SUSTAINABLE MANUFACTURING PRACTICES AND OPERATIONAL PERFORMANCE OF MANUFACTURING FIRMS IN NAIROBI, KENYA

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DECLARATION

I hereby declare that this research proposal is my own work and that it has never been presented to any other university for assessment or award of a degree.

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This research proposal has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

To my parents Mr. and Mrs. Mwangi, for their love for education.

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I wish to thank God Almighty, my family and friends, as well as my supervisor Dr. E. Akelo for their unwavering support.

ABSTRACT

The objective of the study was to establish the relationship between sustainable manufacturing practices and operational performance of manufacturing firms in Nairobi, Kenya. Two theories anchored the study; institutional theory and the resource-based theory. A descriptive design of a cross-sectional type was used in the study. The target respondents were 59 respondents from manufacturing firms in Nairobi. Primary data was collected from the respondents using structured questionnaires through drop and pick method. The questionnaires had three sections. Section A addressed the demographic information. Section B addressed statement on sustainable manufacturing practices while section C addressed statements on operational performance. The data collected was analyzed using descriptive and inferential statistics such as means and standard deviation. The inferential statistics was undertaken by performing 5 regression analyses. The study found that sustainable manufacturing practices have a significant impact on operational performance in manufacturing firms in Nairobi, Kenya. The study thus recommends the manufacturing sectors to invest and enhance on sustainable manufacturing practices within all the dimensions of their firms so as to improve operational performance.

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ABBREVIATIONS AND ACRONYMS

EAC	East African Community
GDP	Gross Domestic Product
KAM	Kenya Association of Manufacturers
KNBS	Kenya National Bureau of Statistics
SMEs	Small and Medium-sized Enterprises
SMPs	Sustainable Manufacturing Practice

CHAPTER ONE
INTRODUCTION

1.1 Background

The concern over sustainability is greater than ever in the manufacturing industry. It is now important for manufacturing firms to focus on factors such as waste treatment, resource usage, water pollution and air emissions in addition to facing intensive competition from other firms. Environmental issues are now being integrated into functional considerations by managers since the concept of pollution control has grown to include a set of management decisions, programs, tools, and technologies that (Hunt & Auster, 1990). This has led to a sustainable manufacturing concept which involves practices that are more environmental friendly; from the inputs, transformation and packaging to supplier management. These practices are known as Sustainable Manufacturing Practices.

The manufacturing industry causes serious resource depletion and environmental degradation issues. Every day manufacturing firms generate wastes in the form of pollution (Davies et al., 1976). This study will be guided by two theories, the institutional theory which focuses on direct impact on institutional rules, pressure and sanctions on organization to adopt Sustainable Manufacturing Practices and the resource dependence theory which emphasizes on structural adaptation in the face of dependencies on external organizations (Sarkis et al., 2010).

There has been an increasing demand to incorporate sustainable practices in manufacturing from the stakeholders in the sector. This demand is due to environmental issues associated with the process involved in production of goods. Environmental awareness and responsibility is expected of manufacturing firms in production of their products (Rusinko, 2010). The trend and state of

environmental degradation calls for a significant change in manufacturing practices and the manufacturing sector need not only adopt Sustainable Manufacturing Practices but also understand their relationship with operational performance.

1.1.1 Sustainable Manufacturing Practices (SMPs)

There definition of sustainability has not been confined to a single or specific one and this is because it has no endpoint or state. Ideally, it is seen as a process or journey. Just like the term sustainable development practices, a number of terms have been established and tried to define Sustainable Manufacturing Practices. Some of the definitions that have risen up from different scholars include, best manufacturing practices, green manufacturing and cleaner production. Others include sustainability of manufacturing services and sustainable production.

Sustainable Manufacturing Practices has been defined as sustainability in the creation of manufactured products (U.S. Department of Commerce, 2008). A few concepts have tried defining Sustainable Manufacturing Practices as a continuous improvement program structure (Joseph & Taplin 2011; Molamohamadi & Ismail, 2013).

Sustainable manufacturing practices have been defined as a value creating business model consistent with preservation and conservation in the long run (Gunasekaran & Spalanzani, 2011; Habidin et al.,2013). The practices can be used in the creation of new products through, regulated measures, current technology and rationalized social behaviors when raw materials are used effectively (Garetti&Taisch,2012).

The above definitions are based off Sustainable Manufacturing Practices concepts focused on aspects like improvement of aspects like cost, waste effluents, energy efficiency, and environmentally sound products and services, some of which attribute to operational

performance. From these studies, Sustainable Manufacturing Practices can therefore be referred to as the ability to use available resources, minimizing pollution and waste in the process and still maintaining optimum performance.

1.1.2 Operational Performance

According to Eshikumo and Odock (2017), operational performance is the degree to which quality, speed, dependability, flexibility and cost are fulfilled at any point in time in production and delivery of products and services. Businesses regularly review various performances to create a more objective sense on business operations and whether improvement is needed.

The generic performance objectives can be comprised of measures like customer contentment, overall service level and operational agility; or by means of measures like achieving market targets, financial, operations, overall strategic objectives and even environmental objectives. Comprehensive performance measures have greater strategic relevance in the overall performance of the business (Acquilano, 2005). Operational performance puts emphasis on Performance measurement variables that include quality, efficiency and flexibility.

1.1.3 The Manufacturing Sector in Kenya

In Kenya, manufacturing is characterized by activity from formal and informal firms. The informal sector, small and medium enterprises and the large formal enterprises play a huge part in manufacturing (Were, 2016). In 2014, Kenya's manufacturing sector grew at 3.2% and 3.5% in 2015 contributing to gross domestic product (GDP) by 10.3% (KNBS, 2016). The manufacturing sector has however been growing at a slower rate than the economyhaving(Were, 2016).According to the Kenya vision 2030 reported of 2007, there are about 2000 fragmented manufacturing units in Kenya (KNBS, 2016) with the Kenya Association of Manufacturers (KAM) membership being made up of 853members.

Although the sector is fragmented, food processing, beverages and tobacco manufacturing, refined petroleum products and textiles and clothing account for 50 percent of GDP and exports and 60 percent of formal employment (KAM, 2016; KNBS, 2016). This diversification of the sector comprises non-agricultural products as well as products from agro-processing industries.

The non-agricultural products include; refined petroleum products, textiles and clothing, paints and varnishes, transport machinery, electrical machinery and alliances, metal products, paper and paperboard products, medicinal and pharmaceutical products, organic and non-organic chemicals, pesticides and fertilizers, non-metallic minerals like fluorspar and soda ash, hides, skins and leather products, soaps, essential oils, perfumes and cleansing products. The agro-processing industries largely comprises of products from food processing, beverages and tobacco manufacturing. An estimated 18% of Kenyan manufactured goods are exported (KAM, 2016). 6.1% of the goods are exported to the EAC and 12% to the rest of world (KNBS, 2013).The export products in Kenya are immensely primary.

Of the total export value, tea alone constitutes about25%.Kenyan exports are primary in nature and also low in technology component and aspect. Kenya's total manufactured exports are only destined to 12 countries globally with the country. Despite the decline and market loss, there is great potential to improve Kenya's competitiveness when it comes to exports by replacing external suppliers.

1.2 Research Problem

Manufacturing and production operations are considered to be impediments to environmental protection because of waste generation, ecosystem disruption and depletion of natural

environment (Beamon2014). According to the Kenya Economic Survey (2016), NEMA's major challenges were solid waste disposal and emerging environmental health issues, whereas those faced by Nairobi City Council were plastic bags menace, noise, river, water and air pollution with tree planting as the only achievement.

