

**Factors Influencing the Adoption of Environmental Management Accounting
(EMA) Practices among Manufacturing Firms in Nairobi, Kenya**

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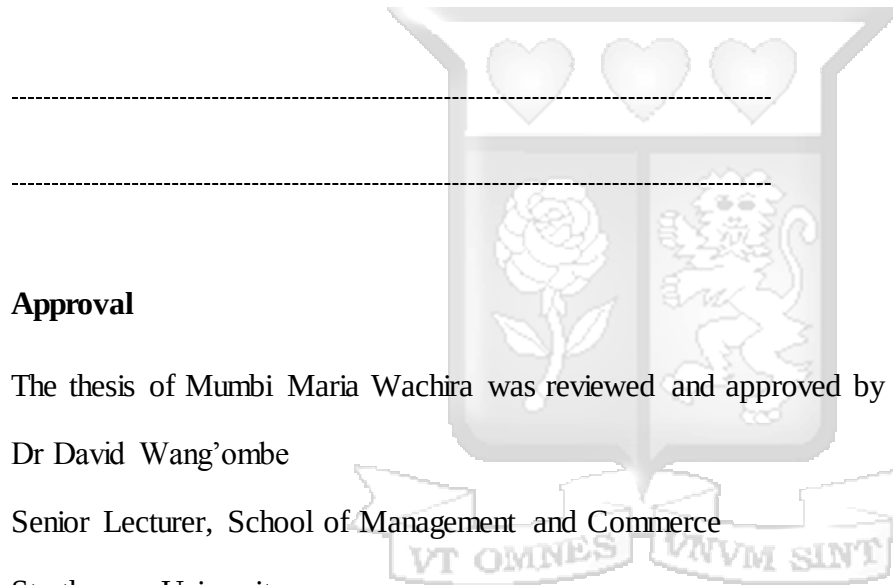
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Abstract

Concerns about the preservation of the environment have encouraged businesses to implement environmental management accounting (EMA) practices which has been shown to contribute to managerial decision making. However local manufacturing entities have been reluctant to adopt EMA, thus this research seeks to establish if there is a business case for the adoption of EMA practices. The study used surveys to establish the levels of adoption of EMA practices, which were consequently tested against the factors identified in the research using both simple and multiple regression analysis. Next, semi-structured interviews were conducted to complement the findings from the questionnaires. The findings of the study reveal that the costs of compliance, the environmental strategies employed by an organization and the organization's financial performance are able to explain the variability in the levels of adoption of EMA practices. This research offers a preliminary understanding of the techniques used in EMA and those that are prevelently used by manufacturing companies operating in Nairobi. The study will be particularly useful to the Kenya National Cleaner Production Center (KNCPC), since it is a governmental body mandated with the task of training manufacturing businesses in EMA and promoting resource efficiency among local manufacturers. The results from the research can be used to make structural changes in the way EMA trainings are conducted by the KNCPC. Furthermore, the findings can encourage production managers of manufacturing entities to promote efficienct production through the implementation of EMA practices.

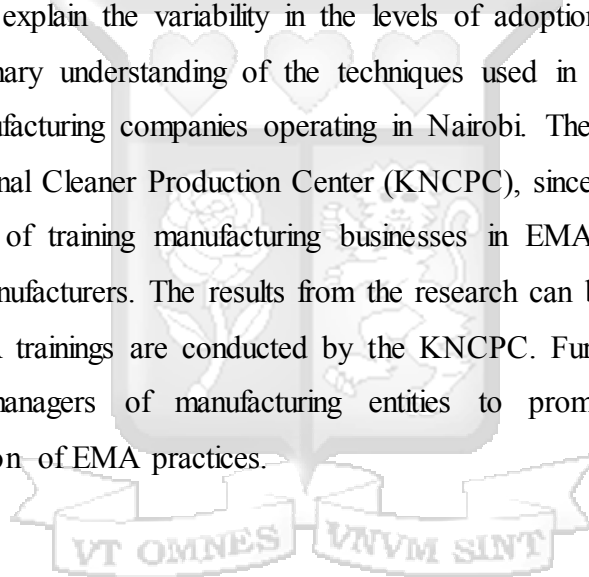
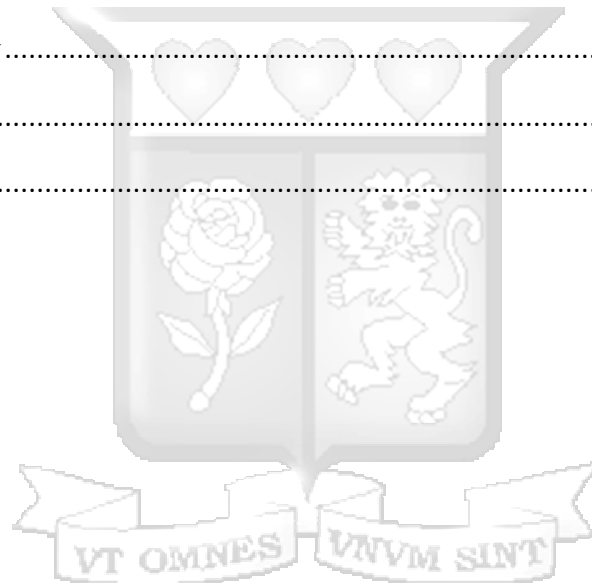


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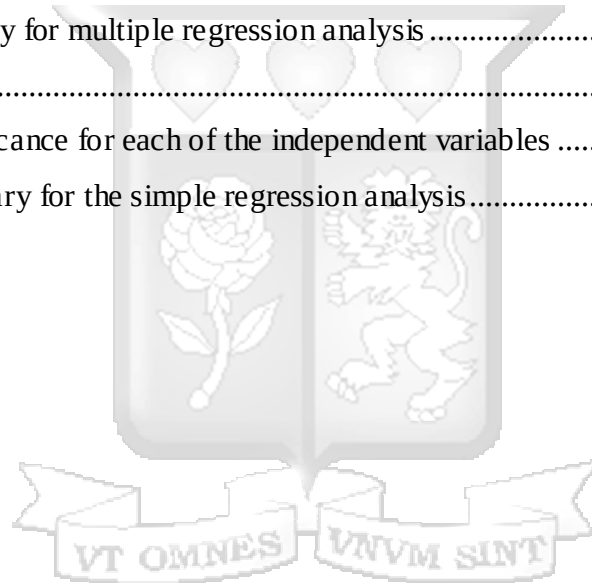
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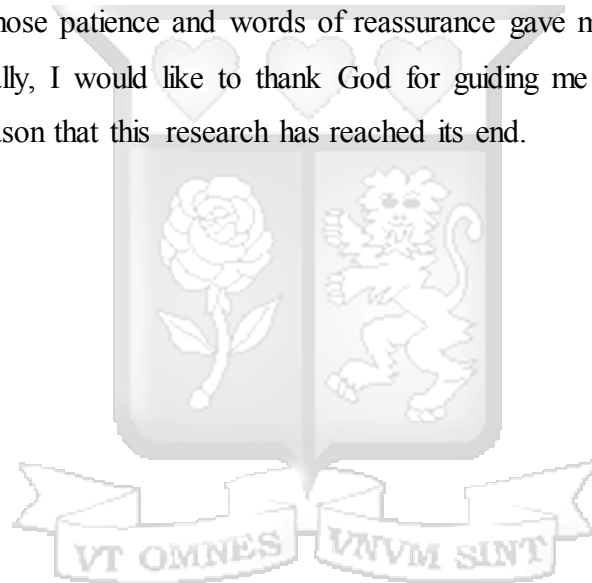


List of Abbreviations

UNEP	United Nations Environmental Program
GHGs	Green House Gases
UNFCCC	United Nations Framework on Climate Change
UNSD	United Nations Division on Sustainable Development
EFA	Environmental Financial Accounting
EMA	Environmental Management Accounting
IFAC	International Federation of Accountants
IAS	International Accounting Standards
NEMA	National Environmental Management Authority
KNCP	Kenya National Cleaner Production Center
UNIDO	United Nations Industrial Development Organization
EPI	Environmental Performance Indicator
EA	Environmental Accounting
MEMA	Monetary Environmental Management Accounting
PEMA	Physical Environmental Management Accounting
ABC	Activity Based Costing
LCA	Lifecycle Assessment
FCA	Full Cost Accounting
TCA	Total Cost Assessment
IMA	Institute of Management Accountants
EPA	Environmental Protection Agency
EBSC	Environmental Balanced Scorecard
ECA	Environmental Cost Accounting
MFA	Materials Flow Accounting
AMS	Advanced Manufacturing Systems
AMT	Advanced Manufacturing Techniques
MAP	Management Accounting Practice

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Chapter 1

1.1 Background of Research

Concerns about the preservation of natural resources have intensified (Graff, 2010). Adverse environmental effects such as global warming have been inexorably linked to human activity (Dascalu, Caraiani, Lungu, Colceag & Guse, 2010). According to the United Nations Emissions Gap Report, the largest emitters of greenhouse gases (GHGs) are companies that operate in environmentally sensitive industries such as manufacturing businesses (UNSD, 2001; Khalid & Dixon, 2012). The Kyoto Protocol (which is an international agreement that sets emissions parameters for member countries) was introduced as an initiative of the United Nations Framework on Climate Change (UNFCCC), aimed at decreasing the levels of GHGs released into earth's atmosphere (Ratnatunga & Balachandran, 2007). The protocol enacted in 1997 was set to expire by the end of 2012 but member countries decided to extend it from 2012 to 2020 at the United Nations Climate Conference (Harrabin, 2012). The extension of the Kyoto Protocol is a reflection of the seriousness nations have attached to protecting environmental resources.

