

**ADOPTION OF GREEN MANUFACTURING PRACTICES
BY FOOD PROCESSING FIRMS IN MOMBASA COUNTY,
KENYA**

BY

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DECLARATION

This research project is my original work and has not been submitted for a degree courses this or any other university.

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This research project has been submitted for examination with my approval as a university Supervisor.

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Foremost I thank Almighty God for supporting me.

DEDICATION

To my entire family for the encouragement and support they gave me throughout the Course. To my wife Calyster for her encouragement and support and to my daughter Blessine Moraa for her patience and endurance during my absence from home as I went through the course.

ABSTRACT

Green manufacturing has emerged as a key approach for manufacturing firms seeking to become environmentally sustainable and globally competitive. As a developing country, Kenya has to balance both operational and environmental performance. The objective of this study was to determine the extent of Green Manufacturing Practices' adoption by food processing firms in Mombasa County, Kenya. A descriptive research design was adopted for this study. It targeted a population of food processing firms in Mombasa County listed by Kenya Association of Manufacturers (KAM). A sample of 66 firms was taken. The data was collected using questionnaires. The results obtained indicated that green manufacturing practices adoption was at implementation stage as most food processing had considered adoption. The study also established that the major perceived benefits of adopting green manufacturing are; reduction of waste water, reduction of frequency of environmental accidents and reduction in scrap rate. Lastly, the major factors influencing adoption of green manufacturing were found to be; organization capabilities and awareness, desire for economic benefit, government rules and legislation, and high waste generation. The study recommends that the management in food processing firms should focus and allocate more resources towards pollution prevention practices than pollution control practices, as these results in greater product innovation and thus higher firm performance. They should also strive at achieving green manufacturing through remanufacturing and substitution, this will enhance efficiency and synergy in the industry, environment performance and reduce waste to achieve cost savings. Finally, the managers should act fast and implement green manufacturing practices since there are potential benefits which will result in sales growth.

TABLE OF CONTENTS

DECLARATION	ii
ACKNOWLEDGEMENT	iii
DEDICATION	iii
ABSTRACT	ix
LIST OF TABLES	vi
ABBREVIATIONS AND ACRYNOMS	ix
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the study	1
1.1.1 Green Manufacturing.....	3
1.1.2 Food Processing Industry in Kenya	5
1.1.3 Food Processing Firms in Mombasa County	5
1.3 Research Problem	7
1.4 Research Objectives.....	9
1.5 Value of the Study	9
CHAPTER TWO: LITRATURE REVIEW	11
2.1 Introduction.....	11
2.2 Theoretical Review	11
2.2 Theoretical Review	11
2.2.1 Institutional Theory	11
2.2.1 Resource Based View.....	13
2.2.1 Resource Dependence Theory.....	14
2.2.1 Stakeholder Theory	15
2.3 Green Manufacturing Practices.....	16
2.2.1 Pollution Prevention Practices	17
2.2.1 Management System Practices.....	18
2.2.1 Pollution Control Practices.....	19
2.4 Benefits of Green Manufacturing	20
2.5 Challenges of Adopting Green Manufacturing Practices	22
2.6 Empirical Review.....	24

CHAPTER THREE: RESEARCH METHODOLOGY	27
3.1 Introduction.....	27
3.2 Research Design.....	27
3.3 Population	27
3.4 Sample Design	28
3.5 Data Collection	28
3.5 Data Analysis	28
CHAPTER FOUR: DATA ANALYSIS, RESULTS AND	
DISCUSSION.....	30
4.1 Introduction.....	30
4.2 Company’s Basic Information Analysis	30
4.2.1 Length of Time in Operation.....	30
4.2.2 Number of Employees.....	30
4.2.3 Environment Management Department	32
4.2.4 Environmental Management Policy	33
4.2.5 Registration with Environmental Management Body.....	33
4.3 Green Manufacturing Practices.....	35
4.4 Perceived Benefits of Adopting Green Manufacturing Practices	37
4.5 Factors Influencing Adoption of Green Manufacturing Practices	39
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND	
RECOMMENDATIONS	43
5.1 Introduction.....	43
5.2 Summary	43
5.3 Conclusions.....	45
5.4 Recommendation.....	46
5.5 Limitations.....	48
5.6 Suggestions for Further Research	48
REFERENCES	49
Appendix 1: Introductory Letter	49
Appendix 2: Questionnaire	55
Appendix 3: Food Processing Firms in Mombasa County Registered by KAM.....	62

LIST OF TABLES

Table 4.2: Length of Time in Operation	31
Table 4.3: Number of Employees	32
Table 4.4: Environmental Management Department.....	32
Table 4.5: Presence of Environmental Management Policy	33
Table 4.6: Registration with Environmental Management Body	34
Table 4.7: Green Manufacturing Practices	36
Table 4.8: Perceived Benefits of GMP.	39
Table 4.9: Factor Influencing Adoption of GMP.....	42

ABBREVIATIONS AND ACRONYMS

CERES	Coalition for Environmentally Responsible Economies
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
GMP	Green Manufacturing Practices
GOK	Government OF Kenya
KAM	Kenya Association of Manufacturers
KEBS	Kenya Bureau of Standards
KNBS	Kenya National Bureau of Statistics
UK	United Kingdom
USA	United States of America

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Management research and conceptual thinking on environmental issues has expanded from a narrow focus on the concept of pollution control to include a larger set of management decisions, programs, tools, and technologies that incorporate environmental issues into functional considerations (Hunt & Auster, 1990). This led to green manufacturing concept which involves production processes which use inputs with relatively low environmental impacts, which are highly efficient, and generate little or no waste or pollution. Due to heterogeneous pressures from various organizational groups, different industries have variations, though commonalities may exist in their adoption of green manufacturing practices.

An explanation of similarities and differences may be derived from four theoretical perspectives, which offers explanations why firms adopt green manufacturing. They include: institutional theory which focuses on direct impact on institutional rules, pressure, and sanctions on organization to adopt green manufacturing; resource dependence theory which emphasizes on structural adaptation in the face of dependencies on external organizations; resource based view that focuses on green manufacturing as a resource that can lead to a firms competitive advantage; and stakeholder theory emphasizing that stakeholders can influence green manufacturing adoption by exerting pressure on firms (Sarkis et al., 2010).

The increase in consumption and production of goods using non-replenishable resources and environmentally detrimental manufacturing practices over the past few

years has increased the scale of negative human impact on earth. Manufacturing industry provides mankind with goods to fulfill his various needs but at the same time it generates serious problems of the resource depletion and environmental degradation. Every day manufacturing firms generate wastes in the form of pollution (Davies et al., 1976). In response to the above environmental problem there has been an increasing demand from the stakeholders, requesting the manufacturing companies to be more environmentally responsible to their products and production processes (Rusinko, 2010).

In Kenya, food processing sector remains the largest components of manufacturing sector representing 21.79 percent of the KAM registered members (KAM, 2012). The sector contributes about 28.7 per cent to the country's Gross Domestic Product (GDP) (Kenya National bureau of statistics, 2012). The sector also faces challenges including: high production cost resulting from high; energy, raw material, labor, and transport costs, slow development and implementation of policies and use of obsolete technologies and skills, competition from sectoral association and environmental degradation (GOK, 2011). Hence, this sector will be the primary means of realizing the goal of economic development in Kenya. Therefore there is a need for food processing firms in Kenya to adopt green manufacturing practices.

1.1.1 Green Manufacturing

The term "green" is used frequently in everyday life, and yet its definition tends to be ambiguous (Saha & Darnton, 2005). It is commonly associated with a wide range of issues, such as eco-friendly living, recycling, energy saving, waste management, pollution reduction, and offsetting. Intriguingly, there are relatively few formal

definitions of green manufacturing given within the literature. Smith and Melnyk (1996) defined green manufacturing as a system that integrates product and process design issues with issues of manufacturing planning and control in such a manner as to identify, quantify, assess, and manage the flow of environmental waste with the goal of reducing and ultimately minimizing environmental impact while also trying to maximize resource efficiency. Baines et al., (2012) defined green manufacturing as making a comprehensive commitment to environmentally benign practices across the spectrum of the manufacturing process.