There is often closure of some industries followed by rise in cost of their products due to the high cost of production resulting from power rationing and high fuel costs. Kenya's forest cover is only 2 percent and yet there are local manufacturers of paper and other wood products. The economic performance of Kenyan manufacturing firms is also threatened by legislation and the customer demands. Kenya for example encounters restriction in exporting agricultural products, which is her main source of foreign exchange.

According to studies, positive relationships have been associated with sustainable practices and operational performance. Sound environmental practices such as pollution control and financial indicators like profitability ranging from medium to strong in the pulp and paper industry have shown sufficient association (Spicer, 1978). Spicer's research has been supported by other researchers as well. Zhu et al. (2012); Hart(2005); Shrivastava (1995) have all suggested that; to improve a company's performance, environmental and social practices should be adopted.

Some studies have however shown a negative relationship in regard to sustainable initiatives and a company's operational performance. This is because sustainable practices have been known to increase operational costs and subsequently an increase in prices of products, impacting negatively on financial performance and market share (Friedman, 2007)

Studies in the manufacturing sector are not sufficient compared to those in other industries despite the sector playing a huge role in the world economy. This study was intended to answer the gap and enrich the body of knowledge by answering the research question: what is the relationship between sustainable manufacturing practices and operational performance in manufacturing firms in Nairobi, Kenya?

1.3 Research Objectives

The main research objective was to establish the relationship between sustainable manufacturing practices and operational performance in Kenyan manufacturing firms. The specific objectives of this study were to;

i. To establish sustainable manufacturing practices adopted by manufacturing firms in Nairobi, Kenya.
ii. To determine the relationship between sustainable manufacturing practices and the operational performance of manufacturing firms in Nairobi, Kenya.

1.4 Value of the Study

This study will contribute to enhancing the existing knowledge gap on sustainable manufacturing practices. It will be done through provision of insights and knowledge into the adoption of these practices by Kenyan manufacturing firms. It will additionally provide the much needed evidence as to whether these practices have a relationship with operational performance in Kenyan manufacturing firms. The manufacturing fraternity in Kenya is set to be enlightened through this study on the available sustainable manufacturing practices that can be used to better their operational performance.

Through this research, adoption of sustainable manufacturing practices can thereafter be done either individually or collectively. The findings from this study may consequently provide firms with information on Sustainable Manufacturing Practices methodologies and assist in policy formulation regarding their adoption. The relationship between sustainable practices and operational performance will appropriately guide policy formulators on which sustainable manufacturing practices or techniques are most appropriate for adoption in their firms.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter looked into different literature on the sustainable manufacturing practices as well as the theoretical foundations that underpin these practices. The chapter equally brought into perspective some of the empirical studies relating to sustainable manufacturing practices to provide more insights into the subject of study.

2.2 Theoretical Framework

The sustainability theme has piqued the interest of operations management academia and researchers in recent years. Theories in sustainable manufacturing are scant even though there exist studies on sustainability and sustainable development. The Institutional theory, Resource based view and Resource dependency theory are however applicable in this research.

2.2.1 Institutional Theory

Organizations tend to conform to acceptable standards or standards that are easily recognizable within the same organizational field. According to DiMaggio (1998) an organizational field is an acknowledged area of institutional life that produces services or products.

There is pressure for institutions to become similar and the theory focuses on the responsibility of the pressures on organizations. There are two types of organizations according to institutional theorists, that is; technical and institutional. Manufacturing firms are associated with technical institutions that have easily identifiable and measured outputs which follow well-defined technologies. These technical institutions operate in an organizational field where external factors and pressures determine how they should operate. The factors may include government

agencies, accreditation bodies and disciplinary associations. The factors more often than not push institutions towards isomorphism.

Coercive, mimetic, and normative processes form isomorphic processes (DiMaggio & Powell, 1983). Within an organizational field, these process lead to increased homogenization in one way or another. Coercive isomorphism usually happens when other organizations of higher authority that are associated with an institution apply pressure and influence on them. These may include government regulations in the manufacturing sector or new accreditation standards in quality assurance. These pressures force organizations to adapt so as to continue operating in the field. Mimetic isomorphism arises through the emulation of leaders within an organizational field. The emulation or modeling is often done by less prestigious or less resourced institutions. Finally, when networks and communication grows in an organizational field, normative isomorphism occurs. Organization will tend to encourage each other to undertake best practices in their operations, subsequently encouraging a homogenization of institutional activity.

From the above literature, this theory is suitable since manufacturing firms tend to adopt sustainable practices in response to institutional pressure. According to Sharma, (2000) the pressure can be brought about by environmental strategies that focus on compliance of rules and adoption of industrial practices, or reducing environmental impact of operations beyond the regulatory requirements. In light of this, firms may work with customers and suppliers to achieve sustainable practices and improve their operational performance.

2.2.2 Resource-Based View

Resource-based view theory focuses on specific capabilities that give the firms competitive

advantage over other firms. The capabilities are firm-specific, internal and are developed from available resources (Barney, 1991). According to Barney (1991) the resources on the other hand are valuable, rare, and imperfectly imitable. Hart (1995) discussed that resources can provide sustained competitive advantage and competitively create organizational capabilities when they are allocated to develop environmental strategies. Hart (1995) went further and presented a conceptual framework considering constraints of natural resources. He came up with three strategies; preventing pollution, stewardship of a product and sustainable development.

According to Hart (1995) control and prevention are practices that facilitate pollution prevention. Pollution-control equipment can be used for control while prevention is done by reducing or modifying emissions or effluents. In his view, pollution prevention results into lower costs while manufacturing much more.

As argued by Hart (1995) Product stewardship can lead to competitive advantage as firms can manufacture environmentally friendly products and sell these products at a higher price. Sustainable development subsequently depends on pollution prevention and product stewardship. It ensures resources for the future generation are not compromised.

This theory is important to the study because, firms pursuing sustainable manufacturing practices in their operations can use pollution prevention practices such as reducing emissions and effluents. Product stewardship practices can also be used to reduce costs incurred in the life cycle of products. Sustainable development practices can minimize the environmental responsibility subjected on a firm during its growth and development (Hart, 1995). Looking at Hart's

framework, the theory touches on aspects of manufacturing efficiency and sustainability which are important in realizing the implementation and how manufacturing firms adopt sustainable manufacturing practices.

2.3 Sustainable Manufacturing Practices

Sustainable Manufacturing Practices have attracted a lot of attention and manufacturing firms have interpreted these practices differently. The practices in sustainable manufacturing have been seen to vary widely in the manufacturing industry. According to Russell and Millar (2014), there's little synthesis on Sustainable Manufacturing Practices literature and as such categorized them into; manufacturing inputs, transformation process, packaging and supplier management. This study will focus on these four practices, their adoption and relation to operational performance.

The types of materials and energy used in the manufacturing of products are known as manufacturing inputs (Russell & Millar, 2014). Sustainable practices associated with the use of raw materials include; using recycle, biodegradable or environmentally-benign materials and substituting materials that are environmentally questionable (Arup, 2007; Ljungberg, 2005).

The practices and activities involved in the transformation of raw materials to finished goods make up the transformation phase. Other than ensuring pollution prevention, this phase also plays an important role in optimizing the processes so that little or no waste is generated during transformation (Rao & Holt, 2005). According to Arup (2007), the use of renewable resources, recycling, waste and emissions reduction are some of the practices adopted during this phase.