International treaties such as the Kyoto Protocol, statutes and regulations governing environmental management, public opinion and environmental interest groups have placed corporations under pressure to consider the effects their activities have on the ecosystem (Masanet-Llodra, 2006). Firms have been forced to look for ways of providing an account for their interaction with the environment. Thus, the role of accounting in business has extended beyond the conventional recording and reporting of financial information, to managing environmental performance through the use of environmental accounting (EA) (UNSD, 2001; Schaltegger & Synnestvedt, 2002; Hopwood, 2009; Jalaludin, Maliah, & Ahmad, 2011; Debnath, Bose, & Dhalla, 2012). Managing environmental performance encompasses the means an entity uses to control the environmental effects of its actions, products and services as well as their impact on the ecosystem (IFAC, 2005).

Environmental accounting has two main foci: environmental financial accounting (EFA) which involves the disclosure of environmental concerns in public financial reports (Qian & Burritt, 2010); and environmental management accounting (EMA) that focuses on providing organization management with environmental information to aid in the efficient use of company assets, budgeting, formulation of business strategy, policy etc. (Bennett & James, 2000; IFAC, 2005).

Environmental information encompasses elements such as the levels of radiation, waste, emissions and other harmful releases into the ecosystem caused by companies (Burritt, Hahn & Schaltegger, 2010). IFAC (2005) further classifies environmental information into physical/non-financial and monetary/financial information. Physical information relates to an organization's impact on the natural ecosystem expressed in terms of quantifiable units. For example carbon emissions are measured in tons. Monetary information refers to the costs incurred by companies to prevent or lessen environmental degradation (Schaltegger, Burritt, & Peterson, 2003; IFAC, 2005; Dascalu, et al., 2010).

Businesses have begun incorporating environmental information into managerial decisions through the use of EMA (Graff, 2010; Masanet-LLodra, 2006). The United Nations Division on Sustainable Development (UNSD) states that the adoption of environmental management accounting (EMA) is vital for businesses to apply cleaner and more productive procedures such as reduction of carbon emissions, efficient use of physical resources such as water, raw materials etc. (UNSD, 2001). EMA can also be harnessed by firms to make decisions pertaining to product pricing, investment appraisals, calculation of costs associated with environmental projects, among others (UNSD, 2001). EMA practices are composed of both conventional and modern managerial accounting methods such as activity based costing, lifecycle costing and total cost assessment among others. These methods consider the costs and benefits arising from an entity's interaction with the environment (Chang, 2013).

Research studies such as those carried out by Burritt & Saka (2006); Masanet-LLodra (2006); Ferreira, Moulang, & Hendro (2010) have shown that there are multiple advantages accruing to organizations that fully adopt EMA practices. For instance, a positive association was discovered between the use of EMA and process modernization implying that firms that have implemented EMA are likely to have modified production processes and ultimately lower costs of production (e.g. reduced input expenses resulting from recycling of raw materials) (Masanet-LLodra, 2006; Porter & Esty, 1998). Schaltegger & Burritt (2010) and Jasch (2001) are also of the opinion that the application of EMA achieves the double aim of reducing a corporation's negative environmental impact and at the same time reduces the costs (accruing to an organization) associated with environmental protection. Moreover, Hart & Ahuja (1996) concluded that environmental accounting practices such as EMA have a positive influence on the economic

performance of companies suggesting an association exists between the adoption of EMA and financial performance. Other benefits identified in previous studies have been significant reductions in operating costs, competitive advantage, increased market share, image improvement and technological leadership (Spencer, Adams & Prem, 2014; Klassen & McLaughlin, 1996).

The findings of these studies suggest that the adoption of EMA is highly beneficial, yet the degrees of implementation of EMA practices vary among entities (Khalid & Dixon, 2012). A distinction must be drawn between proactive and reactive businesses. Organizations that apply EMA solely to meet legal requirements are termed as reactive companies whereas those that seek to manage environmental performance beyond compliance are called proactive businesses (Buysse & Verbeke, 2013). Reactive firms generally apply EMA practices because it is required by law (Jalaludin, Maliah, & Ahmad, 2011). On the other hand, companies may take a more proactive stance and adopt EMA as a strategic management tool to aid in internal decision making (Hecht, 2000). Reactive corporations are characterized by lower degrees of adoption of EMA practices while proactive companies exhibit higher levels of adoption (Buysse & Verbeke, 2003; Jalaludin, Maliah, & Ahmad, 2011). The adoption levels depend on the number of managerial accounting techniques or methods used to account for environmental activities related to the organization (Chang, 2007).

In terms of the measurement of adoption levels, research has shown there is no standard method of measuring the extent of adoption of EMA practices. For instance, Masanet-Llodra (2006) and Gale (2006) both used case studies to gather information of the extent to which environmental information is incorporated into management accounting systems. Levels of adoption have also been measured using a checklist of the known methods and practices of EMA and analysing the findings using factor analysis (Jalaludin, Sulaiman & Ahmad, 2011). Since there is no standard or generally accepted framework guiding the practice, organizations apply EMA differently and therein lies the problem. The variances in the levels of adoption could be because of differences in the understanding of meaning of EMA adoption in terms of the practices required for adoption and the information that should be gathered and presented by an organization. Contextual differences could also explain the variations in the level of adoption. For example, a significant number of entities lack adequate systems for measuring and tracking environmental costs (Schaltegger & Burritt, 2000).

There are multiple advantages associated with high levels of adoption of EMA practices (Bartolomeo, Heydkamp, James, & Wolters, 2000; Jasch, 2003; Burritt & Saka, 2006; Kamande & Lokina, 2013). Yet, there are still reactive companies characterized by minimal levels of adoption of EMA methods while other corporations exhibit much higher levels of adoption. Understanding the factors that influence adoption could possibly explain why such variances exist despite the multiple benefits associated with higher levels of adoption. Ferreira, et al. (2010) found that a firm's industry influences the extent to which EMA methods were used to capture relevant environmental information. Gadeneo & Zaman's (2002) study concluded that Australian businesses use EMA practices to meet legal requirements. Thus, the salient factors that influence the implementation of EMA practices seem centered on regulatory requirements and the strategies used by businesses to curb adverse environmental effects caused by their activities. Yet, other factors could be responsible for the variances in adoption levels.

Since EMA practices are managerial, their scope is not standardized by international accounting standards (IAS). (Chang, 2007). Yet, other factors could be responsible for the variance in adoption levels.

1.1.1 The manufacturing industry in Kenya

Kenya's manufacturing industry is comprised of various sub-sectors as shown in Appendix 1. Kenya's Vision 2030 highlights the significant role manufacturing has in contributing to GDP and local employment (GOK, 2007). Kenya's manufacturing sector has been characterized by low productivity and poor linkages between the industry and governmental training bodies (Bigsten, Kimuyu, Arne & Söderbom, 2010). The adoption of EMA is critical for local manufacturing companies as Kenya transitions to a green economy (UNEP, 2014). A green economy fosters resource efficiency in manufacturing processes, low emissions of greenhouse gases (GHG's) and stronger economic growth. The application of EMA practices enables companies to identify opportunities for cleaner production, product development, operational cost reduction and at the same time ensure environmental preservation (UNEP, 2014). The adoption of EMA practices by Kenyan manufacturing companies is not an express requirement by law. However, the government has established an environmental regulatory institution known as the National Environmental Management Authority (NEMA) to implement the laws listed under the Environmental Management and Co-ordination Act (Environmental Management and Coordination Act, 1999;

UNEP, 2014). NEMA conducts environmental impact assessments on proposed environmental projects, issues licenses such as waste licenses, emissions licenses and effluent licenses to organizations whose activities contribute towards environmental degradation (Environmental Management and Co-ordination Act, 1999).

The Kenyan government has also created the Kenya National Cleaner Production Centre (KNCPC) in collaboration with the United Nations Industrial Development Organization (UNIDO) to encourage cleaner production processes among business enterprises by emphasizing on material, water & energy efficiency as well as waste minimisation (Resource Efficient and Cleaner Production Report, 2010). KNCPC has also been conducting environmental audits since 2005 to confirm that businesses are able to use their resources effectively and achieve cost benefits associated with doing so. Companies that have only adopted EMA to comply with requirements set by NEMA are reactive whereas those that undertake cleaner production initiatives such as those implemented by KNCPC are proactive (Kamande & Lokina, 2013). Chandaria Industries, Haco Industries and Pwani Oil products are proactive companies that have used EMA practices to improve their production processes and significantly reduce operational costs with KNCPC's assistance.

It is apparent that the Kenyan government has recognized the significance of resource efficiency and cleaner production among manufacturing companies, yet the practice of EMA has not been encouraged directly despite the benefits associated with its use as identified in previous research.

1.2 Problem Statement

EMA is one of the least used strategic management tools by businesses (Ross & Kovachov, 2009; Gadenne, Kennedy, & McKeiver, 2009). However, preceding research has shown that there is a significant correlation between high levels of adoption of EMA practices and benefits such as reduction in operational costs, managing resources product and process innovation and improved economic performance among other advantages (Burrit, Hahn & Schaltegger, 2002; Gibson & Martin, 2004; Masanet-Llodra, 2006; Dunk, 2007; Henri & Journeault, 2008; Ferreira, Moulang, & Hendro, 2010). Despite the rewards associated with higher levels of adoption of EMA practices, some entities (reactive companies) only use EMA in fulfillment of environmental regulations (Jalaludin, Maliah & Ahmad, 2011) and are characterized by low levels of adoption. Regulatory

requirements, business strategy and industry have been identified as some of the factors that influence adoption levels (Gadenne& Zaman, 2002; Ferreira, et al. 2010). However other reasons such as disparities in the understanding of EMA practices and contextual differences could lead to disparities in adoption levels.