When considered in a manufacturing context, green is readily used as an umbrella term covering a range of concepts, such as “environmentally-conscious”, “ethical”, “organic” and “fair-trade” production. These concepts address specific forms of manufacturing, namely: Environmentally-conscious - Industrial companies make themselves committed to slowing down the degradation of the natural resources and the planet’s ecosystems. Ethical - Business enterprises take responsibility for the rights of the workers in their supply chains according to specific labor standards or codes of practice. Fair-trade - Buyers accept to pay prices above market levels for products of disadvantaged or marginalized producers, typically from the growing economy, when these products are provided by the fair-trade label. Organic - Food manufacturers or producers of certain non-food items, such as health and beauty products or textiles, obtain a certification from an entitled organization, meaning that their products are made from a balanced living soil (Baines et al., 2011).

Basing on the past studies in green manufacturing there is an increasing demand from customers for green products, they prefer products that are environmentally friendly

(Bjorner et al., 2004). Customers are willing to switch to green products and willing to pay the premium (Bhargava & Welford, 1996). Green products enable firms to gain a competitive advantage (McEachern & McClean, 2002). Adopting green manufacturing leads to good organizations reputation and provides a point of differentiation (Carlson & Ripley, 1997). It also leads to reduced manufacturing costs (Porter & Van der Linde, 1995). Finally adopting green manufacturing makes firm to adopt socially responsible policies that lead to economic payoffs in the long term (King & Lenox, 2001).

Performance based environmental claims on green products must be verifiable in order to be believable (Carlson & Ripley, 1997). Some of the claims of adopted green manufacturing practices cannot be verified mostly on biodegradable products, non-credible claims have made customers suspicious of the green products (Bhaskaran et al., 2006). Davis (1993) noted that implementation of green manufacturing practices needs huge investment. And customers are willing to pay for the premium when the benefits outweigh the cost (Laroche et al., 2001). Hence marketing such products is at the lowest rate (McEachern & McClean, 2002). Because of low and unpredictable demand most firms tend to adopt 'wait and see strategy'. It is difficult to understand and appreciate what are green manufacturing best practices. Consequently in situations where customers are concerned with environmental impacts and are unable to know in order to make the right choice, third party accreditation is required. The image and credibility of the third party create confidence, however different sources of accreditation can lead to confusion and impacts on the believability of claim (McEachern & McClean, 2002). It is also difficult to identify the most appropriate area of attention to focus. When implementing or using a system that embody green

manufacturing practices. It is also difficult to know how to deal with the various trade-offs when implementing green manufacturing practices (Wycherley, 1999).

1.1.2 Food Processing Industry in Kenya

The Kenyan food-processing sector, which includes food, beverages and tobacco, remains the largest component of the manufacturing industry. In terms of structure, economic contributions, and performance within the manufacturing sector, this sector is the most important and largest comprising of over 1,232 food processing firms, encompassing everything from small family organizations to large multinational companies. Out of 525 manufacturing firms registered by KAM 21.7 percent are foods processing firms (KAM, 2012).

According to Kenya National Bureau of Statistic (2012) the sector grew by 2.1 percent and contributes to the country's gross domestic product by 28.7 percent. The sector also faces challenges including: high production cost resulting from high; energy, raw material, labor and transport costs, slow development and implementation of policies and use of obsolete technologies and skills, competition from sectoral association and environmental degradation (GOK, 2012).

1.1.3 Food Processing Firms in Mombasa County

Mombasa County is the hub of industrial activities in the entire coastal region. It accounts for 90% of the establishment and employment opportunities (Mwaguni & Munga, 1997). There are 187 food processing firms in the Mombasa County out of which 32 are middle and large scale (KEBS, 2013). The ecosystem around the coastline receives considerable quantities of riverine and coastal watershed discharge

which include industrial wastes that impact on the water sediment quality, productivity, biodiversity and system functioning. Indeed coastal and marine resources such as mangrove swamps and coral lagoons are under relentless pressure from rapid population growth and industrial pollution (Mwaguni & Munga, 1997).

About 9% of the total population of Kenya is based in coast province and growing at the rate of 3.1% Per Annam. This is significantly faster than the national growth of 2.9% per Annam (GOK, 2009). Increase in population has led to high demand for food which in return has attracted more food processing industries such as maize millers hence increasing industrial pollution. It is worthy that industrial activities in the 1990s were dominated by food processing firms and other agro-based industries. This earlier assessment of the pollution loads from industrial establishments indicated high level of biological oxygen demand (BOD). Suspended matter and nitrogen compounds, Solid wastes from industries is usually not sorted and tended to be deposited at the kibarani dumpsite. It is realized however that some of the industrial refuse is toxic and potentially hazardous to animal and human health (Mwaguni & Munga, 1997).

As populations grow, and economies expand, the planet's ecosystems and resources are experiencing tremendous challenges (Esty & Winston, 2009). And systems, that supply the growing demand for goods, are linked to adverse impacts (Gallopoulos, 2006). Food processing firms in Mombasa County have been linked to negative environmental impacts. These firms face challenges of sustainable energy consumption, management of solid and liquid wastes, and compliance with environmental regulations. Urgent measures need to be taken to achieve a pivotal

change in the way society in general, and industry in particular, manages natural resources (Lisney, Riley & Banks, 2003). Consequently, adoption of green manufacturing will be an option for these food processing firms.

1.2 Research problem

Managers have to adopt green manufacturing strategy to reduce the effect of their operations and products to the environment (Smith & Melnyk, 1996). Previously organizations perceived that adopting green manufacturing is costly but realized ignoring negative impact on the environment will be more costly in the future (Van der Vorst et al., 2008). The purpose of green manufacturing is to use products and methods that would not negatively impact the environment through pollution or depleting natural resources. Green manufacturing adoption leads to a reduction of environmental footprint, reduction of wastes and re-use of materials, furthermore it results in the use of scarce natural resources efficiently and effectively, while keeping the environment free from detrimental products (Dallas, 2008).

Food processing industry in Kenya is a global business and therefore there is need for players in the industry to re-engineer the manufacturing process to conform to global manufacturing best practices in order to remain competitive. It is important for the food processing industry players to conserve their key raw materials, energy and water to enable them to achieve green manufacturing practices. The food processing sector represents the largest component of the manufacturing sector in Kenya. The sector contributes about 28.7 percent to the gross domestic product in Kenya. In Mombasa County the rapid increase in population has attracted food processing firms and other Agro-based industries. The earlier assessment of the industrial pollution in

Mombasa County indicated that major contribution was from food processing firms (Mwaguni & Munga, 1997). These firms face challenges of sustainable consumption, management of solids and liquid wastes, compliance with environmental regulations. Hence these motivated this research study.

In Kenya research has been done in green manufacturing and green supply chain management. Otieno (2011) did a study on green supply chain management practices in the food manufacturing industry in Kenya. The study showed that green supply chain management practices adoption was at a low stage. Mohamed (2012) did a study on green supply chain management and performance of manufacturing in Mombasa. The study finding indicated that green supply chain management has a positive impact on manufacturing firms' performance. Ong'ong'o (2012) carried out a study on factors affecting adoption of green technology by firms in Kenya. The study established that regulatory policy is the major factor affecting adoption of green technology.

From past studies, it could be noted that most of them are on green supply chain management. Therefore, there was a need to conduct a study in green manufacturing on food processing firms. The researcher is also not aware of a study done on adoption of green manufacturing in food processing firms in Mombasa County. The preceding discussion leads to the researcher to pose the following questions; to what extent have food processing firms in Mombasa County adopted green manufacturing practices? What are the perceived benefits of adopting green manufacturing practices by these firms? What are the factors influencing these firms to adopt green manufacturing practices?

1.3 Research objectives

The objectives of the study are;

- i. To determine the extent to which food processing firms in Mombasa County have adopted green manufacturing practices.
- ii. To determine the perceived benefits of adopting green manufacturing practices by food processing firms in Mombasa county
- iii. To establish factors influencing adoption of green manufacturing practices by food processing firms in Mombasa County.

1.4 Value of the study

This study made several contributions, some of the notable contributions include: contribution to the body of knowledge by extending the “green” perspective research in manufacturing. This study provides theoretical insights to green manufacturing researchers, the extent to which green manufacturing practices have been adopted in food processing firms in Mombasa County. The findings also provide researchers’ a useful conceptual and methodological reference to pursue further studies in this under-explored green manufacturing research area.

The study helps policy makers in developing economies to set environmental standards to attract investors. The finding provides policy implications for Kenyan government in supporting green manufacturing practices among food processing firms. It also provides information to the government policy maker to encourage additional organizations to adopt green manufacturing practices through the use of voluntary environmental programs and partnership with organizations. Regulators may use the findings to persuade additional organizations to implement green

manufacturing practices by offering incentives to organizations that have already adopted green manufacturing practices.