The practices involved in the protection of products for distribution, storage, use or sale are referred to as packaging practices (Russell & Millar 2014). Reduced packaging, recyclable packaging and returnable packaging are examples of sustainable operations practices (Montabon et al., 2007).

Post-use disposal of packages that are used may also contribute to unsustainable environmental waste. The practices involved during this phase are known as post-use disposal (Russell & Millar, 2014). According to Glavic and Lukman (2007), there are more disposal practices which are environmental friendly and they include; planning and designing products for reuse, recycling and repairing, regeneration and remanufacturing.

2.4 Supplier Management

A number of practices can be used to facilitate management of the relationship between manufacturing firms and suppliers (Russell & Millar, 2014). These practices can include; better choice of suppliers who have high environmental practices, making the suppliers part of a firm's environmental management process and offering proper guidance to suppliers, for them to set up their own environmental programs (Sarkis, 2003; Walton, Handfield & Melnyk, 1998; Rao & Holt, 2005).

2.5 Operational Performance

Operational performance is the output of an organization driven by operations towards goals achievement financially, operations wise and organizational effectiveness (Venkatraman & Ramanujam, 1986, Richard et al., 2009). An organization can measure its operational performance based on its objectives including; cost, speed, quality, dependability, flexibility and innovation.

Operational performance deals with meeting cost budgets. The relationship between price and quality implies that focus on quality has a direct link on profit maximization (Kaynak, 2003; Slack et al., 2010). Speed improvement can be achieved through elimination of bottlenecks in the processes which results in slack of the entire process of production (Kaynak, 2003; Jenkins et al., 2007; Slack et al., 2010). Dependability as an aspect of quality implies how reliable, certain and consistent the processes and products of an organization are which results to a certain reputation that is seen as an intangible asset for the organization.

Flexibility entails speed of product adaptability in meeting the varied customer demands in terms of specifications. Flexibility concerns delivery of a service and production of goods which implies that modes of delivering a service can lead to increased sales and flexible production methods can bring down costs and reduce lead times. The measurement of cost allows quality related activities to be easily expressed and understood in management (Prajogo & Goh, 2007). For a company's performance to reach its basic objectives, operational performance needs to be taken into account. Operational performance therefore incorporates speed of service and product delivery. Time is a valuable and essential tool in a competitive environment and to gain competitive advantage, businesses need to respond faster than their competitors (Russell & Taylor, 2008).

2.6 Sustainable Manufacturing Practices and Operational Performance

Klassen (2001) studied the effect of environmental management on firm performance by investigating the personal opinions and views of plant managers through identifying and measuring plant-specific factors on performance of the environment. His study showed that

when the managers put emphasis and focus on short term economic and ethical values, a more proactive course and better environmental performance was achieved. Similarly, emphasis on these values led to a more reactive environmental management.

Longoni et al. (2014) survey results suggested that teamwork when used as a relevant practice only impacted environmental performance when it came to implementing environmental sustainability action programs. Klassen and Whybark (1999) developed a portfolio for environmental technology, a new manufacturing strategy concept of a resource-based view. The strategy included pollution prevention and pollution control technologies. Where pollution prevention technologies were introduced, the performance improved and it was worse in plants that chose to introduce pollution control technologies afterwards.

Schoenherr (2012) studied the environmental management and operational performance of manufacturing plants. In his findings, environmental practice included preventing pollution, recycling of the materials used and reduction of waste. The performance of plants was measured through quality, delivery, flexibility, and cost. Their survey findings concluded that the environmental initiatives in plants in emerging economies had a greater influence compared to industrialized and developing nations.

2.6 Summary of Literature Review

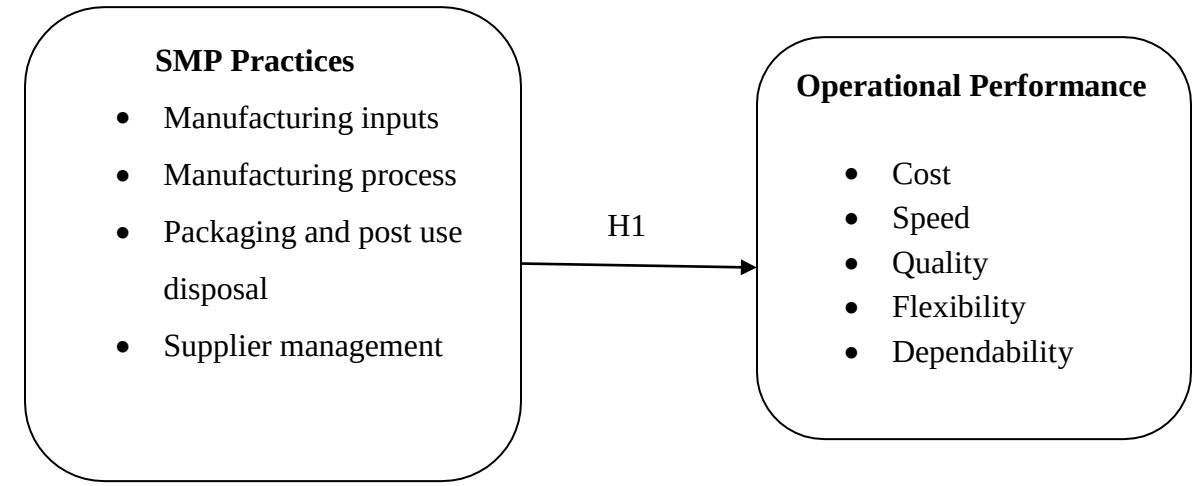
Table 2.1: Summary of Literature Review

Author	Focus of Study	Methodology	Major Findings	Major Contribution	Knowledge Gap
Klassen (2001)	Environmental management impact on firm performance	Descriptive Research Survey	A reactive environmental management is brought about by emphasis on short-term economic value.	A proactive orientation and better environmental performance is attributed to ethical values.	Does not focus on operational performance
Longoni et al., (2014)	Sustainable operations and human resource and customer benefits	Descriptive Research Survey	Training positively has an effect both social and environmental performance	Teamwork only impacted environmental performance during implementation of environmental sustainability action programs.	Does not focus on operational performance
Klassen and Whybark (1999)	Environmental technologies' impact on performance outcomes	Descriptive Research Survey	Where pollution prevention technologies were introduced, performance improved.	Performance worsens in plants that introduced pollution control technologies	Does not focus on Sustainable Manufacturing Practices and operational performance
Schoenherr (2012)	Impact of environmental management on manufacturing plant operations' performance	Descriptive Research Survey	Emerging economies emphasize environmental initiatives more strongly compared to the developed ones.	Influence of environmental management initiatives is strongly felt in emerging and developing economies compared to the developed ones.	Does not focus on Sustainable Manufacturing Practices and operational performance

2.7 Conceptual Framework

A conceptual framework guides the study and is a researcher's own position on the problem. It is defined as a set of ideas used to structure the research, a sort of a map (Kothari, 2012).

Figure 2.1: Conceptual Framework



This study aims at testing one hypothesis where;

H1: There is a relationship between sustainable manufacturing practices and operational performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The steps and approaches that were used in executing the research study are outlined in this chapter. This chapter comprises of the research design, population under study, data collection instruments that will be deployed and the data analyses methods that will be used for this study.