Kenya's manufacturing industry is burdened by mutiple challenges such as high energy costs, unreliable supply of electricity, resource scarcity, low levels of technology and product innovation (UNEP, 2014). The full adoption of EMA practices could potentially solve some of the problems faced by local manufacturers. However, low levels of adoption of environmental management practices among local manufacturing companies have been observed; in particular most entities do not have adequate systems for measuring and tracking environmental costs (Kamande & Lokina, 2013; Chang, 2007). The KNCPC has been mandated with the task of training companies on the procedures necessary for the adoption of EMA and other cleaner production techniques with the aim of promoting resource efficiency. Yet, most of the trainings are attended by self sponsored individuals and not companies (RECP, 2001). Local manufacturing companies in Kenya have been reluctant in embracing the practice of EMA (UNEP, 2014). Establishing the factors that influence the adoption of EMA practices can give insight into why there are disparities in adoption levels in spite of the advantages associated with higher degrees of adoption.

Therefore, this research aims to identify the factors that influence the adoption of EMA practices within Kenya's manufacturing sector.

1.3 Research objectives

1.3.1 Main objective

To establish the levels of adoption of EMA practices among manufacturing companies in Kenya and, to determine the factors influencing such adoption levels.

1.3.2 Specific objectives

1. To establish the level of adoption of EMA practices among manufacturing companies in Kenya
2. To establish the factors influencing the levels of adoption of EMA practices among manufacturing companies in Kenya.

1.3.3 Research questions

1. What is the level of adoption of EMA practices among manufacturing companies in Kenya?
2. a) What are the factors that influence the levels of adoption of EMA practices among manufacturing companies in Kenya?
b) What are the managerial perceptions of the value of EMA among manufacturing companies in Kenya?

1.4 The scope of the study

This scope of the study is manufacturing companies operating within Nairobi. Due to the nature of their operations, manufacturing businesses are likely to be active users of EMA practices. These companies are drawn from the Kenya Association of Manufacturers (KAM) directory that gives a detailed list of manufacturing entities located in Kenya.

1.5 Justification for the study

a) Managers of manufacturing firms

Firstly, this study will be significant to the managers of corporate entities that operate in the manufacturing sector. Financial implications associated with the adoption of EMA must always be considered even in the light of environmental consideration (Khalid & Dixon, 2012). Dascalu, et al, (2008) suggest that the inclusion of environmental costs assists a company in maximizing its long run profitability. Yet, in some organizations, environmental costs are not considered material. (Chang, 2013). The findings of this study could possibly determine if any financial benefits such as improved financial performance accrue to entities that use EMA.

b) Environmental regulatory bodies

Local government and environmental regulatory agencies may also find this study useful. Local governments tend to be influenced by the expectations of society. Consequently, regulations governing EMA practices need to be oriented towards the required or expected behavior in society (Qian & Burritt, 2010). This study could specify the role of regulatory pressure in EMA adoption.

c) Academic scholars

This research aims to contribute to extant literature, specifically studies covering environmental accounting. Jalaludin, et al., (2011) state there is insufficient knowledge on the current state of EMA adoption within developing countries. Thus the insights offered by this research could be helpful in offering a different contextual perspective.



Chapter 2

Literature Review

2.1 Introduction

This chapter presents a review of literature pertaining to the adoption of Environmental Management Accounting (EMA). The first section of the literature review gives a brief albeit detailed explanation regarding the concept of EMA and its development in management accounting. Section 2.2 describes the features characterizing the adoption of EMA practices. Section 2.3 looks into the state of adoption on a global scale and focuses on environmental management practices in Kenya. Section 2.4 gives an overview of the theories that may be used to explain adoption of EMA practices with particular emphasis laid on the stewardship theory. Section 2.5 highlights possible factors that may influence the adoption of EMA practices, and section 2.6 gives a brief summary of the entire chapter.

2.2 The Concept of EMA

Multiple studies on environmental accounting have been done in order to establish the responsibility the accounting profession has in supporting global efforts to conserve the earth's ecosystem (Bennett & James, 2000; Bartolomeo, Heydkamp, James, & Wolters, 2000; Debnath, Bose, & Dhalla, 2012). Notably, determining the association between ecological problems and the practice of accounting is complex, specifically because environmental impacts or effects are difficult to measure and control (Maunder & Burritt, 1991). Yet, companies must develop deeper comprehension of the costs and benefits arising from an entity's interaction with the environment (Bartolomeo, 2000).

Consider the going concern assumption of accounting that assumes a business will be in operation in the foreseeable future (IAS 1, 2011). Orthodox accounting methods are unable to provide for potential environmental calamities and their consequent effects on a corporation's capacity to remain in operation as a going concern (Baumol & Oates, 1993). The Deepwater Horizon oil spill (or the British Petroleum oil spill) of 2010 for instance, is taken to be the largest accidental oil spill ever to occur in the petroleum sector covering 68,000 square miles of sea (Deepwater Horizon Marine Casualty Investigation Report, 2011). The cost of cleaning up the spill amounted to \$40.9

billion and BP reported a \$5 billion dollar loss during 2010. Though this incidence was an extreme case, companies must be able to use accounting methods to estimate the potential contingencies that may arise from their interaction with the natural ecosystem.

Information relating to the environment can serve both an ex-post and an ex-ante function. When accounting methods are used to identify and provide measures to lessen contingent or future costs that may arise from externalities such as oil spills, emissions of toxic gases into the atmosphere, etc., then such information serves an ex-ante role. On the other hand, if accounting procedures are used to measure the costs incurred as a result of negative environmental activities caused by the entity, then such information is ex-post e.g. carbon taxes incurred as a direct result of air pollution (Maunder & Burritt, 1991).

The origin of environmental accounting (EA) can be traced back to the 1970s following elevated public consciousness regarding the state of the environment (Hecht, 2000). Financial reports did not provide detailed information relating to an organization's interaction with the ecosystem. Initially, EA leaned towards public disclosure of environmental information suggesting a bias to financial accounting; management accounting procedures were not emphasized on (Christmann, 2000). Thus, EMA was developed out of corporate EA to address the managerial accounting aspects surrounding environmental performance (Debnath, et al, 2012). EMA could now be used by managers of corporations to isolate environmental expenses concealed in accounting systems to achieve cost reductions and ultimately attain an edge over other businesses (Setthasako, 2010).

There is no international agreement or uniform standard that outlines the scope or definition of EMA (Setthasako, 2010). Nevertheless, the United Nations Division for Sustainable Development (UNSD) has published a document providing guidelines for EMA application for national governments interested in environmental accountability (UNSD, 2001). The International Federation of Accountants (IFAC) has also published an international guidance document on EMA outlining the uses and benefits related to the adoption of EMA practices (IFAC, 2005). IFAC (2005) defines EMA as the collection and analysis of two types of information for decision making: Physical information involving the usage of energy, water and materials. Next, monetary information relating environmentally related expenditures and earnings (IFAC, 2005). The latter is accounted for using what is known as monetary environmental management accounting (MEMA) while the former uses physical environmental management accounting (PEMA).

2.3 The adoption of EMA practices

Though the use of EMA among manufacturing entities is not standardized, there are certain aspects that characterize the adoption of EMA practices. Firstly, organizations that use EMA must be able to identify and measure environmental costs (Debnath, Bose, & Dhalla, 2012). In fact, a study carried out by Beloff, Shields, & Heller, (1997) referred to EMA practices as environmental cost analysis (ECA). Thus, for an organization to claim it has adopted EMA, it must separate environmental costs from general overheads or operational costs (Holst, 1996; Schaltegger, Hahn & Burritt, 2000; Khalid & Dixon, 2012; UNDSO, 2001). Hence the first characteristic of adoption of EMA is the identification and categorization of environmental expenditures.

Next, the methods used to account for environmental costs and the extent of their use determine adoption levels (Jalaludin, et al., 2011; Chang, 2007; Ferreira, Moulang & Hendro, 2010). Organizations that have adopted EMA practices still use both conventional and modern management accounting techniques such as full cost accounting (FCA), life cycle costing (LCC) and activity based costing (ABC) to measure both current and potential environmental costs (Frost & Wilmhurst, 2006). LCC for example, was originally designed to determine the actual costs of a product throughout its life cycle. In the same way, LCC can be used to establish specific environmental externalities associated with producing a product (over its entire life) such as water effluents, air emissions etc. (Chang, 2013) This information can then be utilized by management to reduce the deteriorating effects such production has on the environment. Though environmental costs can be quantified using various methods, the cost/benefit implications of gathering this information depends on the needs of the organization and the extent to which it actively interacts with the environment.

Prior studies suggest that EMA practices are not homogeneously applied within the manufacturing industry (Buysse & Verbeke, 2003; Jalaludin, Maliah, & Ahmad, 2011). The levels or degree of implementation of EMA depend on the firm's orientation towards environmental issues and its environmental strategies. Green (1993) describes the variances in adoption as dark green and light green approach; where the dark green approach represents firms that have adopted EMA practices beyond legal compliance and the light green approach as entities that have adopted EMA practices solely to meet the requirements of the law. The resource based theory put forward by Hart (1995) has also attempted to explain the disparity in levels of adoption, by drawing a distinction between

businesses that have proactive environmental management strategies and those that take a reactive stance towards environmental management. Corporations that are reactive are said to use an end of pipe approach to solve environmental problems. Such entities assign limited resources to environmental activities and as such their levels of adoption are low. Notably, research conducted by Setthasako (2010) and Qian & Burritt (2010) concluded that reactive firms only used EMA to fulfill legal environmental requirements.

Conversely, proactive organizations are associated with higher levels of adoption since their approach is aimed at ensuring sustainability of the business (Buysse & Verbeke, 2013). Managers in proactive organizations will look beyond simple accounting for environmental costs and will seek to find ways to permanently minimize those costs, e.g. through investment in cleaner production technologies. The Institute of Management Accountants takes a different approach in explaining the levels of adoption. Their proposition is that the implementation of EMA can be understood from the point of view of the decisions it addresses at the managerial level as shown in the table below.