The research provides data that will assist the industrial sector with implementation and management of green manufacturing practices. It addresses some of the existing factors influencing the adoption of green manufacturing practices in food processing firms in Mombasa County. The project fulfills a resource need for the structure of green manufacturing in the food industry; this is based on the setting that Kenya through its Industrial Development Policy seeks to bring about sustained economic growth and rapid employment generation in Kenya through industrialization. The study highlights the need for more awareness and training so that local manufacturers can unlock the potential for competitiveness by focusing on green manufacturing practices. Finally the results of this study can be used by government and manufacturing firms to formulate strategic responses to the factor influencing the adoption of green manufacturing practices.

CHAPTER TWO: LITRATURE REVIEW

2.1 Introduction

This chapter introduces the theoretical review of green manufacturing followed by the concept of green manufacturing practices. The first section defines and describes green manufacturing practices followed by a description of the benefits of green manufacturing adoption. The third section looks at challenges of green manufacturing practices. The chapter is concluded by looking at empirical review.

2.2 Theoretical Review

Green manufacturing is grounded on four major theories. These are the institutional theory, resource based view, resource dependence theory and stakeholder theory.

2.2.1 Institutional Theory

Institutional theory emphasizes the role of social and cultural pressures subjected to organizations that influence organizational practices (Scott, 1992). DiMaggio (1998) argue that managerial decisions are strongly influenced by three institutional mechanisms namely; coercive, mimetic and normative isomorphism- that creates and diffuses a common set of values, norms and rules to produce similar practices and structures across organizations that share a common organizational field. An organizational field is defined as those organizations that constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies and other organizations that produce services or products. De Boer and Zandberg (2012) argue that because of coercive forces in the form of regulations and regulatory enforcement has been the main impetus of environmental management

practices. Firms that share the same organizational field are affected in similar ways by institutional forces that originate from them. Delmas and Toffel (2002) proposed an institutional perspective to analyze the drivers of ISO 14001 environmental management system (EMS). And also came up with how distinct levels of coercive pressures are exerted upon different industries which may lead to different environmental strategies.

Firms tend to adopt green manufacturing practices in response to institutional pressure. They can be based on; environmental strategies of conformance that focus on complying with regulations and adopting standard industry practice, or to reduce environmental impact of operations beyond regulatory requirements (Sharma, 2000). Management can also include environmental management as a key performance indicator in employee performance (Nelson & Winter, 2002). Firms can create relationships with regulators and signal a proactive environmental stance by participating in government sponsored voluntary program such as the US EPA has developed a voluntary agreement between government agencies and firms to encourage technological innovation or reduce pollution while providing relief from particular procedural requirements (Delmas & Toffel, 2008). Companies can also work with their customers and suppliers to improve their environmental performance (Nelson & Winter, 2002).

2.2.2 Resource Based View

Resource based view argues that for the firm to gain sustainable competitive advantage its resources should be costly to copy by its competitors (Russo & Fouts, 1997). This view adds that, the firm can sustain competitive advantage if the capabilities creating the competitive advantage are supported by resources that are

rare, non- substitutable, difficult to imitate, and valuable to customers. Resources include; physical assets, financial assets, employees skills and organization's process. The resource based view emphasizes resources that contribute to a firm's capability are hard to transfer or trade. Such resources are difficult to copy since they are 'invisible' assets accumulated through past experience and learning-by-doing (Hart, 1995). Hence firms that are able to accumulate resources to support unique capabilities will be able to enjoy a sustainable competitive advantage (Russo & Fouts, 1997).

Hart (1995) went further to elaborate resource-based view by considering the constraint of natural resources. He developed a conceptual framework considering resource based view of the firm to characterize the firm's capabilities that facilitate three interrelated environmental strategies: pollution prevention, product stewardship and sustainable development. The three can lead to competitive advantage in the form of improved manufacturing efficiency, enhanced reputation and raising rivals' costs by influencing future industry standards. Not all firms can realize these benefits in the same fashion. To pursue these strategies it involves long term investment and commitment to the environment. To mention a few, pollution prevention strategy requires manpower investment; environmental product stewardship requires the integration of life-cycle-costing into firms' product development process (Hart, 1995). This means an organizational ability not only to coordinate functional groups within the firm, but also to communicate across function, departments, and organizational boundaries. A company pursuing green manufacturing must have an organization wide shared vision of the future. Such vision needs strong leadership and an empowering social process inside the firm. Given the difficulty in generating such

a consensus, shared vision becomes a firm specific resource that cannot be imitated by competitors (Esty & Porter, 1998).

2.2.3 Resource Dependence Theory

In resource dependence theory firms are dependent on resources provided by others in order to sustain growth as well as other firms who depend on them (Pfeffer & Salancik, 1978). The assumption of this theory is that the firm cannot be independent with regard to strategically critical resources for survivors. Hence it must depend on resources from outside parties to compete (Wathne & Heide, 2004), and manage this dependence with other firms for sustainable development (Ulrich & Barney, 1984). Examples of these critical resources are; standards, procedures, enabling technologies, material resources and distribution channels. Firms that lack the required resources to achieve its goals are likely to partner with others to acquire these resources. Where partner coordination and resource sharing are beneficial for environmental and productivity improvement this leads to diffusion of environmental practices through the supply chain (Sarkis et al., 2010).

Green manufacturing eco-design of products and material recovery are unique organizational resources requiring firms' partnerships to effectuate performance benefits (Sarkis et al., 2010). In many instances, inter-organizational relationship is essential for managing the internal and external for green manufacturing to gain performance outcomes, where partner coordination and resource sharing are beneficial for environmental and productivity improvements (Zhu & Sarkis, 2004). The power of the development aspects of resource dependence argues for the diffusion of environmental practices through the supply chain. It has been found that

the larger firm given their power over smaller firms will require environmentally sound practices to adopt by smaller supplier firms (Sarkis et al., 2010).

2.2.4 Stakeholder Theory

Harrison and Freeman (1999) defined the concept of a stakeholder approach to corporate environmental management to include any individual or group who can affect the firm's performance or who is affected by the achievement of the organizations' objectives. The stakeholder theory is grouped into two: strategic stakeholder who emphasizes the active management of stakeholder interests and moral stakeholder interested in balancing stakeholder interests (Frooman, 1999). Corporations should not focus narrowly their strategic management decisions on creating shareholder value; rather broaden their objectives to tackle the expectations and interest of a wide variety of salient stakeholders (D'Aunno et al., 2006).

Poor environmental performance leads to poor company's relationship with its stakeholders. This will affect the firm's reputation and shareholders will suffer financial losses on their investments if a firm's is found liable to environmental damage. Consequently shareholders and financial institutions perceive companies with a poor environmental record as riskier to invest in and may demand a higher risk premium (Henriques & Sadorsky, 1999). Also companies with a poor reputation of environmental management will find it harder to attract and retain highly qualified employees who may have a strong proactive environmental management (Reinhardt, 1999). From the above argument the success of companies aiming to develop green manufacturing competencies strongly depend on the participation of their employees. Consumer awareness has led to them to demand industry improvement on their environmental performance (Buysse & Verbeke, 2003). Also the emergence of green

products, consumers who are willing to pay premium prices (Vandermerwe & Huillier, 1989). Consumers can reject the products of companies with poor environmental management reputation (Greeno & Robinson, 1992). Similarly suppliers may stop delivering inputs to protect their own reputation (Henriques & Sadorsky, 1999).

A firm with a reactive environmental strategy may face big loss of competitive advantage if proactive environmental management becomes a common practice among its competitors (D'Aunno, 2006). The threats posed by various stakeholders in response to the poor environmental management may thus induce firms to improve their corporate environmental practice. From the above argument Freeman and Phillips, (2002) suggest that business should take a leadership role to improve the natural environment.

2.3 Green Manufacturing Practices

Green manufacturing practices are production equipment, methods and procedures, product designs and product delivery mechanism that conserves energy and natural resources, minimize environmental load of human activities, and protect the natural environment. They include both hardware such as pollution control equipment, ecological measurement instrumentation, and cleaner production technologies. They also include operating methods such as waste management practices and conservation-oriented work arrangements used to conserve and enhance nature (Shrivastava, 1995).