3.2 Research Design

A descriptive design of a cross sectional type was used for this study. According to Cooper and Schindler (2007), a descriptive cross sectional research design is one that sets out to examine a phenomenon, behavior or information in the target population as it is at a given time. This study critically observed the Sustainable Manufacturing Practices and their adoption in Nairobi, Kenya's manufacturing firms.

3.3 Population of the study

According to the KAM, manufacturing firms in Kenya operate in different sectors and are classified into 12 sub sectors which are based on the products manufactured by the firms or the type of raw materials they import. The manufacturing entities within Nairobi are reportedly is 594 out of 700 in Kenya (KAM, 2016). Nairobi therefore presented a suitable study area as 80% of the manufacturing organizations are located in it.

3.4 Sampling Design

Mugenda and Mugenda (2008) accords a sample size to be a minor group or sub-group obtained from the available population. A sample population of 59 was reached by taking 10% of 594. The proportion, 10%, chosen for the sample was guided by Mugenda and Mugenda (2008) which states that 10-30% of a target population is sufficient for drawing conclusion of an entire

population. The technique that was used was stratified random sampling where the firms were stratified into sectors.

Table 3.1 Sample distribution

	Manufacturing Sector	**Number of firms**	**Number of firms to be sampled**
1	Chemical & Allied	68	7
2	Energy, Electricals	37	3
3	Food and Beverages	149	14
4	Leather	7	1
5	Metal	59	6
6	Motor vehicle	27	3
7	Mining	19	2
8	Paper and Board	68	7
9	Pharmaceuticals	23	2
10	Plastic	67	7
11	Textiles	53	5
12	Timber	17	2
Total	**12 sectors**	594	59

3.5 Data Collection

Primary data was used for data collection in this study. Structured questionnaires were used to collect the data. The questions in the questionnaire (appendix I) were based on a Likert type scale so as to measure the degree and extent of the different variables that were under study.

The questionnaire (appendix I) was divided into three parts namely: Section A which included the firm's basic information, Section B which examined the adoption of Sustainable Manufacturing Practices and Section C investigated the level of operational performance in manufacturing firms in Nairobi, Kenya. These questionnaires were issued using the drop and pick method.

3.6 Data Analysis

Descriptive statistics was used in analysis and it included frequencies, percentages, mean and standard deviation. This was followed by use of regression analysis in examining the influence of sustainable manufacturing practices and operational performance. Tables were used to represent the data.

CHAPTER FOUR
DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter therefore presents the research findings based on the proposed methodology and procedures. The chapter comprised of the following sub- sections: demographic information, sustainable manufacturing practices adopted by the firm and operational performance measures. Tables were used to represent the findings.

The study did not realize a response rate of 100% since there were some instances of non-response. Consequently, only 44 firms out of the 59 firms answered the questionnaire fully and returned them as per the requirements of the study. Therefore, 15 firms did not respond to the questionnaires creating a non-response rate of 25%. Subsequently, the study achieved a response rate of 75%.

4.2 Demographic Information

The demographic information presented in the study included the period in years that the firms had been in operation, the size of the firms, whether the firms were registered with an environmental management body, whether they had environmental firms, whether they had environmental policies and the manufacturing sector they belonged to.

4.2.1 Years of Operation

Table 4.1 Years of Operation

	Frequency	Percent
Less than 5 years	6	13.6
5-10 years	24	54.5
10-20 years	11	25.0
More than 20 years	3	6.8
Total	**44**	**100.0**

The study established that 13.6% of the firms had operated for less than 5 years, 54.5% of the firms had operated for 5-10 years, 25% of the firms had operated for 10-20 years and 6.8% of the firms had operated for more than 20 years. The findings imply that most of the manufacturing firms had been in operation for 5-10 years while manufacturing firms that had been in operation for more than 20 years had the least representation. The findings are shown in Table4.1.

4.2.2 Size of Staff

Table 4.2 Size of Staff

	Frequency	Percent
Less than 25	5	11.4
25-100	25	56.8
300-1000	11	25.0
More than 1000	3	6.8
Total	**44**	**100.0**

The findings of the study indicate that 11.4% of the firms had less than 25 staff, 56.8% of the firms had 25-100 staff, 25% of the firms had 300-1000 staff and 6.8% of the firms had more than 1000 staff. The findings imply that most of the firms had 25-100 staff. These findings are shown in Table 4.2.

4.2.3 Registration with an Environmental Management Body

Table 4.3 Registration with an Environmental Management Body

	Frequency	Percent
Yes	30	68.2
No	14	31.8
Total	**44**	**100.0**

The study determined that 68.2% of the firms were registered with an environmental body while 31.8% were not registered with any environmental body as shown in Table 4.3.

4.2.4 Presence of an Environmental Management Department

Table 4.4 Presence of an environmental management department

	Frequency	Percent
Yes	17	38.6
No	27	61.4
Total	**44**	**100.0**

The study determined that 38.6% of the firms had established environmental management departments and 61.4% of the firms had not established environmental management departments as shown in Table 4.4.

4.2.5 Environmental Management Policy

Table 4.5 Environmental Management Policy

	Frequency	Percent
Yes	31	70.5
No	13	29.5
Total	**44**	**100.0**

The study determined that 70.5% of the firms had Environmental Management Policies and 29.5% of the firms did not have Environmental Management Policies as shown in Table 4.5.

4.2.6 Manufacturing Sector

Table 4.6 Manufacturing Sector

	Frequency	Percent
Chemical and allied	6	13.6
Energy, Electricals	2	4.5
Food and Beverages	12	27.3
Metal	5	11.4
Motor vehicle	2	4.5
paper and Board	6	13.6
Plastic	6	13.6
Textiles	4	9.1
Timber	1	2.3
Total	**44**	**100.0**

The study determined that 13.6% of the firms were in the Chemical and allied sector, 4.5% of the firms were in the Energy, Electricals sector, 27.3% of the firms were in the Food and Beverages sector, 11.4% of the firms were in the Metal sector, 4.5% of the firms were in Motor Vehicle sector, 13.6% of the firms were in the Paper and Board sector, 13.6% of the firms were in the plastics sector, 9.1% of the firms were in the Textiles and 2.3% of the firms were in the Timber sector. These findings suggest that most of firms were in the Food and beverages sector as shown in Table 4.6.

4.3 Descriptive Analysis for Sustainable Manufacturing Inputs.

To establish the sustainable manufacturing inputs adopted by the manufacturing firms, the respondents had to indicate the degree to which the sustainable manufacturing practices had been adopted at the manufacturing firms. The rating as per attribute was expressed using a five point Likert Scale: **1) Strongly disagree; 2) Disagree; 3) Neutral 4) Agree; 5) Strongly Agree**.

4.3.1 Descriptive Statistics manufacturing inputs

The extent to which manufacturing inputs were being practiced at the firms was to be established. The results are shown in Table 4.7 below:

Table 4.7 Manufacturing inputs

	Mean	Std. Deviation
The manufacturing inputs are recycled materials	2.68	1.290
The manufacturing inputs are biodegradable materials	3.63	1.080
The manufacturing inputs are environmentally-benign materials	2.36	1.080
The manufacturing inputs are a substitute of environmentally-questionable materials	2.29	1.001
Average	**2.74**	**1.113**

The results from the means and standard deviations supported the findings, where the respondents agreed or disagreed with the statements: The manufacturing inputs are recycled materials (M =2.68, *SD* = 1.290); the manufacturing inputs are biodegradable materials (M =3.63, *SD* =1.080); the manufacturing inputs are environmentally-benign materials (M =2.36, *SD* =1.080); the manufacturing inputs are a substitute of environmentally-questionable materials (M =2.29, *SD* =1.001). The overall mean was 2.74and *SD* of 1.113. The mean of 2.74implies that sustainable manufacturing inputs are not highly used in the manufacturing firms.

