55. Tian Long Industry Limited
56. Toyota Kenya Ltd
57. Unilever Kenya Ltd
58. Vermount flowers (EPZ) Ltd
59. Waridi creations
60. Wartsila E.A Ltd

Source: KEBS (2019)