The classification of green manufacturing practices is a necessary first step in the process of discussing them. Shrivastava (1995) proposed classifying green manufacturing practices into five themes based on their general management orientation: design for disassembly, manufacturing for the environment, total quality environmental management, industrial ecosystems, and technology assessment. However, these themes are difficult to measure over time, cannot be easily overlaid onto existing manufacturing strategy research, and include aspects of both strategy development and implementation. Most studies support a more straightforward typology for characterizing green manufacturing practices as belonging to three general categories: pollution prevention (Klassen & Whybark, 1999), management systems (Angell & Klassen, 1999), and pollution control (Russo & Fouts, 1997).

2.3.1 Pollution Prevention Practices

This category is defined as the structural investments in operations that involve fundamental changes to a basic product or primary process. These practices reduce or eliminate pollutants by using cleaner alternatives than those currently in place. Pollution prevention practices can be further characterized as product or process adaptation, although the two are related. Product adaptation encompasses all investments that significantly modify an existing product's design to reduce any negative impact on the environment during any stage of the product's manufacture, use, disposal, or reuse. Process adaptation refers to fundamental changes to the manufacturing process that reduce any negative impact on the environment during material acquisition, production, or delivery (Freeman & Phillips, 1992).

Some management systems, such as improved housekeeping practices, might be considered to be pollution prevention or to be part of implementing a product or process adaptation (Freeman & Phillips, 1992; Hart, 1995). The emphasis here is the physical product and/or process change. This narrow definition reflects the structural/infrastructural distinction made in manufacturing strategy research, which has earned broad theoretical and managerial acceptance in operations management (Hayes & Wheelwright, 1984).

2.3.2 Management Systems Practices

These green manufacturing practices are infrastructural investments that affect the way manufacturing is managed. They include efforts to formalize procedures for evaluating environmental impacts during capital decision budgeting, to increase outside stakeholder involvement in managing operations, to increase employee training for spill prevention and waste reduction, to establish an environmental department, and to develop new procedures for cross-functional coordination. Monitoring, internal and external reporting, and related compliance systems are also examples of management systems practices (Henriques & Sadorsky, 1999).

Management systems practices also include: use of environmental systems as the primary management approach for addressing environmental aspects of internal operations and activities, environmental aspects, establishment of environmental objectives and targets and implementation, collection, analysis, and reporting of information to measure performance in the implementation (Curkovic, 2003).

2.3.3 Pollution Control Practices

Like pollution prevention practices, these are structural investments. However, in contrast to prevention practices, pollution control practices treat or dispose of pollutants or harmful by-products at the end of a manufacturing process, either immediately or later, to accomplish this, a plant must add operations or equipment to the end of an existing manufacturing process, thereby leaving the original product and process virtually unaltered. Pollution control practices can be further characterized as either remediation or end-of-pipe controls. Remediation refers to cleaning up environmental damage caused by crises or past practices, and it is often driven by regulation or by improvement in scientific understanding of environmental damage. End-of-pipe controls refer to using equipment that is added as a final process step to capture pollutants and wastes prior to their discharge (Linton & Klassen, 2007).

In contrast to pollution prevention practices, pollution control practices do not usually reduce the total quantity of harmful pollutants either released into the environment or disposed off, thus also posing future liabilities. Any environmental benefit offered by pollution control practices is limited to reducing the risk associated with a specific pollutant, either transferring it from a less secure medium to a more secure one (for instance, from air emission to solid waste) or converting it to a more benign substance. Thus, no significant change in the quantity of pollutants is expected (Schmidheiny, 1992).

Industrial ecosystems are a new innovation in designing inter-organizational linkages. They consist of a network of organizations linked to each other through an ecological logic. Organizations within the network use each other's wastes, byproducts, and

outputs, to reduce the total use of energy and natural resources, and reduce the total waste and pollution from the system. Through inter-organizational cooperation they collectively minimize their impacts on the environment. The idea is to mimic natural ecosystems in which several organisms live in mutual interdependence to create stability and life sustaining ecosystem (Shrivastava, 1995).

2.4 Benefits of Green Manufacturing

There are many ethical reasons for the adoption of green manufacturing. However, taking a more clinical business view, the motives for adopting green manufacturing practices can be grouped into three categories: Regulation compliance, market value and cost reduction.

Regulation compliance plays a big role in an organization benefit of adopting green manufacturing practices. There is a growing body of environmental regulations such as ISO 9001, ISO 14000 and OHSAS 18000 that are forcing companies to reduce their resource consumption, to minimize their waste, and to take responsibility for the take-back of products at the end of the use phase (Kleindorfer et al., 2005). However, there are also other motives that currently drive companies to engage in green production. According to Williamson (2006), these can be classified into “business case” and “business performance” motives.

The opportunity for companies to use green manufacturing to enhance their reputation and strengthen their position in the marketplace constitutes the business case for green manufacturing to gain market value. Financial institutions increasingly price companies according to their social and environmental liabilities, thus leading

investors to take into consideration corporate green reputation during their acquisition decisions (Dobers et al., 2001). In a similar way, potential strategic partners, such as government agencies, suppliers, banks and other lenders, currently appear much more sensitive to social and environmental performance when selecting companies to create alliances (Miles & Covin, 2000). Indeed, in some business sectors, companies are claimed to be also spurred by competitors' green activism (Polonsky, 1994). Moreover, constantly growing pressures are being exerted by non-governmental organizations, such as Green Alliance in the UK or the Coalition for Environmentally Responsible Economies (CERES) in the US, which call for a central role of the environment in public policy and business practices (Miles & Covin, 2000).

Business performance motives are mainly related to environmental protection actions and generally understood as opportunities for cost savings and efficiency. Porter and Van der Linde (1995) provide several examples of how environment focused innovations can help companies use a range of inputs more productively. Such innovations include process enhancements, more complete material utilization, design simplifications, elimination of unnecessary packing, recycling of scraps, improved secondary treatments, reduced handling and disposal of discharges. There is substantial empirical evidence suggesting that the increase of resource productivity can offset the cost of environmental improvements, thus driving down the total cost of production (Corbett & Klassen, 2006). In addition, adopting an eco-efficiency perspective can aid plant-level productivity efforts (Kleindorfer et al., 2005; Rusinko, 2010). Here, the view of poor resource productivity as a form of economic waste is seen to evoke management techniques (Hart, 1995; Porter & Van der Linde, 1995)

and so to endorse the implementation of approaches such as total quality management, just-in-time, or lean production (Kleindorfer et al., 2005; Hart, 1995).

2.5 Factor Influencing Adoption of Green Manufacturing Practices

At a broader level, the factors influencing adoption of green manufacturing practices appear to fall into two clusters, namely: internal (organizational related) and external influences. There is a range of different organization-related green manufacturing factors influencing adoption of green manufacturing practices. The personal commitment of individuals (including founder and owner) has been found to be positively related to green manufacturing practices adoption (Corbett & Klassen, 2006). Having analyzed a leading organization in the environmental field, Wycherley (1999) found that the environmental activities undertaken at the site were seen as 'way of life'. The personal and ethical values of the founder of the company filtered through the whole organization. Interestingly, not top management but middle management's support is positively related to environmental manufacturing (Carter & Jennings, 2004). Operational and environmental improvement has been found to be positively related to employee involvement (Hanna, 2008).

The desire to reduce costs represents a common influencing force for green manufacturing (Handfield et al., 1997). Throughout a product's life cycle, pollution reflects hidden costs in the form of wasted resources and effort (Porter & Van de Linde, 1995). In Handfield et al., (2002) study, the company that excelled in green manufacturing practices was influenced neither by environmental compliance nor by a policy entrepreneur. The initiatives were often not even immediately apparent to customers. Instead, these initiatives were influenced by a focus on cost reduction,

waste elimination, and quality improvement. Environmental performance has been found to influence superior quality (Rothenberg, 2007). An increased pressure from investors has also been observed in the development of environmental policies (Trowbridge, 2001).

External factors that influence adoption of green manufacturing involves: government regulation and incentives, customers demand, stakeholder pressures, and competitive advantage. A significant body of research indicates that government regulation and legislation is a major influence for companies' environmental efforts (Handfield et al., 1997). Compliance driven companies, which were in a reactive mode, did not appear to have integrated environmental concerns into their value chain processes as thoroughly as companies which were initially motivated to do so. (Handfield et al., 2002). Governments are found to be more active towards green manufacturing. For the fulfillment of the same they provide economic compensation to the firms which help a lot to motivate the firms towards adoption of green practices (Lassar & Gonzalez, 2008).