4.3.2 Descriptive Statistics for Manufacturing process or production phase

The study assessed the extent to which sustainable manufacturing processes were being practiced at the firms. The results are shown in Table 4.8 below:

Table 4.8 Manufacturing process

	Mean	Std. Deviation
The manufacturing process produces minimal waste and emissions	3.68	.674
Recycling and use of renewable resource is done during the production phase	2.45	.791
Average	**3.07**	**0.734**

Table 4.2 above indicates that majority of the respondents moderately agreed thatthe manufacturing processes produce minimal waste and emissions. The findings indicate that respondents agreed with the following statements; the manufacturing process produces minimal waste and emissions (M =3.68, *SD* = .674); Recycling and use of renewable resource is done during the production phase (M =2.45, *SD* =.791). The average mean was 3.07 implying that the respondents agree to a moderate extent that sustainable manufacturing process is maintained during production.

4.3.3 Descriptive Statistics for Packaging

The study examined the extent to which sustainable packaging was being practiced at the firms. The results are shown in Table 4.9 below:

Table 4.9 Packaging

	Mean	Std. Deviation
Packaging used is returnable	3.80	.553
Packaging used is recyclable and reduced	4.34	.713
Average	**4.07**	**0.633**

The results reveal that the respondents agree with the following statements; Packaging used is returnable (M =3.80, *SD* = .553); Packaging used is recyclable and reduced (M =4.34, *SD*

=.713).The average mean was 4.07implying that the respondents agree to a great extent that sustainable packaging is used in the manufacturing firms.

4.3.4 Descriptive Statistics for Post-use disposal

The research looked into the extent to which sustainable post-use disposal practices were being practiced at the firms. The results are shown in Table 4.10 below:

Table 4.10 Post-use disposal

	Mean	**Std. Deviation**
The products can be reused	3.95	1.033
The Products can be recycled	3.95	1.033
The products can be repaired	3.02	1.045
The products can be regenerated	2.27	.450
The products can be remanufactured	2.98	1.101
Average	**3.24**	**0.934**

The findings indicate that respondents generally agree with the following statements; the products can be reused (M =3.95, *SD* = 1.033); the Products can be recycled (M =3.95, *SD* =1.033); the products can be repaired (M =3.02, *SD* =1.045); the products can be regenerated (M =2.27, *SD* =.450); the products can be remanufactured (M =2.98, *SD* =1.101). The average mean of 3.24 implies that the firms employed post-use disposal practices to a moderate extent.

4.3.5 Descriptive Statistics for Supplier Management

It was also in the interest of the study to establish the extent to supplier management practices were being practiced at the firms. The results are shown in Table 4.11 below:

Table 4.11 Supplier Management

	Mean	Std. Deviation
Suppliers have adopted effective environmental practices	2.16	.370
Suppliers are integrated in the company's environmental management process	3.20	.930
Encourage suppliers to set up their own environmental programs	3.55	.730
Average	**2.97**	**0.68**

From the findings, respondents generally agree with the following statements; suppliers have adopted effective environmental practices (M =2.16, SD = .370; suppliers are integrated in the company's environmental management process (M =3.20, SD =.930); encourage suppliers to set up their own environmental programs (M =3.55, SD =.730).The average mean was2.97 implying that the firms disagree on the adoption of sustainable manufacturing practices by their suppliers.

4.4 Descriptive Statistics for Operational Performance

To measure the operational performance of the firms, the respondents were to indicate the extent to which they agree with different statements on various variables of performance measures which were cost, speed, flexibility, quality and dependability. A five point Likert- Scale was used to rate the responses, where; 1-Very Low Extent, 2.Low Extent, 3.Moderate Extent, 4.Great Extent, 5.Very Great Extent and their cumulative means presented as shown in the tables below.

4.4.1 Descriptive Statistics for Cost

Different dimensions of costs were examined. The respondents were presented with different attributes regarding cost and results presented as shown in Table 4.12 below

Table 4.12 Cost

	Mean	Std. Deviation
Productivity is improving	3.73	.624
Unit cost of manufacturing is decreasing	3.07	.398
Waste levels are decreasing	3.10	.698
Average	**3.59**	**0.573**

The findings show that respondents generally agree with the following statements; productivity is improving (M =3.73, *SD* = .624); unit cost of manufacturing is decreasing (M =3.07, *SD* =.398); waste levels are decreasing (M =3.10, *SD* =.698). The average mean recorded was 3.59meaning that the respondents agree to a slightly great extent on the attributes of cost.

4.4.2 Descriptive Statistics for Speed

Different speed dimensions were also examined. The respondents were presented with different attributes regarding speed and results presented as shown in Table 4.13 below

Table 4.13 Speed

	Mean	Std. Deviation
Lead time is low	3.18	.971
Speed of production is low	3.55	.820
Reworks are low	3.25	3.250
Average	**3.33**	**0.743**

From the findings, respondents generally agree with the following statements; lead time is low(M =3.18, *SD* = .971); speed of production is low (M =3.55, *SD* =.820); Reworks are low (M =3.25, *SD* =3.250). The average mean recorded was 3.33 meaning that the respondents agree to a slightly great extent on the attributes of speed.

4.4.3 Descriptive Statistics for Flexibility

Dimension of flexibility were examined. The respondents were presented with different attributes regarding flexibility and results presented as shown in Table 4.14 below

Table 4.14 Flexibility

	Mean	Std. Deviation
Product adaptability is fast	4.14	.554
Level of adapting to change in demand is fast	4.07	.661
Average	**4.10**	**0.607**

The findings indicate that respondents generally agree with the following statements; product adaptability is fast(M =4.14, *SD* = .554); level of adapting to change in demand is fast (M =4.07, *SD* =.661). The average mean recorded was 4.10 implying that the respondents agree with the attributes of flexibility to a great extent.

4.4.4 Descriptive Statistics for Quality

Attributes of quality were also assessed. The respondents were presented with different attributes regarding quality and results presented as shown in Table 4.15 below

Table 4.15 Quality

	Mean	Std. Deviation
Quality management system is in place	3.86	.979
There is continuous improvement and innovation	3.93	.974
Average	**3.90**	**0.976**

On quality, the findings indicate that respondents generally agree with the following statements; quality management system is in place (M =3.86, *SD* = .979); there is continuous improvement

and innovation (M =3.93, *SD* =.974). The average mean of 3.90 implies that the manufacturing firms agree to a slightly great extent on the quality dimensions in their firms.

4.4.5 Descriptive Statistics for Dependability

The researched looked into the dimensions of dependability. The respondents were presented with different attributes regarding dependability and results presented as shown in Table 4.16 below

Table 4.16 Dependability

	Mean	**Std. Deviation**
There is timely delivery of customer orders	4.27	.451
Level of customer focus is high	4.14	.734
Average	**4.20**	**0.592**

The findings indicate that respondents generally agree with the following statements; there is timely delivery of customer orders (M =4.27, *SD* = .451); level of customer focus is high (M =4.14, *SD* =.734). The average mean of 4.20 shows that the respondents agree to a great extent on the dependability attributes.