Table 2.1 : The levels of adoption of EMA practices

Level of adoption	Decisions
Stage 1: Low levels of adoption of EMA practices	Costing decisions:
Stage 2: Moderate levels of adoption of EMA practices	Investment decisions
Stage 3: High levels of adoption of EMA practices	Performance evaluation decisions

Source: IMA (1996)

Stage 1 firms only apply EMA to manage regulatory compliance. Essentially, their application of EMA is to identify and monitor environmental costs that may arise out of failure to conform to environmental laws. Stage 2 businesses acknowledge that using resources more efficiently can lead to competitive advantage and may focus on pollution prevention processes that target the core causes of pollution. The main aim of Stage 2 companies is the management of environmental costs thus they will use EMA for both costing and investment decisions. Stage 3 organizations view environmental performance as a key contributor towards economic growth and sustainability of their business. Hence EMA is used as a tool to measure environmental performance in addition to costing decisions and investment decisions. Notably Frost & Wilmhurst (2006) and Schaltegger et al., (2001) expanded the pool of managerial decisions to include risk assessment, budgeting,

product pricing, product design, distribution, continuous improvement etc. The classification used by IMA (1996) is unique because it related the decisions addressed to the levels of adoption of EMA practices.

Due to variances in adoption levels, researchers have measured adoption in different ways. For example, Frost & Wilmhurst (2006) measured the level of adoption of EMA based on the amounts of environmental costs identified by the firm, methods employed such as lifecycle costing (LCC), integration of environmental information into conventional managerial decisions such as costing, budgeting, investment and performance appraisal decisions.

One of the problems associated with measuring the levels of adoption is that there is no standard framework or mode of measurement due to the lack of internationally accepted standards governing EMA practices. However Schaltegger & Burrit (2000) have a proposed framework for the application of EMA practices and this has been used as the yardstick to measure the extent of adoption of EMA practices in prior studies (Zvezdov, 2012; ICAEW, 2013; Kamruzzaman, 2012). Their framework captures the entire practice of EMA because it links the decisions made to the methods of EMA that must be applied to address each decision.

2.3.1 Environmental Costs

The knowledge of environmental costs is fundamental since the identification and measurement of such costs is at the root of EMA. Before the adoption of EMA practices, businesses failed to consider the environmental effects resulting from their goods and services. Thus, costs incurred to remedy negative environmental impacts (remediation costs) are being incurred presently even though they were caused years ago (Holst, 1996). Expenditures in relation to environmental degradation and preservation, are called environmental costs e.g. costs incurred for the disposal of waste, carbon taxes, investments in green technology etc. (IFAC, 2005)

Bartolomeo, et al., (2000), Medley (1997) and Hansen & Mowen (2005) emphasize on the importance of understanding environmental costs since they directly affect firm profitability especially for manufacturing corporations since their activities significantly affect the environment. Conventional cost accounting does not separate environmental costs from non-environmental costs and as such, both may be recorded as general expenses. This means that

environmental costs remain hidden from internal management which hinders effective decision making (Bennett, et al., 2004).

Environmental costs have been classified in different ways in green accounting literature. Caraiani, et al., (2008) divide environmental costs into what they term as positive eco-costs and negative eco-costs. Positive eco-costs are expenditures sustained to prevent degradation of the ecosystem whereas negative eco-costs are expenses incurred to eliminate the consequences of an entity's environmental influence. Environment-related costs can also be categorized as either internal or external costs where internal costs are environmental costs for which the business is legally responsible for and external costs are environment-related costs that the company is not lawfully accountable for (IFAC, 2005).

IFAC (2005) further break down environmental costs into six main classes of costs namely waste and emission control costs, material costs of product outputs, prevention and environmental management costs, research and development costs etc. The costs are illustrated in table 2.2.

Table 2.2: Environmental costs classification

1. Materials Cost of Product Outputs: <i>e.g. costs of materials (natural resources) converted into finished products-</i>
2. Materials Cost of Non-Product Outputs: <i>e.g. costs of energy, water and other materials that do not get converted into finished products (emissions costs)</i>
3. Waste and Emissions Control Costs: <i>e.g. waste disposal costs and legal compliance costs</i>
4. Prevention and other Environment Management Costs: <i>e.g. costs of cleaner and more efficient production processes</i>
5. Research and Development Costs
6. Less Tangible Costs: <i>e.g. company reputation, future regulations, contingent liabilities such as lawsuits incurred as a result of environmental damage</i>

Source: IFAC (2005)

Material costs of product and non-product outputs are calculated using both monetary environmental accounting (MEMA) and physical environmental accounting methods (PEMA). The remaining costs are accounted for using MEMA. A more comprehensive list of environmental costs under each of the six categories is given in Appendix 1.

Both classifications are similar but the categorization given by IFAC is more comprehensive and provides a detailed description of environmental costs. The varying taxonomies of environmental

costs are expected since EMA is not governed by international standards. For the purpose of this study, the classification used by IFAC will be used for classifying external costs.

2.3.2 Tools and techniques of EMA

Integrating environmental-related information into conventional systems of management accounting requires specific tools and techniques (Debnath, Bose, & Dhalla, 2012). Broadly, EMA practices support three main managerial decisions: costing decisions, investment decisions and decisions pertaining to environmental performance evaluation (Holst, 1996). Traditional management accounting methods such as absorption costing, variance analysis, and life cycle costing can be modified to include environmental considerations.

EMA practices are not practiced evenly across manufacturing businesses but previous studies have identified similar methods used by businesses that have adopted EMA practices. Firstly for costing analysis, life cycle costing (LCC) has been used to identify the environmental effects associated with the production of goods across their entire life cycles (Chang, 2007; Debnath et al., 2012; Olson & Jon, 2008; Wabuyi, 2009). Hence there is consensus that lifecycle costing is one of the main methods that is used in EMA. Activity Based Costing (ABC) is another technique used to separate environmental costs from general operational costs. Essentially, ABC is used to identify and assign environmental costs to cost centers. The allocation of environmental costs is based on the activities that caused the costs, hence internal management is able to understand the specific product lines and/or production processes that incur the highest amounts of environmental expenditures (Ratnatunga & Balachandran, 2008; Holst, 1996; Schaltegger, Hahn & Burritt, 2000).

Notably, both LCA and ABC fall under the domain of monetary environmental management accounting (MEMA). To address the physical accounting aspects of EMA, materials flow accounting (MFA) is used to analyze the flows of materials and energy moving through the production system of a manufacturing organization (Burrit et al., 2000; Jasch, 2003; Chang, 2007; Abiola & Ashamu, 2007). MFA quantifies environmental impacts such as CO₂ emissions, into physical units such as tons, kilograms, etc.

EMA practices can also be used to make investment decisions. Essentially, total cost assessment or total cost accounting (TCA) incorporates environmental costs into investment appraisals. In this way, organizations are able to consider potential environmental costs that may be incurred by

accepting a particular investment proposal (Medley, 1997). Finally, EMA at its highest level of adoption can be used as a tool for performance measurement. Strategic management tools such as the balanced scorecard can be custom made to consider goals of environmental management. The balanced scorecard transforms business objectives into actions. Thus, an environmental balanced scorecard (EBS) or sustainability balanced scorecard (SBSC) can be used to measure an entity's environmental performance (Alewine & Stone, 2013).

The Institute of Management Accountants (IMA) offer an in depth description and explanation of the methods that can be applied in EMA based on costing, investment and performance evaluation decisions. Markedly, the costing methods outlined by the IMA are similar to the recommended techniques suggested by UNDSO on their policy document that outlines the procedures of EMA (UNDSO, 2001). Jalaludin, Maliah & Ahmad (2012) also used the same accounting procedures under EMA to measure adoption levels. However, they did not consider performance evaluation procedures that fall under EMA which is a weakness because EMA practices are designed centrally to address managerial decisions. The methods are outlined in Appendix 2.

The extent or level of adoption of EMA practices is best measured based on the number of tools and techniques adopted. For example Jalaludin, Maliah & Ahmad (2012) gaged adoption levels by using a checklist comprising of the methods outlined in Table 2.3 rated on a scale of 1 (none at all) to 5 (very much) the implementation of each method. Notably, Table 2.3 merges the information within Table 2.1 and Table 2.2 by identifying the methods that will be used by entities at Stage 1 of adoption. Specifically, the classes of environmental costs separately accounted for at Stage 1 are listed in table 2.2. A similar checklist approach was used by Frost & Wilmhurst (2006) but they did not use a weighted scale. They simply asked the respondents if they had adopted a particular technique or not. They also considered the managerial decisions addressed using environmental information such as costing, budgeting, investment and performance appraisal decisions.

Table 2.3 EMA tools and techniques

Description of method	(EMA practices)
Stage 1	
Costing decisions	Allocation of environmental costs to production activities responsible for those costs Estimation of environmental costs of a product to determine its selling price Identification of environment related expenditures Quantification of environmental costs over a product's life

	Creation of environmental cost accounts Analysing physical flows of materials and energy moving through the production system
Stage 2	
Investment decisions	Estimation of long term and short term effects of a company project on its location's environment Inclusion of environmental costs in investment appraisals
Stage 3	Estimation of long term and short term effects of a company project on its location's environment Identification of opportunities for reduction of environmental impact caused by products
Performance evaluation decisions	Incorporation of environmental goals into business strategy Estimation of potential environmental contingencies

Source IMA (1996); UNDSO (2001); Schaltegger & Burritt (2000)

Thus a checklist of relevant practices derived from Schaltegger & Burritt's (2000) proposed framework for EMA can be derived and used as a tool to measure the level of adoption.