Customer demands take a long-term green manufacturing perspective; it has a more positive influence on environmental management in contrast to customer requests which involve an unreasonable timeframe (Carter & Jennings, 2004). Customers exert pressure on organizations to engage in environmental practices (Rothenberg, 2007). Small companies are especially under pressure from their customers (Hall & Soskice, 2001). Competitors, as potential environmental technology leaders, may be able to set industry norms and/or legal mandates and thus clearly have the ability to drive environmental innovation (Henriques & Sadosky, 1999). A proactive environmental

strategy can help a firm to gain competitive advantage through the development of manufacturing capabilities (Zhu & Sarkis, 2005).

The deterioration of the environment over recent decades has drastically increased the public's awareness of environmental issues. The public is increasingly influenced by a company's reputation with respect to the environment when making manufacturing decisions (Keogh & Polonsky, 1998). They demand more environmentally friendly products (Handfield et al., 2002) and are more socially conscious. Public pressure and stakeholders are causing firms to review their environmental manufacturing practices (Delmas & Toffel, 2008) and is most visible from activist campaigners, non-governmental organizations (NGOs) or green pressure groups (Hall & Soskice, 2001).

2.6 Empirical Review

Recent years have seen a rapid expansion in both the interest and body of literature on green manufacturing. Dangayach and Deshmukh (2001) recognize the relatively infantile nature of environmental matters in the mainstream manufacturing and operations strategy research and argued for more studies in this area. Rahimifard and Clegg (2007), in their editorial of the special issue on green manufacturing design concluded that there is an urgent and imperative need for further research in every phase of a product's life-cycle. There is little to indicate that the challenges particular to manufacturing are any exception. This situation is succinctly captured by (Linton et al., 2007) when they argue that we must enlarge our perspective in operations management to include "the planet" because companies will be expected to do so.

In Kenya most research has been done in green supply chain but a few in green manufacturing. Ong'ong'o (2012) carried a study on factors affecting adoption of green technology by firms in Kenya. The study employed descriptive survey design. The study found that government policy is the major factor affecting adoption of green technology. Although there has been some anecdotal evidence that links green manufacturing practices and financial success, empirical studies have not established consistent evidence that it enhances firm performance (King & Lenox (2001). Griffin and Mahon (1997) found that it is not clear that green manufacturing leads to improved performance. Hence the study intends to fill this gap. Also a resource based theory view of the firm provides a promising framework that links green manufacturing and firm performance, from the literature there is limited evidence to support the causal relationship between green manufacturing and improved performance (Barney, 2001).

Considering literature in green manufacturing in general, authors publishing green manufacturing have been from the USA or the UK than other nations. However, a few relevant papers have also emerged from other European countries. None is cited from Africa specifically Kenya hence this motivates the study (Griffin & Mahon, 1997). The literature of green manufacturing is also missing green manufacturing practices in the food industry from growing economy that can give the extent to which it has been adopted, factors influencing the adoption of green manufacturing practices and their benefits. This research therefore intends to fill this gap.

The study will differ from the previous research as follows: will focus on green manufacturing adoption in food processing firms in the Mombasa County since most

of the previous studies were based on the developed economies where the business environment is different. The study will focus on green manufacturing in food processing industry as most research has been done in other manufacturing sectors. Since most research in Kenya focused on a broad study on Green supply chain management and as manufacturing is the core business area in supply chain, more study is required in green manufacturing.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology employed to study the adoption of green manufacturing practices of food processing firms in Mombasa County. The following segments are covered in the chapter: research design, the population, sampling design, data collection, and data analysis.

3.2 Research design

Cross sectional survey research design was used as it is appropriate where the overall aim is to establish whether significant associations among variables exist at some point in time. Cross sectional survey design was effectively used by Florida (2001) in surveying environmental management system inside and outside the factory. Zutshi and Sohal (2004) used the same design in analyzing the relationship between environmental motivation and ISO 14001 certification. Lastly, Zhu and Sarkis (2004) used it in studying green supply chain management implications. This design was chosen as conclusions will be based on the information provided at the time of study.

3.3 Population of the Study

The population of this study consisted of all food processing firms in Mombasa County. According to the Kenya Bureau of Standards, there were 187 food processing firms registered with diamond marklabel asof October 2013 (KEBS, 2013).

3.4 Sampling Design

The study employed the purposive sampling technique. The sample comprised of all 66 food processing firms registered by the Kenya Association of Manufacturers (KAM, 2013). The primary reason why the sample was strictly limited to these firms is because they are perceived to be well organized and structured, and getting information is easy.

3.5 Data Collection

Primary data was used for this study. The data were collected using a structured questionnaire that was administered using 'drop and pick later' method. The questionnaires were dropped to Human resource managers, production managers, maintenance managers and quality assurance managers. The questionnaire allowed for a more flexible and comprehensive view in obtaining relevant information through structured open and closed ended questions. The questionnaire was divided into four sections. The first part consisted of the company's basic information, the second section consisted questions relating to green manufacturing practices adoption, the third section comprised of questions on the perceived benefits of adopting green manufacturing practices, and the last section looked at factors influencing adopting of green manufacturing practices.

3.6 Data Analysis

The data was first checked for completeness, consistency and accuracy. It was then coded. The data collected was analyzed using descriptive statistics (percentages, frequency, average scores and standard deviations). This is because the data collected was descriptive in nature. The percentages and frequency were used to examine the

company's basic information. Mean scores and standard deviations of the survey were used to give extent to which green manufacturing practices were adopted, perceived benefits and factors influencing adoption of green manufacturing practices.

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter introduces the analysis of the data collected and interpreted on adoption of green manufacturing practices by food processing firms in Mombasa County, Kenya. Of the 66 targeted firms, 38 of them responded representing 58% response rate considered adequate to constitute a basis for valid conclusion.

4.2 Company's Basic Information

4.2.1 Length of Time in Operation

Table 4.2 illustrates the percentage of the length of time firms have been in operation. According to table 4.2, 21.1% of the firms have been operating for less than five (5) years, while zero percent between five to ten (5-10) years, and 7.9% ten to twenty (10-20) years, and the remaining 71.1% of the firms have been operational for over twenty (20) years. This finding illustrates that majority of Food processing firms in Mombasa County has been in operation for more than 20 years in Kenya. Therefore this implies that they might have realized the environmental effects of their operations and started considering or implemented green manufacturing practices.

Table 4.2: Length of Time in Operation

Time	Frequency	Percentage (%)
Less than 5yrs	8	21.1
5-10yrs	0	0.0
10-20yrs	3	7.9
More than 20yrs	27	71.1
Total	38	100

4.2.2 Number of Employees

Table 4.3 illustrates the percentage of the size of the staff of the food processing firms in the Mombasa County, Kenya. From the findings, Zero percent had less than twenty five (25) employees, 42.1% of the firms had between twenty five to hundred (25-100) employees, zero percent hundred to three hundred (100-300) employees, 57.9% had between three hundred to a thousand (300-1000) employees and none had over a thousand employees. This research finding shows that the majority of food processing firms had employees between three hundred and a thousand. This implies that the most of the firms are medium to large size that requires more resource such as energy and raw material that have negative environmental effects. Hence green manufacturing adoption might have been considered as a means of reducing this consumption of resources to cut costs and reduce the negative environmental effect.

Table 4.3: Number of Employees

Number of Employees	Frequency	Percentage (%)
Less 25	0	0
25-100	16	42.1
100-300	0	0
300-1000	22	57.9
Greater than 1000	0	0
Total	38	100

4.2.3 Whether Firms has an Environmental Management Department

Table 4.4 shows the percentage of food processing firms in Mombasa County, Kenya that had established environmental management department. The respondents were asked to indicate whether they had established an environmental management department. The results show that 89.5% of the firms had an environmental department while 10.5% didn't. This implies that most food processing firms are either practicing or are considering practicing green manufacturing practices.

Table 4.4: Environmental Management Department

Presence of Environmental Department	Frequency	Percentage (%)
Yes	34	89.5
No	4	10.5
Total	38	100

4.2.4 Presence of Environmental Management Policy

Table 4.5 illustrates the portion of the food processing firms in Mombasa County, Kenya that had established the environmental management policy. From the table, 81.6% of the firms had established the environmental management policy while 18.4% had not. This research finding shows that the majority of food processing firms in Mombasa County had established the environmental management policy. Implying that most food processing firms are environmental conscious thus have started or intend to implement green manufacturing practices.