4.5Sustainable Manufacturing Practices and Operational Performance

4.5 Regression analysis

In the quest to link the two variables, 5 multiple regression analyses were applied. The independent variables were the sustainable manufacturing practices; manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management while the dependent variable were the operational performance dimension. The model summaries are shown in the tables below.

4.5.1 Sustainable Manufacturing Practices and Cost

Table 4.17 Model Summary for Sustainable Manufacturing Practices and Cost

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.573[a]	.329	.240	.846

a. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The study found that manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management explained a significant proportion of variance in cost, R^2=0.329 meaning 32.9 % of the variation in cost could be explained by the sustainable manufacturing practices while the other 67.1% was due to other factors that were not covered in the study.

Table 4.18 ANOVA Table for Sustainable Manufacturing Practices and Cost

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.322	5	2.664	3.719	.008[b]
	Residual	27.223	38	.716		
	Total	**40.545**	**43**			

a. Dependent Variable: Cost
b. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The findings indicate that the significance value in testing the reliability of the model for the relationship between manufacturing inputs, manufacturing process, packaging, post-use disposal, supplier management and cost was (F = 3.719, p = 0.08). Therefore the model is statistically significant in predicting the relationship between the study variables. Results are as presented in Table 4.18.

Table 4.19 Coefficients of the Model for Cost

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	2.568	1.438		1.786	.082
	Manufacturing Inputs	-.042	.133	-.056	-.320	.751
	Manufacturing Process	-.394	.263	-.321	-1.495	.143
	Packaging	.570	.235	.325	2.422	.020
	Post-use disposal	-.190	.165	-.205	-1.152	.256
	Supplier Management	.030	.299	.023	.101	.920

a. Dependent Variable: Cost

The results show that manufacturing inputs had a negative relationship with cost (β = - .042; p = .751). The relationship was insignificant at 5% level of significance. The study found that manufacturing process had a negative and insignificant effect on the cost (β = -.394; p = .143). Thus, the relationship was insignificant. Packaging had a positive and significant effect on cost (β = .570; p = .020).This means that a 1% improvement in packaging leads to a 0.57% improvement in cost. The results also show that post-use disposal practices had a negative and insignificant relationship with cost (β = -.190; p = .256). Finally, supplier management had a negative and insignificant effect on cost (β = .030; p = .920).

4.5.2 Sustainable Manufacturing Practices and Speed

Table 4.20 Model Summary for Sustainable Manufacturing Practices and Speed

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.910[a]	.828	.806	.22965

a. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The study found that manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management explained a significant proportion of variance in speed, R^2=0.828 meaning 82.8 % of the variation in speed could be explained by the sustainable manufacturing practices while the other 17.8% was due to other factors that were not covered in the study.

Table 4.21 ANOVA Sustainable Manufacturing Practices and Speed

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.660	5	1.932	36.631	.000[b]
	Residual	2.004	38	.053		
	Total	**11.664**	**43**			

a. Dependent Variable: Speed
b. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The findings indicate that the significance value in testing the reliability of the model for the relationship between manufacturing inputs, manufacturing process, packaging, post-use disposal, supplier management and speed was (F = 36.631, p = 0.00). Therefore the model is statistically significant in predicting the relationship between the study variables. Results are as presented in Table 4.21.

Table 4.22 Coefficients of the Model for Speed

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	5.790	.437		13.241	.000
	Manufacturing Inputs	-.130	.050	-.237	-2.621	.013
	Manufacturing Process	-.112	.094	-.122	-1.197	.239
	Packaging	.055	.079	.048	.695	.491
	Post-use disposal	.575	.068	.751	8.483	.000
	Supplier Management	-1.296	.141	-.891	-9.166	.000

a. Dependent Variable: Speed

The results show that manufacturing inputs had a positive relationship with speed (β = - .130; p = .013). The relationship was significant at 5% level of significance. This means that a 1% improvement in manufacturing inputs leads to a 0.13% improvement in speed. The study found that manufacturing process had a negative and insignificant effect on the speed (β = -.112; p = .239). The relationship was therefore insignificant. Packaging had a negative and insignificant effect on speed (β = .055; p = .491). The results also show that post-use disposal practices had a positive and significant relationship with speed (β = -.575; p = .000) and therefore, a 1% improvement in post-use disposal leads to a 0.58% improvement in speed Finally, supplier management had a positive and significant effect on speed (β = -1.296; p = .000). This means that a 1% improvement in supplier management leads to a 1.30% improvement in speed.

4.5.3 Sustainable Manufacturing Practices and Flexibility

Table 4.23 Model Summary for Sustainable Manufacturing Practices and Flexibility

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865[a]	.748	.715	.23397

a. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The study found that manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management explained a significant proportion of variance in flexibility, R^2=0.748 meaning 74.8 % of the variation in flexibility could be explained by the sustainable manufacturing practices while the other 25.2 % was due to other factors that were not covered in the study.

Table 4.24 ANOVA Table for Sustainable Manufacturing Practices and Flexibility

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.170	5	1.234	22.541	.000[b]
	Residual	2.080	38	.055		
	Total	**8.250**	**43**			

a. Dependent Variable: Flexibility
b. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The findings indicate that the significance value in testing the reliability of the model for the relationship between manufacturing inputs, manufacturing process, packaging, post-use disposal, supplier management and flexibility was (F = 22.541, p = 0.000). Therefore the model is statistically significant in predicting the relationship between the study variables. Results are as presented in Table 4.24.

Table 4.25 Coefficients of the Model for Flexibility

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	2.830	.397		7.120	.000
	Manufacturing Inputs	-.155	.037	-.456	-4.219	.000
	Manufacturing Process	-.323	.073	-.584	-4.440	.000
	Packaging	-.128	.065	-.162	-1.973	.056
	Post-use disposal	.366	.046	.873	8.018	.000
	Supplier Management	.285	.083	.475	3.448	.001

a. Dependent Variable: Flexibility

The results show that manufacturing inputs had a positive relationship with speed (β = - .155; p = .000). The relationship was significant at 5% level of significance. This means that a 1% improvement in manufacturing inputs leads to a 0.16% improvement in flexibility. The study found that manufacturing process had a positive effect on the flexibility (β = -.323; p = .000). The relationship was therefore significant and thus a 1% improvement in manufacturing process leads to a 0.32% improvement in flexibility. Packaging had a slightly positive effect and significant relationship with flexibility (β = -.128; p = .056). Therefore, a 1% improvement in packaging leads to a 0.13% improvement in flexibility The results also show that post-use disposal practices had a positive and significant relationship with flexibility (β = .366; p = .000) and therefore, a 1% improvement in post-use disposal leads to a 0.37% improvement in flexibility. Finally, supplier management had a positive and significant effect on flexibility (β = .285; p = .001). This means that a 1% improvement in supplier management leads to a .29% improvement in flexibility.

4.5.4 Sustainable Manufacturing Practices and Quality

Table 4.26 Model Summary for Sustainable Manufacturing Practices and Quality

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.590[a]	.348	.263	.83388

a. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The study found that manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management explained a significant proportion of variance in flexibility, R^2=0.348 meaning 34.8 % of the variation in quality could be explained by the sustainable manufacturing practices while the other 65.2 % was due to other factors that were not covered in the study.