2.4 Global perspective on the adoption of EMA

EMA practices have been adopted in varying degrees by businesses all over the world. Take for example, Ferreira, Moulang & Hendro's (2010) research that was looking at manufacturing companies in Australia and the adoption of EMA practices. Their findings indicated that most entities were proactive in environmental management and had adopted EMA for reasons beyond compliance e.g. reputational improvements, process innovation etc. They measured adoption of EMA practices based on the methods used such as the identification of environmental related expenses, life cycle costing, inventory analysis, activity based costing and the use of environmental performance indicators. Their constructs for measurement of adoption fall under the docket of the IMA's (1996) checklist. High levels of adoption have also been observed in Spain though acceptance of EMA has been driven largely by environmental regulations enacted by the government (Masanet-Llodra, 2006).

Qian & Burritt (2010) also conducted a study in Australia that was focused on the adoption of EMA practices. The only difference is they were studying local government institutions. Their observations showed that such associations were characterized by very low levels of adoption and their main motivation for implementing EMA was to fulfill environmental regulations. Notably, to measure adoption levels they focused on the identification and measurement of environmental costs.

In Malaysia it seems that the implementation of EMA practices is driven by the need for companies to reduce operational costs (Khalid & Dixon, 2012). Their research was based on Malaysian manufacturing firms. To measure adoption, they considered four main aspects: the identification of environmental costs, cost benefit analysis when looking into the viability of green projects, application of standard accounting processes when to address environmental issues and external reporting of environmental information to shareholders. Their findings showed that adoption levels were moderate but most corporations used EMA to create reports from external stakeholders and not necessarily for decision making. Jalaludin, et al., (2011) also did a study on manufacturing entities in Malaysia. The adoption levels were extremely low in their case and mostly influenced by regulatory pressure.

2.4.1 The adoption of EMA practices among Kenyan manufacturing companies; The regulatory framework

As previous research has shown, environmental regulations have encouraged the adoption of EMA practices on a global scale. In Kenya, the government has used both local and international bodies to preserve environmental resources (Ndung'u, Thugge, & Owino, 2009). International arrangements with the United Nations such as the REDD+ (Reducing Emissions for Deforestation and Degradation) program intends to create a national forest monitoring system and to encourage the use of carbon accounting. Local regulatory authorities such as the National Environmental Authority (NEMA) have been created to ensure local companies adhere to environmental laws outlined in the Environmental Management and Coordination Act. Furthermore, Kenya's Vision 2030 (which is a national plan created by the government) aims to improve waste management by creating economic incentives for companies that dispose of waste properly (GOK, 2007). The government has also encouraged companies (especially manufacturing entities) to adopt cleaner and more efficient production processes by using channels such as the KNCPC to train organizations on environmental management.

Specifically, the resource efficient and cleaner production initiative by KNCPC has been very successful in ensuring manufacturing organizations improve resource productivity and reduce pollution levels (RECP Report, 2010). The implementation of this program enacted by KNCPC has enabled local businesses such as Chandaria Industries to save up to \$0.6336 million on an annual basis. Though EMA practices are not expressly required by law, the KNCPC trains companies to account for their activities that impact the ecosystem using many of the methods

used in EMA e.g. materials flow accounting, lifecycle costing, identification and classification of environmental costs etc. (RECP Report, 2010). Though there are potential cost saving opportunities associated with accounting for the environment, Kamande & Likon's (2013) research into Kenyan manufacturing firms reveals that environmental accountability does not necessarily improve an organization's profitability. Furthermore, their findings indicate that proactive businesses perform better in terms of environmental performance. Yet, the factors influencing disparities in adoption between both reactive and proactive companies still remains blurred (Kamande & Likon, 2013). Therefore, the business case for EMA still remains uncertain within the Kenyan context.

2.5 Theoretical framework

There is no universally accepted theory for EMA (UNSD, 2001; IFAC, 2005; Schaltegger & Burritt, 2010). Earlier research has applied various theories to explain the motivations surrounding the adoption of EMA practices. Deegan (2002) used the legitimacy theory to explain environmental accounting practices in corporate entities. Basically, the legitimacy theory states that an entity's activities must conform to the values and customs existent in the social context within which it operates. The implications of acting outside societal norms are that the organization may encounter difficulties in obtaining support from the community in continuing its operations (Qian & Burritt, 2010; Deegan, 2002).

The use of EMA would be a tool to legitimize the company and to make it seem environmentally accountable to the society. A weakness emerges in this perspective since the assumption made is that a business' environmental management strategy may not be a reflection of the importance it attaches to environmental problems; all its actions are based on societal influences and public opinion (Shrivastava, 1995).

The institutional theory has also been used in prior studies to explain the underlying motives businesses may have for adopting EMA (Jalaludin, et al., 2012; Khalid & Dixon, 2012). Unlike the legitimacy theory, the institutional theory attempts to explain further motives (apart from seeking legitimacy) businesses may have for adopting similar practices (Meyer & Rowan, 1977). Isomorphism is further broken down into three constraining processes namely, coercive, mimetic and normative isomorphism (Khalid & Dixon, 2012). Coercive isomorphism arises when

corporations change their institutional activities because of pressure from those stakeholders upon whom the organization is reliant. Mimetic isomorphism occurs when companies within a particular sector imitate the practices of leading institutions in that sector and eventually end up resembling each other (DiMaggio & Powell, 1983).

Finally, normative isomorphism results from pressures from group norms to adopt particular institutional behavior. Normative pressures stem from educational background and professionalism (Jalaludin, et al., 2012). Qian & Burritt (2011) used the institutional theory to show that coercive pressures from environmental regulatory agencies are the driving forces behind the adoption of EMA practices. Though the institutional theory provides a deeper explanation of the pressures that have led to the application of EMA practices, further clarification is needed to identify the business case for EMA.

2.5.1. Business case for EMA: A stewardship perspective

Though EMA is one of the methods of ensuring firms remain environmentally responsible, financial considerations remain at the focal point (Khalid & Dixon, 2012). Corporations that have employed the use of EMA expect it to yield benefits such as better financial performance. The theory in support of this argument is the stewardship theory. The stewardship theory proposes that managers are not driven by self interest but instead their goals are aligned with those of the shareholders (Davis, Schoorman, & Donaldson, 2013). The manager is viewed as a “steward” of company assets and aims to achieve the objectives of the organization such as increased profitability, growth in revenue etc. (Donaldson & Davis, 1991). Thus EMA practices would only be adopted if they contributed towards realizing a manufacturing firm’s objectives. EMA practices can only be adopted if they are beneficial for the manufacturing business in some way. For example, research conducted by Bennett & James (2000); UNDSO (2001); Olson & Jon (2008) similarly conclude that the use of EMA practices may significantly lead to reduction of a company’s operational costs, especially if it operates within an environmentally sensitive industry. Thus this research intends to discover if there is a business case for EMA and to contribute to existing literature covering adoption practices.

2.6 Factors influencing the levels of adoption of EMA practices

In order to understand EMA practices, it is important to consider management accounting practices in general. Managerial accounting is concerned with the delivery of accounting information to management to assist them in making decisions (Drury, 2008). Management accounting practices (MAPs) have been used extensively by manufacturing firms. Ittner & Larcker (2002) are also of the opinion that management accounting techniques were specifically designed to meet the information requirements of managers within manufacturing businesses.

In the case of EMA practices, manufacturing firms are more likely to adopt them because of the impact their production activities have on the ecosystem. This is not to say that non-manufacturing entities do not adopt EMA practices. Chang (2013) carried out an exploratory study to discover the level of EMA implementation within higher education institutions (universities) in Taiwan. His findings showed that universities used EMA simply to identify environmental costs. Qian, Burritt & Monroe (2011) did a similar study, but looked at the levels of implementation in local government institutions. Both studies concluded that the levels of implementation of EMA were very low.

In the case of manufacturing companies or organizations that operate within environmentally sensitive industries, the adoption of EMA is likely to be higher (Khalid & Dixon, 2012). Hart (1997) proposed that the management of natural resources through the application of EMA may result in pollution prevention and may assist manufacturing corporations in saving energy consumption costs, material costs and waste disposal costs through recycling and cleaner production processes. Hence, an organization is able to produce and deliver goods and services while simultaneously reducing their ecological impact and resource utilization. This double effect is known as eco-efficiency.

Preceding studies have looked at the possible influencing factors that affect adoption of EMA practices. The factors identified and the findings are discussed below:

a) Regulatory compliance

It would seem that manufacturing companies would choose to implement EMA practices beyond regulatory compliance, but this is not always the case. Jalaludin, Sulaiman, & Ahmad (2011) and Khalid & Dixon (2012) both carried out studies to discover the motives manufacturing entities

have for using EMA practices. They concluded that regulatory pressure was the main factor influencing EMA adoption. Their findings similarly suggest that manufacturing firms may not see value in applying EMA. Perhaps the use of EMA is not as beneficial as prior research has shown. Furthermore Gadene & Zaman (2002) carried out a comprehensive study of Australian companies with the aim of discovering their motivation for adoption of EMA methods. Their findings indicate that Australian firms adopt EMA mainly because of legal compliance. Since there is no consensus on the scope or procedures of EMA, businesses aiming to comply with regulatory provisions may opt for fewer and simplified cost accounting methods that achieve legal compliance at the lowest possible cost to the organization. Thus the following hypothesis can be derived.

H₁ There is a positive association between the levels of adoption of EMA practices and the costs of compliance to environmental regulations

b) Size of the company

Prior literature has attempted to explain the motives surrounding the adoption of management accounting practices (apart from legal compliance) among manufacturing firms (Haldma & Laats, 2002; Chang, 2013; Alleyne & Marshall, 2011; Otley 1980). For example the size of the firm was found to influence the range of managerial accounting techniques that were used. On the other hand, Liaqat's (2006) research into Indian manufacturing firms revealed that the size of a company did not influence the adoption of specialized management accounting techniques e.g. activity based costing. In the study, Liaqat (2006) measured size using sales turnover, yet other studies such as Ondiek's (2008) used the number of employees to measure the size of an entity.