Table 4.5: Presence of Environmental Management Policy

Presence of Environmental Policy	Frequency	Percentage (%)
Yes	31	81.6
No	7	18.4
Total	38	100

4.2.5 Registration with Environmental Management Body

Table 4.6 shows the percentage of the food processing firms in Mombasa County, Kenya that were registered with environmental management body. The table shows that 78.9% were registered while 21.1% were not. This research finding illustrates that the majority of food processing firms in Mombasa County were registered with environmental management body. Implying that external pressure such as government legislation and regulations, customers and investors are playing key role in forcing these firms to adopt green manufacturing practices.

Table 4.6: Registrations with Environmental Management Body

Registration With Environmental Body	Frequency	Percentage (%)
Yes	30	78.9
No	8	21.1
Total	38	100

4.3 Green Manufacturing Practices

This section highlights the findings on green manufacturing practices adopted by food processing firms in Mombasa County, Kenya. To measure the extent to which these practices were adopted, a 5-Likert scale was used where: 1 representing not being considered, 2-future consideration, 3-planning to implement, 4-currently implementing, and 5-successfully implemented.

Table 4.7 shows the results, from the table the most adopted green manufacturing practices is energy (energy conservation, efficiency, recovery, fuel recovery installation energy efficient equipment), with a mean score of 4.63, this is followed by packaging (returnable, reduced, recyclable packages) with a mean of 4.21 and waste reduction (reactive) 4.16. This confirms the earlier finding from section 4.2.2 that most food processing firms are large in size and as a result are consuming a great deal of energy in their operations thus they have given energy management practice a priority. Also this implies that food processing firms use a lot of packaging materials thus generating a great deal of waste and as a result have put measures to reduce these wastes.

The least adopted Green Manufacturing Practices are; design for eco-efficient products, remanufacturing, product development and innovation, spreading risks and substitution with mean scores of 2.89, 2.79, 2.79, 2.68, and 2.47 respectively. This implies that these food processing firms have not allocated financial resources to long term investment on pollution prevention practices that do not have immediate returns on investment and they lack latest technology to substitute old technology for green manufacturing practices. It also demonstrates that the food processing firms lack the knowledge, experience and tools to effectively and efficiently adopt proactive green manufacturing practices.

Other practices that were cited included, environmental risk analysis (3.89), resource allocation (3.89), creating market for waste products (3.89), consuming wastes internally (3.74), environmental information (3.63), waste reduction (proactive) (3.53), specific design targets (3.53), environmental participation (3.39), environmental management system (3.50), communication (3.53), commitment from senior managers (3.42), environmental participation (3.39), design for environment (3.32), and recycling wastes (3.21), they were considered to be planned for implementation. The overall mean was 3.48 this indicates that most firms are at planning phase of adopting green manufacturing practices.

Table 4.7: Green Manufacturing Practices

Green Manufacturing Practices	Mean	Std. Deviation	Ranking
Energy: energy conservation, efficiency, recovery, fuel recovery installation energy efficiency equipment.	4.6316	0.4889	1
Packaging: returnable, reduced, recyclable packages	4.2105	1.1427	2
Waste reduction (reactive)	4.1579	1.5162	3
Creating a market for waste products	3.8947	1.2034	4
Money spent on environmental initiatives: resource allocation.	3.8947	1.2034	5
Environmental risk analysis	3.8947	1.0078	6
Consume internally: consume waste or scrap internally.	3.7368	1.2667	7
Environmental information: tracking, capturing.	3.6316	1.7151	8
Waste reduction (proactive)	3.5263	1.3703	9
Specific design targets	3.5263	1.6561	10
Communication : stakeholders	3.5263	1.3703	11
Environmental management system	3.5000	1.3305	12
Commitment of green manufacturing from senior managers	3.4211	1.6543	13
Environmental participation	3.3947	1.3262	14

Design for environment	3.3158	1.5787	15
Recycling wastes	3.2105	1.7577	16
Design eco-efficiency products	2.8947	1.9142	17
Remanufacturing	2.7895	1.6301	18
Product development and innovation	2.7895	1.7577	19
Spreading risks	2.6842	1.7101	20
Substitution.	2.4737	1.4470	21
Overall Mean	3.4812		

4.4 Perceived Benefits of Adopting Green Manufacturing Practices

This section highlights research findings on the Perceived benefits of adopting green manufacturing practices by food processing firms in Mombasa County, Kenya. To assess the extent to which respondents considered the various benefits. A 5-point Likert scale was used, where 1 means not at all, 2-a little bit, 3-to some degree, 4-relatively significant and 5-significant.

Table 4.8 shows the results, from the table, most companies had a mean score of (4.39) they considered a reduction in waste water as the key benefit of adopting green manufacturing practices, followed by a reduction in the frequency of environmental accidents (4.26), improved firm's reputation (4.16) and decrease in scrap rate (4.16). This indicates that most food processing firms use a lot of water in their processes for example cooling, steam generation, cleaning and as a raw material thus reduction in waste water will cut cost of water treatment and overall water bill. As noted in section 4.3 that most firms consider adopting green practices of reducing packaging materials wastes and reduction of other wastes this indicates that more benefits could be earned

through this reduction in scrap rate. The results also mean that food processing firms are competing amongst themselves and they are as well facing external pressure from stakeholders to adopt green manufacturing practices that is why they consider the good environmental reputation as one of the key benefits of adopting green manufacturing practices. Environmental accidents lead to big loss and will as well contribute to the loss of a company's reputation and loss of property that might be the reason why these firms have considered reduction of these accidents as one of the major perceived benefits.

The least perceived benefits from the results were, improved innovation performance, decrease in fine for environmental accidents, and the cost of saving for environmental projects with mean scores of 3.53, 3.34, and 3.32 respectively. This means that these firms have not invested in long-term strategy of adopting green manufacturing practices this might be the reason why they have not considered long-term benefits mention above.

Other perceived benefits considered were; reduction of solid wastes (4.05), improved capacity utilization (4.05), promoting product quality (3.95), environmental certification (3.89), decreases of fee of waste discharge (3.87), decrease in cost of raw materials (3.92), sales growth (3.92), decrease in the cost of energy consumption (3.82), continuous improvement (3.71), innovative products (3.63), and reduction of air pollution (3.57). The overall mean was 3.86, indicating that most food processing firms had perceived adopting green manufacturing practices will have relative significant benefits.

Table 4.8: Perceived Benefits of Adopting Green Manufacturing Practices

Perceived Benefits of Adopting GM Practices	Mean	Std. Deviation	Ranking
Reduction of waste water	4.3947	0.9455	1
Reduction of frequency of environmental accidents	4.2632	0.7235	2
Improved firms environmental reputation	4.1579	0.8229	3
Decrease in scrap rate	4.1579	0.8229	4
Reduction of solid wastes	4.0526	0.7693	5
Improved capacity utilization	4.0526	0.7693	6
Promote product quality	3.9474	0.8366	7
Sales growth	3.9211	1.4215	8
Decrease in cost of materials	3.9211	1.2602	9
Environmental certification	3.8947	1.2034	10
Decrease of fee for waste discharge	3.8684	1.0698	11
Decrease in the cost of energy consumption	3.8158	1.2048	12
Continuous improvement	3.7105	1.2282	13
Innovative products	3.6316	1.5143	14
Reduction of air pollution	3.5789	1.1998	15
Innovation performance	3.5263	1.5199	16
Decrease in fine for environmental accidents	3.3421	1.1217	17
Cost saving for environmental projects	3.3158	1.3578	18
Overall mean	3.8640		

4.5 Factors Influencing Adoption of Green Manufacturing

This section highlights research findings on the factors influencing the adoption of green manufacturing practices by food processing firms in Mombasa County, Kenya. To assess the extent to which various factors influencing adoption of green manufacturing practices the study used 5-Likert scale, where 1 means not at all important, 2-not important, 3-not thinking about it, 4-important and 5-extremely important.

The results are shown in table 4.9. From the table, organization capabilities and awareness demand for environmentally friendly products and desire for economic benefits were found to be the primary motivation for adoption of green manufacturing practices with a mean score of 4.26, 4.32 and 4.21. This implies that most food processing firms had acquired organizational capabilities and awareness since most of them had operated for over twenty years and were ready to embrace the green manufacturing practices. Consumers are also exerting pressure for these firms to adopt green manufacturing practices and as the cost of energy, raw material, and process rework are ever increasing firms are motivated to reduce these costs. Finally this finding highlights the power and effectiveness the firms' capabilities and stakeholder pressure has on promoting environmental concerns in food processing firms. The impression obtained from the study environmental legislation undoubtedly played key role in green manufacturing adoption. Also recognizes that pollution reflects hidden costs by considering implementing energy saving practices such as fuel recovery this was due to the firm's desire to reduce costs.