Table 4.27ANOVA Table for Sustainable Manufacturing Practices and Quality

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.122	5	2.824	4.062	.005[b]
	Residual	26.423	38	.695		
	Total	**40.545**	**43**			

a. Dependent Variable: Quality
b. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The findings indicate that the significance value in testing the reliability of the model for the relationship between manufacturing inputs, manufacturing process, packaging, post-use disposal, supplier management and quality was (F = 4.062, p = 0.005). Therefore the model is statistically significant in predicting the relationship between the study variables. Results are as presented in Table 4.27

Table 4.28 Coefficients of the Model for Quality

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.859	1.563		1.189	.242
	Manufacturing Inputs	-.496	.255	-.404	-1.944	.059
	Manufacturing Process	.628	.238	.358	2.641	.012
	Packaging	-.138	.169	-.149	-.818	.419
	Post-use disposal	.005	.284	.003	.016	.987
	Supplier Management	.154	.137	.171	1.121	.269

a. Dependent Variable: Quality

The results show that manufacturing inputs had a slightly positive relationship with quality (β = -.496; p = .059). This means that a 1% improvement in manufacturing inputs leads to a 0.50% improvement in quality. The study found that manufacturing process had a positive effect on the quality (β = .628; p = .012). The relationship was therefore significant and thus a 1% improvement in manufacturing process leads to a 0.63% improvement in quality. Packaging had a negative effect and insignificant relationship with flexibility (β = -.138; p = .419).The results also show that post-use disposal practices had a negative and insignificant relationship with quality (β = .005; p = .987). Finally, supplier management had a negative and insignificant effect on quality (β = .154; p = .269).

4.5.5 Sustainable Manufacturing Practices and Dependability

Table 4.29 Model Summary for Sustainable Manufacturing Practices and Dependability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.848[a]	.718	.681	.46294

a. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The study found that manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management explained a significant proportion of variance in flexibility, R^2=0.718 meaning 71.8 % of the variation in dependability could be explained by the sustainable manufacturing practices while the other 28.2 % was due to other factors that were not covered in the study.

Table 4.30 ANOVA Table for Sustainable Manufacturing Practices and Dependability

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.765	5	4.153	19.378	.000[b]
	Residual	8.144	38	.214		
	Total	**28.909**	**43**			

a. Dependent Variable: Dependability
b. Predictors: (Constant), Supplier Management, Packaging, Manufacturing Inputs, Post-use disposal, Manufacturing Process

The findings indicate that the significance value in testing the reliability of the model for the relationship between manufacturing inputs, manufacturing process, packaging, post-use disposal, supplier management and dependability was (F = 19.378, p = 0.000). Therefore the model is statistically significant in predicting the relationship between the study variables. Results are as presented in Table 4.30

Table 4.31Coefficients of the Model for Dependability

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	4.312	.661		6.525	.000
	Manufacturing Inputs	-.238	.114	-.230	-2.084	.044
	Manufacturing Process	.056	.132	.038	.426	.672
	Packaging	-.679	.137	-.605	-4.957	.000
	Post-use disposal	-.017	.072	-.022	-.230	.819
	Supplier Management	.524	.076	.661	6.913	.000

The results show that manufacturing inputs had a positive relationship with dependability (β = -.238; p = .044). This means that a 1% improvement in manufacturing inputs leads to a 0.24% improvement in dependability. The study found that manufacturing process had a negative effect on the dependability (β = .056; p = .672). The relationship was therefore insignificant. Packaging had a positive effect and insignificant relationship with dependability (β = -.679; p = .000 and thus, a 1% improvement in packaging leads to a 0.68% improvement in dependability). The results also show that post-use disposal practices had a negative and insignificant relationship with dependability (β = -.017; p = .819). Finally, supplier management had a positive and significant effect on dependability (β = .524; p = .000). This means that a 1% improvement in supplier management leads to a .52% improvement in dependability.

4.6 Discussion of results

The U.S. Department of Commerce defines sustainable manufacturing practices as the processes used in the creation of manufactured products that minimize negative environmental impacts while Eshikumo and Odock (2017) define operational performance is the degree to which quality, speed, dependability, flexibility and cost are fulfilled at any point in time in production and delivery of products and services.

From the findings on the different sustainable manufacturing practices it can be construed that the practices are adopted in the firms. This is evidenced by the large and moderate rating on the extent to which the respondents agree with the adoption of the various sustainable manufacturing practices. Therefore, it can be concluded that manufacturing firms in Nairobi are trying to put in the necessary efforts to adopt sustainable manufacturing practices which agree with studies by Millar and Russell (2011) who allege that most manufacturing firms are still in their early stages

of adopting sustainable manufacturing practices. These findings also agree with Stead and Stead (1992) who explain that sustainable practices provide firms with the much needed opportunity to gain competitive advantage in cost leadership.

From findings on the different dimensions of operational performance, all the operational performance measures presented were defined as relevant. Categorically, dependability was ranked the highest followed by flexibility measures, quality Performance then cost and finally speed performance. From the findings, it can be construed that the manufacturing firms are registering positive performances and are efficient in undertaking tasks thus generating more value to the firms. In general, improved sustainability performance leads to more efficient processes and improvement in productivity (Wagner & Schlategger, 2003)

The model summary findings from the regression analyses reveal that sustainable manufacturing practices explain a significant proportion of operational performance and can be reliably used to predict the level of employee performance. These findings concur with Rao and Holt (2003) who found that improved quality, cost savings, improved efficiency and productivity were as a result of sustainable practices.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section looks at the summary of findings, conclusions, recommendations, limitations and suggestions for further research.

5.2 Summary of the findings

The findings on the demographic information reveal that the manufacturing firms had been in operation for a reasonable period of time and thus the respondents had adequate experience and vast knowledge on the sustainable manufacturing processes employed in the firms. The findings showed that the size of the stuff was adequate enough to provide reliable information about the subject. The research discovered that most of the firms were registered with environmental management bodies and had department and policies in line with sustainable manufacturing. The findings also revealed that most of the manufacturing sectors were well represented and contributed to the findings.

The study assessed different attributes of sustainable manufacturing practices which included manufacturing inputs, manufacturing process, packaging, post-use disposal and supplier management. From findings on the different attributes of operational performance, all the operational performance dimensions presented were defined as relevant. Categorically, dependability was ranked the highest, followed by flexibility, quality and cost while the speed was rated the least. From the findings, it can be construed that the manufacturing firms are

registering positive performances and are efficient in adopting the practices and thus generating more value to the firms.

The model summary findings from the regression analyses reveal that sustainable manufacturing practices explain a significant proportion of operational performance and can be reliably used to predict the level of operational performance. These findings concur with Rao and Holt (2003) who found that improved quality, cost savings, improved efficiency and productivity were as a result of sustainable practices.

5.3 Conclusion

It is imperative for manufacturing firms in Nairobi, kenya to ensure that sustainable manufacturing practices are adopted as they play an integral role in enhancing operational performance. This means that failure to adopt and implement sustainable manufacturing practices reduces operational performance. This is evidenced by the findings from the regression model analysis where a significant P value was established meaning that the practices significantly influenced operational performance.

The study also noted that manufacturing firms in Nairobi have adopted most of the practices while operational performance was a continuous and flexible process in the firms. Although most of the statements on the manufacturing practices recorded a high rating, the respondents responded rated some to a moderate and low extent and thus the firms should invest in enhancing the cited practices. The research therefore established that sustainable manufacturing practices bring about measurable improvements in operational performance.