Logically though, as entities become larger, the necessity for more detailed accounting information increases (Haldma & Laats, 2002). Management need to have a better grasp of costs being incurred by different product lines, individual departments, etc. to improve their decision making capacity. In such a case, the adoption of advanced management accounting methods would be out of necessity. Hence, larger organizations are likely to use more specialized management accounting techniques. Hoque & James (2000) conducted a survey of Australian manufacturing firms and concluded that larger firms used the balanced scorecard (BSC) for performance assessment. Cadez & Guilding (2008) similarly found a positive correlation between large firms and the application

of strategic management accounting (SMA). Conceivably the reasons behind adoption are not out of necessity but rather the capacity to do so. Therefore, a second hypothesis can be developed:

H₂ The level of adoption of EMA practices is positively related to the size of the company

c) Level of manufacturing technology

Technological aspects such as the nature of the production processes may also determine the use of management accounting practices. Drury (1994) found that organizations that used advanced technology to manufacture their products were more likely to make extensive use of various kinds of manufacturing accounting techniques. For this particular study, MAPs were used after the introduction of new technological processes of production.

Modern manufacturing technologies have been defined by Baldwin (1995) as software technologies which when adopted aid in improving the efficiency of an entity's manufacturing processes. Advanced technological production procedures used by manufacturing businesses are broadly termed as advanced manufacturing systems (AMS) or advanced manufacturing techniques (AMTs) (Gunawardana, 2006; Baldwin, 1995). The categories of the AMTs are given in Appendix 2 and will be used in this study to measure the levels of manufacturing technology used in manufacturing firms.

In another study conducted by Ferreira, Moulang & Hendro (2010), the application of MAPs (specifically EMA practices) encouraged the development of modern production processes in manufacturing businesses. Their findings indicated that the use of EMA is associated with business process innovation (Ferreira, Moulang, & Hendro, 2010). Their research was carried out in order to determine the relationship between product innovation, process innovation and the use of EMA. Their presupposition was that establishments seeking eco-efficiency are led to develop new products or to improve interior business processes and make them more efficient. Thus the following hypothesis is made:

H₃ There is a positive association between advanced production technology of a manufacturing company and the level of adoption of EMA practices

d) Age

The age of an enterprise may also influence its adoption of management accounting techniques. Sleihat, Al-Nimer, & Almahamid (2012) carried out an exploratory study of management accounting practices adopted by banks in Jordan. His findings revealed that an entity's age is a significant factor in determining the extent of MAPs adopted by a firm. Age was measured using the number of years the company was in operation. Conversely, O'Connor, Chow & Wu (2004) took a different stance and suggested that the application of MAPs would decrease with the age of the firm. Their study was based in China and their presumption was that older companies would have well established norms and bureaucratic processes in place. Therefore, mature companies would find it difficult to embrace newer accounting techniques since they would already have well established routines and processes in place. However, their findings indicated otherwise, as age was found to be positively related to the levels of MAPs adopted. Hence the following hypothesis is drawn:

H₄ There is a positive association between the age of a manufacturing company and the level of adoption of EMA practices.

e) Environmental strategies

Business strategies employed by manufacturing companies may also determine the level of adoption of EMA practices. Collins et al., (1997) attempted to draw an association between the use of budgetary analysis and firm level strategies. His findings indicated a positive relationship between the use of budgets and companies that employed prospector strategies. Considering Hart's (1995) resource based theory, organizations that take proactive measures to manage environmental performance may use EMA to differentiate themselves from other corporations consequently placing them in a good position to achieve competitive advantage (Ferreira, Moulang, & Hendro, 2010). Environmentally conscious consumers may opt for products that have been produced using greener technology with minimal negative externalities on the environment. Thus, such businesses are at liberty to charge premium prices for their products and at the same time acquire high social standing/approval (Burritt, Hahn, & Schaltegger, 2002).

In addition, companies that do not employ the use of EMA but use low cost strategies (reactive), could lose out on cost savings that can be achieved through modified processes such as recycling

of raw materials to minimize costs arising from waste disposal (Bennett & James, 2000). Ferrari & Parker (2006) find that process innovation contributes considerably to competitive advantage for manufacturing entities. Other potential benefits associated with EMA use are improvements in reputation, attraction of human resources and operational cost reductions (Burritt et al, 2002; Hansen & Mowen, 2005). Based on these studies it seems that a firm's strategy may influence the level of adoption of EMA practices. Thus, the following hypothesis is developed:

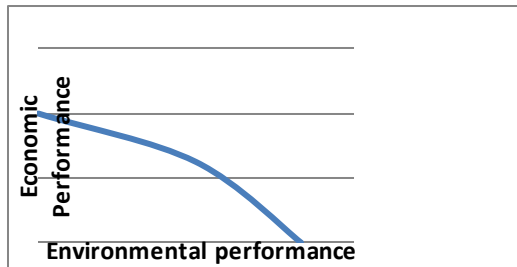
H₅ There is a positive association between environmental strategies employed by manufacturing firms and the level of adoption of EMA practices

f) Financial performance

Since EMA practices are used to measure an entity's environmental impacts for informed decision making, it follows that EMA practices can assist an organization in improving its environmental performance. The association between environmental and economic performance remains controversial (Wagner & Schaltegger, 2001). There are studies that have determined a negative relationship exists between environmental management and economic performance or derived inconclusive results about the nature of the relationship between the two variables (Wagner et al, 2002; Gilley et al, 2000; Qian, 2012).

Nevertheless, prior literature has also attempted to show that a positive relationship exists between environmental performance and financial performance (Mir & Rahaman, 2010). Judge & Douglas (1999) and Sharma & Vredenburg (1998) found that corporate entities that incorporated environmental issues into their strategic planning found that doing so had a positive effect on financial performance. The association between financial performance and environmental performance can be represented graphically in three distinctive approaches. Firstly, the traditionalist perspective as depicted in Figure 1 shows that there is a negative relationship between environmental and economic performance. Financial performance reduces with increased environmental performance. The argument is that businesses that spend copious amounts of financial resources on environmental management do so at the expense of financial wellbeing (Wagner & Schaltegger, 2001).

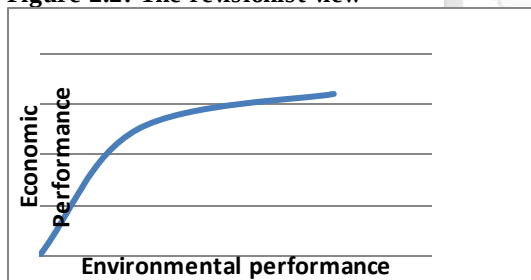
Figure 2.1: The traditionalist view



Source: (Wagner, Schaltegger & Wehrmeyer, 2001)

Next, figure 2 represents the revisionist view that contradicts the traditionalist outlook and stipulates, a positive relationship between economic and environmental performance. Improved environmental performance results in higher financial returns.

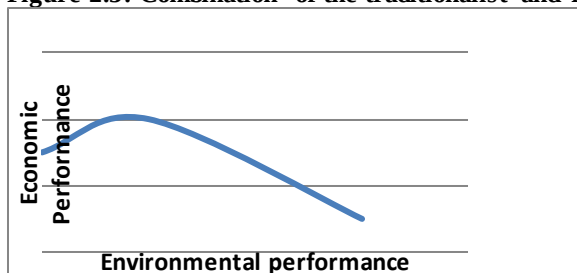
Figure 2.2: The revisionist view



Source: (Wagner, Schaltegger & Wehrmeyer, 2001)

Finally, the third graph (Figure 3) is a combination of the traditionalist and revisionist views. Economic performance increases with higher environmental performance up to a certain point and then decreases steadily with further increases in environmental performance.

Figure 2.3: Combination of the traditionalist and revisionist perspectives



Source: (Wagner, Schaltegger & Wehrmeyer, 2001)

Schaltegger & Synnestvedt (2002), state that the best level of environmental performance (i.e. point before the decline in economic performance) would be that recommended by environmental legislation. If their proposition holds true, it means there would be no value in using proactive techniques or methods to improve environmental performance beyond regulations. Since the use of EMA contributes towards good environmental performance, the following hypothesis can be drawn:

H₆ There is a positive association between the levels of adoption of EMA practices and financial performance

2.7 Chapter summary

The adoption of EMA practices has been discussed at length by various researchers. Their studies show that entities can no longer operate without considering the negative externalities of their actions. EMA has been used as a strategic management tool to assist managers in measuring the costs associated with adverse environmental activities. Yet, the practice has not been standardized by the accounting profession and the methods and techniques of EMA vary across companies. In Kenya, the adoption of EMA practices has been encouraged indirectly by environmental regulatory bodies such as NEMA that functions to ensure entities conform to national environmental laws. Yet, as evidenced by prior researchers, some entities have adopted EMA practices beyond legal requirements. Thus, the study aims to contribute towards extant literature by discovering the current level of adoption of EMA practices among manufacturing companies in Kenya and to establish the factors that influence adoption levels among manufacturing businesses.

Chapter 3

Research Methodology

3.1 Introduction

This chapter addresses the procedures undertaken by the researcher in obtaining and analyzing data. The methodology describes the strategy the researcher used to fulfill the research objectives (Creswell, 2009). The chapter is organized into the following sections; research design, target population, sampling procedure, data collection methods, data analysis and finally ethical considerations.