The least factors influencing adoption of green manufacturing were; investors and shareholder pressure, improved technology of converting wastes into new products and limited space available for disposal had mean scores of 3.42, 3.42 and 3.32 respectively. The results imply that most of the firms are owned either by family or they are not listed in stock exchange thus shareholders have no influence on their business. Kenya is a growing economy, acquiring latest technology is costly thus the results indicate that there is lack of long-term investment in technology by these food processing firms. Lastly, the study indicates that the land is not a big issue as most firms can acquire land to dispose their wastes with little cost.

Other factors that influence adoption of green manufacturing that were considered includes: government rules and regulations (4.11), a desire for improved quality (4.11), environmental concern of the firm (4.03), scarcity of resources (3.95), customer's awareness and pressure (3.92), green image (3.84), employee motivation, health and safety (3.71), society or public pressure (3.63) desire for continuous improvement (3.53) and economic compensation by the government (3.42). The overall mean for the study was 3.71, indicating that the factor listed are important in influencing the adoption of green manufacturing practices.

Table 4.9: Factors Influencing the Adoption of Green Manufacturing Practices

Factors Influencing Adoption of GMP	Mean	Std.	Ranking
		Deviation	
Demand for environmentally friendly products	4.3158	1.1649	1
Organizational capabilities & awareness	4.2632	0.8280	2
Desire for Economic benefit (cost reduction)	4.2105	1.1427	3
Government rules and legislation	4.1053	1.1099	4
Desire for Improved quality	4.1053	1.1099	5
Environmental concerns of the firm	4.0263	1.2189	6
Scarcity of resources, high waste generation & waste disposal problem	3.9474	1.4510	7
Customer's awareness, pressure & support	3.9211	1.2602	8
Green image, Global marketing & competitiveness	3.8421	1.4051	9
Employee motivation, health & safety	3.7105	1.0374	10
Society or public pressure	3.6316	1.3640	11
Desire for continuous improvement	3.5263	1.6561	12
Economic compensation by government	3.4211	1.7184	13
Investor's & shareholder pressure	3.4211	1.4451	14
Improved technology of converting waste into new products	3.4211	1.6543	15
Limited space available for disposal	3.3158	1.8322	16
Overall mean	3.8240		

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the researcher summarizes findings from this study and provides the conclusions. The research also presents recommendations on areas that were set up to have gaps. Lastly, the researcher closes with suggestions on areas that needed further research on this topic.

5.2 Summary

The aim of this study was to ascertain the extent of adoption of green manufacturing practices by food processing firms in Mombasa County, Kenya. The survey also sought to determine perceived benefits of adopting green manufacturing practices, and factors influencing adoption of green manufacturing by these firms. This section draws conclusions from the research findings in this study.

Research findings show that the majority of the firms: had been in operation for more than 20years (71.1%), and had between 300-1000 employees (57.9%), further 78.9% of the firms were registered with an environmental management body, 89.5% had environmental department and 81.6% of the firms had established an environmental policy. This shows these firms had well established systems to manage their environment.

With regard to the extent of green manufacturing practice adoption, the study showed that the most adopted green manufacturing practice includes: Energy (energy conservation, efficiency, recovery, fire recovery installation energy efficient

equipment), packaging (returnable, reduced, recyclable packages), and waste reduction (reactive). And it also found that the least adopted are: remanufacturing, product development and innovation, spreading risks and substitution. In overall the study found the adoption of green manufacturing practices is in the implementation phase.

With regards to perceived benefits of adopting green manufacturing practices by food processing firms in Mombasa County, Kenya. Reduction of waste water, reduction of frequency of environmental accidents, decrease in scrap rate, improved firm's environmental reputation, and decrease in scrape rate were established to be the major perceived benefits. The least perceived benefits include: improved innovation performance, decrease in fine for environmental accidents, and cost saving for environmental projects. The overall indication from the study was that there are relative significant benefits of adopting green manufacturing practices.

Ultimately, the study collected and analyzed data on factors influencing adoption of green manufacturing practices by food processing firms in Mombasa County, Kenya. According to the research findings, organization capabilities and awareness, demand for environmentally friendly products, the desire for economic benefit, government rules and legislation, environmental concern of the firm, customer awareness and pressure, scarcity of resources, green image, employee motivation, health and safety, and public pressure were found to be the major factors influencing adoption of green manufacturing practices. While a desire for continuous improvement, improved technology of converting waste into new products, investors and shareholder pressure, and economic compensation by the government were found to have less influence.

5.3 Conclusions

From the study's findings, it can be concluded that, most food processing firms in Mombasa County, Kenya are at the planning phase of adopting green manufacturing practices. The major green manufacturing practices established was, energy (energy conservation, efficiency, recovery, fuel recovery installation energy efficient equipment), packaging (returnable, reduced, recyclable packages), and waste reduction (reactive). These results are echoed by other studies. Shrivastava (1995) noted that recycling packaging and waste reduction can conserve and enhance the natural environment.

Products development and innovation, spreading risks and substitution were considered as least adopted green manufacturing practices. To embrace these practices requires long-term investment and commitment by the firm thus most firms don't take them in early (Hart, 1995).

The major factors influencing food processing firms to adopt green manufacturing practices include; organization capabilities, demand for environmentally friendly products and desire for economic benefits. This is echoed by a previous study done showing an increasing awareness of green manufacturing practice issues can increase consumer demand for products (Kleindorfer et al., 2005), and more stakeholders are asking or requiring organizations to be more environmentally responsible and eco-efficient with respect to their products or processes (Dangayach & Deshmukh, 2001; Rusinko, 2010). And the desire to reduce costs was found also to represent a common influence force for green manufacturing practices by other studies (Handfield et al., 2002). While improved innovative performance, decrease in fine for environmental

accidents and the cost of saving for environmental management projects were found to have less influence. This was also mentioned in previous studies as knowledge based factors that influence adoption of green manufacturing they are pricey and hard to copy or implement (Hart, 1995).

Ultimately, the potential benefits of adopting green manufacturing established include: reduction of waste water, reduction of frequency of environmental accidents, decrease in scrap rate, improved firm's environmental reputation, and decrease in scrap rate. The same findings were observed by previous studies which provides several examples how environmentally focused practices can help firms use a range of inputs (packaging, recycling of scraps) more productively (Porter & Van der Linde: 1995). Improved innovation performance, decrease in fine for environmental benefits and monetary value of saving for environmental management tasks were found to offer least benefits. This was also identified by previous studies as practices that require huge investment and the returns are unpredictable thus firms don't consider them as immediate benefits (Davis, 1993).

5.4 Recommendations

Based on the conclusion drawn in section 5.3 above, the researcher made the following recommendations: First and foremost food processing firms in Mombasa County should focus on preventing pollution at the source in products as well as manufacturing process rather than reactive strategy. High disposal cost was identified as one of the major factors influencing adoption of green manufacturing practices and has led to green consciousness. Firms need to ensure they utilize whole life costing when procuring inputs, by taking disposal measure and cost into account.

Product development and innovation, and design eco-efficient products practices these concepts of green design had low mean scores therefore firms can enforce these practices through the use of biodegradable raw materials and inputs in the design of buildings and continuously upgrade their product offering to conform with their environmental requirements as it may be the case that using environmentally sensitive design process does in fact result in greater product innovation and thus higher firms performance.

Food processing firms should also strive at achieving green manufacturing through remanufacturing and substitution, this will enhance: efficiency and synergy in the society, environmental performance and reduce waste to achieve cost savings. Allocation of investment towards green manufacturing practices towards the above pollution prevention practices offers the most promising path. To make such investment, firms must develop strategic organizational resources to enable the recognition and deployment of pollution prevention green manufacturing practices.

Secondly, food processing firms should act fast and implement green manufacturing practices since there are potential benefits such as reduction of waste water, reduction of scrap rate and promotion of product quality which in return will increase sales growth.

Finally, the researcher recommends that since government rules and legislations and organization capabilities are the major drivers of adoption of green manufacturing practices they should review their policies and allocate more resources to ensure effective adoption and implementation of green manufacturing practices.

5.5 Limitations of the Study

This study was limited by the fact that some respondents deemed the information required as confidential. As such, some questions were left unanswered. Also only one sector of the industry was covered that is food processing industry thus more study should be extended in other industrial sectors. Lastly only a section of food processing firms were considered that is food processing firms registered by the Kenya Association of Manufacturers to enable generalization all food processing firms in Mombasa county should be analyzed.