5.4 Recommendations

First according to Meadows (2008), activities in an organization cannot be viewed in isolation but as a whole in order to create synergy, interdependence and interconnections within the organization and between the organization and the environment. This study recommends improvement in adoption of Sustainable Manufacturing practices because they have been implemented to a moderate extent in the commercial banks. One or two practices of Sustainable Manufacturing may not bring out the desired operational performance compared to all practices working in synergy.

Second implication and recommendation of this study for practice is based on the fact that adoption of Sustainable Manufacturing Practices is no easy work. There is need for top management commitment to the practices as a strategy. The commitment implies leading by example with provision of training and education and inculcating a culture that helps teams to flourish. Since Sustainable Manufacturing Practices have interactive components as intimated in this study, commitment to one part of the system is not likely to give the desired outcome. Success in implementation implies that perseverance and effort have to be incorporated in the firms.

5.5 Limitations of the Study

This study has a limitation of scope in two ways: first the study focused on the adoption Sustainable Manufacturing Practices and their relationship to operational performance and second it was done in manufacturing firms in Nairobi County and this did not consider representation of other firms in the country. The sample in this study may imply a generalized representation of the whole manufacturing sector in Kenya.

Despite sustainable practices being adopted in the firms, some of the respondents were not well versed with the concept. This was contributed by the lack of experience sustainability and sustainable manufacturing practices. The respondents took time to consult with colleagues and supervisors on the area of study. There was also the fear by most respondentsto divulge information which could be exposed to their competitors because of confidentiality privacy policies. Confidentiality was however guaranteed to the respondents which enhanced response rates and honesty in responses.

5.6 Suggestions for further research

Future research on Sustainable Manufacturing Practices and operational performance could consider using quantitative data collection methods in analyzing the relationship. To increase generalizability and reliability of findings, academicians could consider adopting samples from other regions. Furthermore, future studies could give a focus on firms with different characteristics from various sectors to examine Sustainable Manufacturing Practices and operational performance. This will help in explaining how firm characteristics or sector affects success of the adoption of the sustainable manufacturing practices.

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APPENDICES

Appendix I - Questionnaire

The questionnaire contains three parts: Company's' basic information, Sustainable Manufacturing practices, perceived benefits of Sustainable Manufacturing practices, and factors influencing adopting of Sustainable Manufacturing practices.

Section A: Company's Basic Information.

Please answer the following questions concerning information about your organization.

1. How long your firm has been operating?
    a) Less than 5yrs
    b) 5-10 years
    c) 10-20 years
    d) More than 20 yrs

2. What is the size of the staff of your company?
    a) Less than 25
    b) 25-100
    c) 300-1000
    d) More than 1000

3. Is your company registered with any environmental management body?

a) Yes

b) No

4. Does your firm have environmental management department?

a) Yes

b) No

5. Does your firm have an environmental management policy?

a) Yes

b) No

6. Please tick the sector in which your firm belongs and the type of product you manufacture.

	Manufacturing Sector	**Tick**	**Type of products**
1	Chemical & Allied		
2	Energy, Electricals		
3	Food and Beverages		
4	Leather		
5	Metal		
6	Motor vehicle		
7	Mining		

8	Paper and Board		
9	Pharmaceuticals		
10	Plastic		
11	Textiles		
12	Timber		

Section B: Sustainable Manufacturing Practices

Please answer the questions below regarding Sustainable Manufacturing Practices in your firm? Use the scale given below to appropriately answer the questions that follow by ticking (√) accordingly. 1) Strongly disagree; 2) Disagree; 3) Neutral 4) Agree; 5) Strongly Agree

	Manufacturing inputs	**1**	**2**	**3**	**4**	**5**
1	The manufacturing inputs are recycled materials					
2	The manufacturing inputs are biodegradable materials					
3	The manufacturing inputs are environmentally-benign materials					
4	The manufacturing inputs are a substitute of environmentally-questionable materials					
	Manufacturing process or production phase	**1**	**2**	**3**	**4**	**5**
1	The manufacturing process produces minimal waste and emissions					
2	Recycling and use of renewable resource is done during the production phase					

	Packaging	**1**	**2**	**3**	**4**	**5**
1	Packaging used is returnable.					
2	Packaging used is recyclable and reduced					
	Post-use disposal	**1**	**2**	**3**	**4**	**5**
1	The products can be reused					
2	The Products can be recycled					
3	The products can be repaired					
4	The products can be regenerated					
5	The products can be remanufactured					
	Supplier Management	**1**	**2**	**3**	**4**	**5**
1	Suppliers have adopted effective environmental practices					
2	Suppliers are integrated in the company's environmental management process					
3	Encourage suppliers to set up their own environmental programs					

Section C: Operational Performance

Specify to what extent the following performance measures are true in your organization: Use the scale given below to appropriately answer the questions that follow by ticking (√) accordingly. (1)Very Low Extent, (2) Low Extent (3) Moderate Extent, (4) Great Extent(5)Very Great Extent

	Cost	**1**	**2**	**3**	**4**	**5**
1	Productivity is improving					
2	Unit cost of manufacturing is decreasing					
3	Waste levels are decreasing					
	Speed					
4	Lead time is low					
5	Speed of production is low					
6	Reworks are low					
	Flexibility					
7	Product adaptability is fast					
8	Level of adapting to change in demand is fast					
	Quality					
9	Quality management system is in place					
10	There is continuous improvement and innovation					
	Dependability					
11	There is timely delivery of customer orders					
12	Level of customer focus is high					

Thank you for your response.

Appendix II – List of Manufacturing Firms

Sector: Chemical and Allied (7)	
Basco Product (K)	Unilever Kenya
Buyline Industries	Syngenta East Africa
Beiersdorf East Africa	Twiga Chemical Industries
Vitafoam Products	
Sector: Energy, Electrical and Electronics (3)	
East African Cables	Kenya Power & Lighting Co.
Mecer East Africa	
Sector: Food, Beverages and Tobacco (14)	
Aquamist	Mount Kenya Bottlers
British American Tobacco Kenya	Nairobi Bottlers
Coca cola East Africa	Nairobi Flour Mills
Kevian Kenya	Broadway Bakery
Unga Group	Kenya Wine Agency
London Distillers (K)	Mafuko Industries
East African Breweries	Kenya Nut Company
Sector: Leather Products and Footwear (1)	
Bata Shoe Co. (K)	
Sector: Metal (6)	
Allied Metal Services	Davis &Shirtliff
Alloy Street Castings	Devki Steel Mills
Steelmakers	East Africa Spectre
Sector: Motor Vehicle Assembly and Accessories (3)	

Impala Glass Industries	Kenya Vehicle Manufacturers
General Motor East Africa	
Sector: Building, Construction and Mining (2)	
Kenya Builders & Concrete	Mombasa Cement
Sector: Paper and Paperboard (7)	
Chandaria Industries	Jomo Kenyatta Foundation
General Printers	Kartasi Industries
Graphics & Allied	Kenafric Diaries Manufacturers
	Kitabu Industries
Sector: Pharmaceutical and Medical Equipment (2)	
Alpha Medical Manufacturers	Beta Healthcare International
Sector: Plastics and Rubber (7)	
Bobmil Industries	Raffia Bags (K)
Haco Industries Kenya	Rubber Products
Techpak Industries	Sameer Africa
TreadsettersTyres	
Sector: Textile and Apparels (5)	
Sunflag Textile & Knitwear Mills	Thika Cloth Mills
Tarpo Industries	Kikoy Co.
Teita Estate	
Sector: Timber, Wood Products and Furniture (2)	
Twiga Stationers & Printers	Tetra Pak