3.2 Research design

Hakim (2000) uses the analogy of an architect designing a building to the process a researcher undergoes when developing the research design best tailored to his or her study. Since the first objective seeks to establish the levels of adoption of EMA among manufacturing industries in Kenya, the researcher used a descriptive research design. The purpose of descriptive research is to depict an accurate representation of individuals, events or situations (Robson, 2002). The researcher also intended to establish the factors that influence the levels of adoption of EMA practices among manufacturing companies in Kenya. This particular research objective aimed to establish a causal relationship between the factors identified and the levels of adoption of EMA practices, therefore the research was also explanatory. Saunders, Lewis and Thornhill (2009) assert that when descriptive research is used as a precursor to explaining the relationship between variables, such studies are termed as descripto-explanatory studies. Philosophically, descriptive research leans on the positivist view and only tests research hypotheses without seeking to understand the meaning behind what has been observed. Explanatory research however seeks to obtain meanings from observations. Thus to increase the depth of the study, both elements of descriptive and explanatory research were used. Due to the time constraints of the researcher, the study was conducted on a cross sectional basis, that is, observations were made at a singular point in time (Saunders, Lewis & Thornhill, 2009).

3.3 Target population

For the purposes of this study, the member companies of the Kenya Association of Manufacturers (KAM) (which is a body that represents the collective interests of manufacturing businesses operating locally) formed the population of the research. The Kenya Association of Manufacturers offers a reliable source of information pertaining to individual member corporations. The total number of manufacturing entities that are members of the KAM operating within Nairobi are 455 out of a total membership of 700 in Kenya (KAM, 2011). Therefore Nairobi was a suitable location to carry out this study because 65% of KAM members are based in Nairobi. The individual respondents for the survey were made up of the management accountants and employees from the Environmental Health and Safety departments of the businesses, since they are responsible for applying EMA practice. Sampling was not carried out for the survey; questionnaires were distributed to all members of the Kenya Association of Manufacturers in Nairobi.

The research also incorporated the use of semi-structured interviews to complement the findings from the questionnaires. The production managers of manufacturing businesses were targeted as respondents for the interviews since they could offer deeper insights into the business case for the adoption of EMA practices among local manufacturing companies. The respondents for the interviews were selected based on their willingness to participate in the research.

3.4 Data collection methods

The data collected was comprised of primary data that was both quantitative and qualitative. A mixed methods approach was used meaning both quantitative and qualitative methods of data collection will be combined (Saunders, Lewis & Thornhill, 2009). Bryman (2006) suggests when research is cross sectional and a mixed methods approach is being used, quantitative data should be gathered using questionnaires and qualitative is best collected using semi-structured interviews when carrying out the qualitative section of the study.

The quantitative data was gathered using questionnaires. The questionnaire was divided into 2 sections. The first section contained questions pertaining to specific background information of each organization. The second section of the questionnaire asked questions pertaining to the EMA practices implemented within each organization, the company's Return on Equity (ROE) for the

year 2013, the type of advanced management technology (AMTs) applied within the organization, the percentage cost of compliance to local environmental laws, the company's sales turnover for the year 2013, the possible factors that could influence the adoption of EMA practices and the environmental strategies applied by each organization. Questions related to the benefits and challenges associated with adoption were also included in the questionnaires.

The qualitative data was gathered using semi-structured interviews. The researcher had formulated six questions pertaining to the reasons respondents had adopted EMA practices, the challenges they had experienced as well as the benefits of adoption. The researcher asked the respondents the questions and recorded their responses using a video recorder. Hence the results obtained were sufficiently triangulated to increase the validity of the research (Yin, 2003)

Neuman (2005) asserts that response rates for questionnaires on average is about 9-10% while face to face interviews have a response rate of about 90%. Thus, sampling of respondents for the questionnaires was not necessary since response rates are usually low. The researcher expected to obtain between 50-60 responses. To enhance response rate, respondents were contacted personally by the researcher via telephone and email to confirm their willingness to be part of the research process. Questionnaires were self-administered by the researcher.

3.5 Data analysis

To fulfil the first objective, the second section of the questionnaire had comprehensive checklist that includes the tools and techniques of EMA identified in prior literature that characterize adoption as illustrated in Appendix 2. Thus, the levels of adoption were based on the number of methods/techniques that were being used by the organizations under study. The total number of practices identified was 13 (as shown in Table 2.3). A score of 1 was used to indicate the stated method had been adopted. A score of 0 indicated that the method had not been adopted. The total number of practices adopted by each entity was divided by the total number of practices to establish the level of adoption of EMA practices as a percentage.

Since EMA practices are not applied uniformly, respondents were prompted to disclose other methods (apart from the ones listed in the checklist) that they use to practice EMA. Frequency tables were used to show the tools of EMA that were used prevalently and those that were not.

To fulfill the second objective, the researcher used two stages. The first stage involved using multiple regression analysis to establish if a relationship exists between the levels of adoption of EMA practices and the possible influencing factors identified in Chapter 2. The regression equation is as follows:

$$Y = a + bX_1 + cX_2 + dX_3 + eX_4 + fX_5 + gX_6 + e$$

Where Y = Level of adoption of EMA practices

X₁ = Size of the company

X₂ = Costs of compliance to environmental regulations

X₃ = Level of advanced manufacturing technology used (Appendix 2)

X₄ = Age of the company

X₅ = Environmental strategy

X₆ = Financial performance

e = Error

The coefficient of multiple determination (R²) was computed to measure the degree to which the independent variables can explain the dependent variable. A value of 1 means that the equation is able to completely explain the levels of adoption of EMA practices. The value given by the adjusted R² statistic was also used since it moderates the effects of adding or removing an independent variable in the multiple regression equation. The t-test and F-test were also be utilized to examine the likelihood that the linear relationship represented in the regression equation is coincidental.

In multiple regression analysis, the t-test is used to test the probability of the association between each independent variable and the dependent variable. The F-test is used to test the probability that the relationship between all the independent variables and the dependent variables has happened by chance. Since this is a multiple regression equation, the researcher made provisions to detect the possibility of multicollinearity arising. Multicollinearity occurs when two or more independent variables are correlated making it exceedingly difficult to isolate the effects of each independent variable on the dependent variable (Hair, et al., 2006). The Variance Inflation Factor was also be

used to measure the degree of collinearity (Hair, et al., 2006). Values of 10 and above indicate high collinearity.

Heteroscedasticity is another problem that refers to the extent to which both dependent and independent variables have unequal variances. To remedy this problem, Judge, et al., (1985) suggest weighting each individual observation by the standard deviation of the error for that observation. Long & Ervin suggest the use of the heteroscedasticity covariance matrix (HCCM). To ensure the results were valid, the researcher tested for homoscedasticity using scatter diagrams to see if the dependent and independent variables exhibited constant variances. The researcher found that the plotted values of the independent variables were correlated with the variance of the error term. Hair, et al., (2006) assert that heteroscedasticity does not result in biased parameter estimates.

The second stage of the data analysis involved using narrative analysis to present the results from the semi-structured interviews. The semi structured interviews were used to complement the results from the quantitative findings because employing multiple methods to gather data offers deeper insights into the area being studied (Curran & Blackburn, 2001). The narrative approach does not fragment qualitative data but rather presents and analyses data in its raw form i.e. verbatim scripts or complete sets of notes produced (Saunders, Lewis & Thornhill, 2007). The method commonly used to collect data using this approach is the use of interviews.

3.6 Ethical considerations

The conduct of this research was guided by Strathmore University's code of ethics. Permission to carry out the research was obtained from the university. The privacy of the participants was maintained. Participation in the research study was on a voluntary basis and participants were given the right to withdraw completely or partially from the process at their discretion. Respondents were also given details about the particulars of the research study. Data gathered remained confidential and was not used by the researcher for any other purpose apart from the research objectives outlined in the first chapter.

Chapter 4

Presentation and Analysis of Findings

4.1 Introduction

This chapter contains the analysis and interpretation of data collected from the respondents. Section 4.1 will summarize the results obtained from the questionnaires using descriptive statistics such as the frequencies of responses, mean, median and mode. Section 4.2 of the chapter will present the relationship between the factors identified in Chapter 2 and the varying levels of adoption in form of a multiple regression equation. Section 4.3 of the chapter will outline the findings from the semi-structured interviews using narrative analysis to complement the results obtained in section 4.1 and 4.2. Section 4.4 will give a summary of the findings of the research.

4.2 Summary of the findings obtained from the survey

4.2.1 The subsectors of the participant manufacturing companies

The researcher received 30 responses to the questionnaires distributed to the members of the Kenya Association of Manufacturers (KAM). The responses represent 5% of the entire population. Though there is increased awareness of the need for businesses to be environmentally responsible, a low response rate was expected. Most of the respondents were reluctant to disclose their management accounting practices for the study. Jalaludin, Sulaiman & Ahmad's (2011) study exhibited similar response rates.

The subsectors of the participant companies are presented in Table 4.1. 30% of the respondent companies were from the Food, Beverages and Tobacco subsector of the manufacturing industry. The Paper and Paperboard, Building and Construction and Chemical and Allied firms formed 40 % of the sample. The subsector with the lowest response rate of only one respondent company was Plastics and Rubber constituting 6.7% of the sample respondents who participated. In total the researcher was able to use the findings from 9 out of 12 manufacturing subsectors. Potential respondents from Electrical and Electronic, Motor Vehicle Assembly and Leather products and Footwear subsectors did not participate in the research.

Table 4.1 Subsectors of the manufacturing industry

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Food, Beverages and Tobacco	9	30.0	30.0	30.0
Textiles and Garments	2	6.7	6.7	36.7
Metal and Allied	2	6.7	6.7	43.3
Paper and Paperboard	4	13.3	13.3	56.7
Timber and Products	2	6.7	6.7	63.3
Building and Construction	4	13.3	13.3	76.7
Plastics and Rubber	1	3.3	3.3	80.0
Pharmaceutical and Medical Equipment	2	6.7	6.7	86.7
Chemical and Allied	4	13.3	13.3	100.0
Total	30	100.0	100.0	

4.2.2 Summary of the levels of adoption of EMA practices observed among Kenyan manufacturing entities.

The first objective of the study was to establish the levels of adoption of EMA practices among manufacturing companies operating in Nairobi. A checklist containing the accepted practices of EMA as identified in prior literature to calculate a percentage based on the number of practices that each respondent company had adopted. The total number of practices was 13. So each practice was given a weight of 1/13 to determine the cumulative percentage of practices adopted by each respondent company. This method of measuring adoption has been used in previous studies (Jalaludin, Maliah, & Ahmad, 2011; Gibson & Martin, 2004). As shown in Table 4.2, the minimum level of adoption was at 7.69% representing the bare minimum required for compliance to environmental laws for such cases. The maximum level of adoption was at 84.62%, which indicates that the company had adopted EMA practices beyond legal requirements.