5.6 Suggestions for Further Research

The researcher recommends that future research should be undertaken in adoption of green manufacturing practices by other economic sectors such as mining industry and service, since they contribute much to the growth of the economic system. The relationship between adoption of green manufacturing practices and firm's performance should also be examined. For the green manufacturing practices that were identified to be at the implementation stage, it will be worthwhile to dissect them in depth and establish their relationship with firm's competitive advantage. For more authoritative conclusion on green manufacturing practices, the research recommends a study on relationships between green manufacturing and performance based on objective empirical data rather than opinions and perceptions that were used in that field.

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APPENDICES
Appendix 1: Letter of Introduction



UNIVERSITY OF NAIROBI
MOMBASA CAMPUS

Telephone: 0202059161
Telegrams: "Varsity", Nairobi
Telex: 22095 Varsity

P.O. Box 99469
Mombasa, Kenya

28th August, 2013

Dear Respondent,

RE: INTRODUCTORY LETTER

I am an MBA student at the School of Business, University of Nairobi and currently undertaking my research project titled "*Adoption of Green Manufacturing Practices by Food Processing Firms in Mombasa County, Kenya*". The Attached questionnaire is for gathering data which will be useful in the mentioned research.

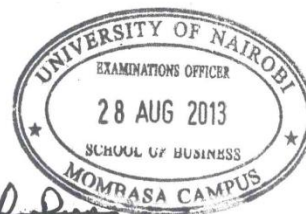
You have been selected as one of the respondents in this study. This is therefore to kindly request you to complete the attached questionnaire or accord me an opportunity to help you complete it.

My Supervisor and I assure you that the information sought is purely for academic purpose and will be treated with utmost confidentiality. A copy of the final report will be available to you on request.

I hope my request will meet your due consideration.

Yours faithfully,

Nyakundi Bonface Momanyi
0712 061 068
nyakundibonface96@gmail.com



Stephen Ochieng
Mr. Odock Stephen Ochieng,
Lecturer,
Department of Management Science.

/maa

Appendix 2: Questionnaire

The questionnaire contains four parts: Company's' basic information, green manufacturing practices, perceived benefits of green manufacturing practices, and factors influencing adopting of green 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) Greater 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) Greater 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

Section B: Green Manufacturing Practices

6. Please tick extent to which your organization has implemented listed green manufacturing practices using the following scale: 1- not being considered, 2- future consideration, 3-planning to implement, 4-currently implementing, 5- successfully implemented.

	1	2	3	4	5
Recycling wastes e.g. Office papers and production process failures.					
Waste reduction (proactive) e.g. Pollution prevention, elimination					
Waste reduction (reactive) emission reduction. e.g. scrubbers, incineration, treatment of wastes					
Remanufacturing					
Substitution.					
Consume internally: consume waste or scrap internally.					
Packaging: returnable, reduced, recyclable packages					
Spreading risks					
Creating a market for waste products					

Energy: energy conservation, efficiency, recovery, fuel recovery installation energy efficiency equipment.					
Money spent on environmental initiatives: resource allocation.					
Commitment of green manufacturing from senior managers					
Environmental information: tracking, capturing.					
Environmental participation					
Design for environment					
Product development and innovation					
Design eco-efficiency products					
Specific design targets					
Environmental risk analysis					
Environmental management system					
Communication : stakeholders					

Any other green manufacturing practice you have adopted (please specify)

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Section C: Perceived Benefits of Adopting Green Manufacturing Practices.

7. Please rate the following benefits to green manufacturing practices adoption to your organization using a five point scale: 1-not at all, 2-a little bit, 3-to some degree, 4-relatively significant and 5-significant

	1	2	3	4	5
Reduction of air pollution					
Reduction of waste water					
Reduction of solid wastes					
Reduction of frequency of environmental accidents					
Improved firms environmental reputation					
Decrease in cost of materials					
Decrease in the cost of energy consumption					
Decrease of fee for waste discharge					
Decrease in fine for environmental accidents					
Decrease in scrap rate					
Promote product quality					
Improved capacity utilization					
Environmental certification					
Cost saving for environmental projects					
Sales growth					
Innovation performance					
Continuous improvement					

Innovative products					
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Any other benefit (please specify)

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Section D: Factors Influencing Adoption of Green Manufacturing Practices

7. Please rate the following factors influencing the adoption of green manufacturing practices using a five point scale: 1- not at all important, 2-not important, 3-not thinking about it, 4-important 5-extremely important.

	1	2	3	4	5
Government rules and legislation					
Society or public pressure					
Green image, Global marketing & competitiveness					
Desire for Economic benefit (cost reduction)					
Desire for Improved quality					
Customer's awareness, pressure & support					
Demand for environmentally friendly products					
Employee motivation, health & safety					
Environmental concerns of the firm					

Organizational capabilities & awareness					
Economic compensation by government					
Investor's & shareholder pressure					
Scarcity of resources, high waste generation & waste disposal problem					
Desire for continuous improvement					
Limited space available for disposal					
Improved technology of converting waste into new products					

Any other reason (please specify)

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Appendix3: Food Processing Firms in Mombasa County Registered by KAM.

SN	FOOD PROCESSING FIRMS IN MOMBASA COUNTY KENYA
1	AFRICAN TEA & COFFEE CO. LTD
2	AFRO TEAS LIMITED
3	AHSAS AFRICA ENTERPRISE
4	ALLFRUITS EPZ
5	ALYSCO FOODS
6	ATTA KENYA LTD - [MOMBASA]
7	AYWAA FOODS LTD
8	BAKE 'N' BITE LTD [MSA]
9	CEREALS EAST AFRICA
10	CHAI TRADING CO. LTD
11	CHOICE KENYA LIMITED
12	COASTAL BOTTLERS LTD
13	DEEPAN MANUFACTURERS
14	DIAMOND INDUSTRIES LIMITED [MSA]
15	DISCOVER KENYA TEA LTD
16	EASTERN PRODUCE KENYA LTD - MBARAKI (MSA)
17	EMERALD FOODS
18	FAYAZ BAKERS LTD- CHANGAMWE BAKERY
19	GOLD CROWN BEVERAGES (K) LTD [MSA]
20	GOLD CROWN BEVERAGES (K) LTD [MSA]
21	ISLAND TRADING LTD

22	ITALIAN GELATI & FOOD PRODUCTS LIMITED
23	JANISH TEA LTD
24	KANAM INDUSTRIES LTD
25	KENSALT LTD-CHANGAMWE
26	KENYA BIXA LTD
27	KENYA COFFEE & TEA SPECIALISTS
28	KITUI FLOUR MILLS LTD
29	KRYSTALLINE SALT (MSA) LTD (CHANGAMWE)
30	LAB INTERNATIONAL (K) LTD [MSA]
31	LIBRA FOOD PRODUCTS LTD
32	M.A PANDIT & CO LTD
33	M.B. SALLOO & COMPANY LTD
34	MAGIC JUICE LIMITED
35	MASASADA INTERNATIONAL LIMITED
36	MAWA DAIRY FARM
37	MILLENIUM TOMATO SAUCE
38	MILLY FRUIT PROCESSORS LTD
39	MOMBASA GRAIN MILLING COMPANY
40	MOMBASA MAIZE MILLERS LTD (MSA)
41	MWANAINCHI BAKERS AND CONFECTIONERS
42	MZURI SWEETS LTD
43	N.P. HALAI
44	NAIVAS LIMITED - MOMBASA
45	NAVIDA NATURAL FOODS LIMITED

46	NEW KCC LTD - MIRITINI
47	PRIDE INDUSTRIES LTD
48	PWANI OIL PRODUCTS (JOMVU)
49	PWANI OIL PRODUCTS (JOMVU)
50	RAHA FOOD PRODUCTS
51	REGERIA LTD
52	SASINI LIMITED
53	SERENDI KENYA LIMITED
54	SHIFA BAKERS & CONFECTIONERS
55	SHIRE INTERNATIONAL CO. LTD
56	SMART TEA KENYA ENTERPRISES
57	SWEET R US LTD
58	T.S.S GRAIN MILLERS LTD
59	TAPIOCA LTD
60	TOP NUT FOODS & BEVARAGES
61	TUSKER MATTRESSES-DIGO
62	UNIMAIZE LTD (MSA)
63	WEST COAST OIL EAST AFRICA LIMITED
64	ZAMEEL SPICES & FOOD PRODUCTS
65	ZAVERCHAND PUNJA LTD
66	ZEIT ICE