Table 4.2 Descriptive statistics on the levels of adoption of EMA practices

	N	Minimum	Maximum	Mean	Std. Deviation
The level of adoption of EMA practices	30	7.69	84.62	32.6030	19.65683
Valid N (listwise)	30				

Table 4.2 is simply a summary of the mean levels of adoption of EMA among the respondents (32.6% approximately). However, deeper analysis is required to understand the actual practices adopted and their frequencies. A summary of the methods of EMA and their frequency of use are shown in Table 4.3.

Table 4.3 Summary of the methods of EMA adopted by manufacturing companies

Stage	Method	N	Percent	Percent of cases
Stage 1 Costing decisions	Allocation of environmental costs to production activities responsible for those costs	6	4.4%	20.0%
	Creation of environmental cost accounts	4	3.0%	13.3%
	Estimation of environmental costs of a product to determine its selling price	11	8.1%	36.7%
	Identification of environment related expenditures	25	18.5%	83.3%
	Analyzing physical flows of materials and energy moving through the production system	25	18.5%	83.3%
	Quantification of environmental costs over a product's life	9	6.7%	30.0%
Stage 2 Investment decisions	Estimation of long term and short term effects of a company project on its location's environment	8	5.9%	26.7%
	Inclusion of environmental costs in investment appraisals	8	5.9%	26.7%
Stage 3 Performance Evaluation decisions	Identification of opportunities for reduction of environmental impact caused by products	2	1.5%	6.7%
	Estimation of potential environmental contingencies	13	9.6%	43.3%
	Conducting environmental assessment programs	19	14.1%	63.3%
	Incorporation of environmental goals into business strategy	3	2.2%	10.0%
	Utilization of environmental key performance indicators	2	1.5%	6.7%

The findings indicate that 83.3% of the respondent firms separately identify environmental expenditures and analyze physical flows of materials and energy moving through the production system. Only 13.3% of the manufacturing companies create separate environmental accounts for recording and tracking environmental costs and only two companies representing 6.7% of the sample utilize environmental key performance indicators such as an Environmental Balanced Scorecard to measure the environmental performance of the company. Table 2.3 gives a detailed summary of the tools and techniques necessary for the adoption of EMA practices. From the findings obtained, the researcher concluded that local manufacturing companies are in the early stages of adoption of EMA practices. The first stage of adoption involves the use of methods such

as materials flow accounting (analyzing physical flows of materials and energy used in production) and identification of environmental related costs/expenditures which form the most utilized techniques of EMA among the sampled respondents.

4.2.2.1 Environmental costs accounted for separately by respondents

Findings related to the classes of environmental costs accounted for by manufacturing firms were also collected and summarized. The summary of the findings are presented in Table 4.4 below.

Table 4.4 Classes of environmental costs

		Responses		Percent of Cases
		N	Percent	
Classes of Environmental Costs	Raw material costs	30	12.8%	100.0%
	Maintenance of operating material costs	25	10.7%	83.3%
	Packaging costs	22	9.4%	73.3%
	Energy costs	27	11.5%	90.0%
	Water costs	29	12.4%	96.7%
	Waste disposal costs	16	6.8%	53.3%
	Waste prevention costs	14	6.0%	46.7%
	Environmental licenses	19	8.1%	63.3%
	External services for environmental management	14	6.0%	46.7%
	Fines and penalties (related to environmental laws)	8	3.4%	26.7%
	Research expenditures incurred to reduce environmental costs	8	3.4%	26.7%
	Insurance for contingent environmental liabilities	6	2.6%	20.0%
	Provisions for clean-up costs	7	3.0%	23.3%
	Expenditure for greener technologies	5	2.1%	16.7%
	Levels of carbon emissions	4	1.7%	13.3%
Total		234	100.0%	780.0%

The results show that all the respondents account for raw material costs. Water, energy, maintenance of operating materials costs, environmental licenses costs are also accounted for by the majority of respondents. Such expenditures are classified as Material Costs of Product Outputs

(IFAC, 2005) as shown in Table 2.2 in Chapter 2. The levels of carbon emissions are only accounted for by four companies. Specifically, two of the companies that account for the levels of carbon emissions are from the Building and Construction subsector of the manufacturing industry. The other two respondents are from the Chemical and Allied and Food, Beverages and Tobacco subsectors. The summaries of findings from both Table 4.3 and Table 4.4 show that manufacturing businesses in Nairobi have adopted EMA practices to support their costing decisions. For example, 83.33% of the respondents account for environmental expenses and use materials flow accounting to analyze the physical flows of energy and water moving through their production system. Only 2.2% and 1.5% of companies have incorporated environmental goals into their strategy and utilized environmental key performance indicators respectively.

4.2.3 Perceptions of the business case for adoption of EMA practices

4.2.3.1. Motives behind the adoption of EMA practices among local manufacturing companies

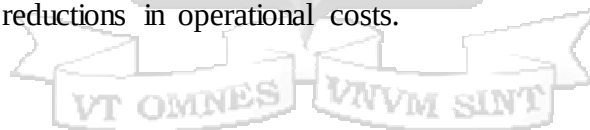
The researcher prompted the respondents to give the factors they believe influence the adoption of EMA practices in their respective companies in the questionnaire. A likert scale was used to measure the degree of responses given for each statement where: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2) and Strongly Disagree (1). The mode of the responses is useful because it gives the prevalent responses to each possible motive for adoption. The findings are shown in the following tables.

Table 4.5 Motives behind the adoption of EMA practices among manufacturing entities

Motive for adoption of EMA practices	Mean	Mode
EMA has been adopted to reduce operational costs	3.2667	2.00
EMA has been adopted to ensure compliance to local environmental regulations enforced by NEMA	3.2333	4.00
Reduce costs of litigation and fines imposed due to non-compliance to environmental regulations	4.1	5.00
EMA has been adopted because the firm actively uses an Environmental Management System	3.0333	3.00
Utilization of advanced manufacturing technology has contributed to the use of EMA	3.0000	3.00
EMA has been adopted to enable the use of cleaner production methods/techniques	3.2333	4.00
EMA has been adopted to enable the production of green products	2.9667	3.00
EMA is used to evaluate investments in green technologies/processes	3.1667	4.00
Management has initiated environmental training programs	3.8000	5.00
EMA has been integrated into company policy	2.8667	1.00

EMA has been adopted to ensure internal compliance to the firm's environmental health and safety policy	2.7667	3.00
EMA has been adopted to ensure compliance to international statutes and/or regulations followed by the firm	3.1333	3.00
The adoption of EMA has contributed to improving financial performance	2.7000	3.00
EMA has been used by our company because of the type of business we are in	3.8667	4.00
The company's production activities have a significant impact on the environment	3.9667	4.00

Motives with a score of greater than 3 were considered significant and motives with a score of less than 3 were not significant. Based on the results obtained, the main motive behind the adoption of EMA practices among manufacturing companies based on the mean and mode of responses is to reduce the costs of litigation and fines imposed due to non-compliance of environmental regulations. The mean value of the thirty responses was 4.1 and the mode was 5 meaning respondents use EMA to meet regulatory requirements. In addition majority of the respondents felt that management's initiation of environmental training programs contributed to the adoption of EMA practices within their organizations. In particular, most of the respondents felt that EMA practices could not be adopted with the aim of reducing operational costs. Yet, the multiple regression equation suggests that financial performance influences the levels of adoption of EMA. Prior studies (Chang, 2007, Schaltegger & Burritt, 2010) have also asserted that the application of EMA leads to significant reductions in operational costs.



4.2.3.2 Challenges associated with the adoption of EMA practices

One of the reasons for variances in adoption levels identified in previous research is the challenges involved in adopting EMA practices. The respondents were asked to rate the challenges experienced by their respective companies in relation to the application of EMA practices. The findings are as follows:

Table 4.6 Challenges associated with the adoption of EMA practices

		Complexity of techniques and methods used make it difficult to adopt EMA	Employees are reluctant to adopt EMA methods	Lack of managerial commitment in implementing initiatives to encourage the use of EMA	Absence of international accounting standards governing the practice of EMA	Difficulties in obtaining personnel experienced in the use of EMA
N	Valid	30	30	30	30	30
	Missing	0	0	0	0	0
Mean		3.7667	3.2333	2.8000	3.8000	4.0667
Mode		4.00	4.00	2.00	5.00	5.00

The mean of 3.8 and mode of 5.00 indicates that respondents agreed that the absence of international accounting standards governing the practice of EMA and difficulties in obtaining personnel experienced in the use of EMA were the main challenges associated with adoption. However, most of the respondents felt that the management of the company was committed to implementing the practice of EMA.

4.3 The factors influencing the levels of adoption of EMA practices among manufacturing companies in Kenya

The second research objective sought to establish the factors that could influence the adoption of EMA practices among local manufacturing companies operating in Nairobi. The research identified six possible factors that could influence the level of adoption of EMA practices from extant literature. The factors identified were the size of the company, the age of the company, the costs of compliance to environmental regulations, the level of technology used (advanced manufacturing technology), the financial performance of the firm and the company's utilization of environmental strategies. The six factors were the independent variables. The levels of adoption of EMA practices formed the dependent variable. Respondents were prompted to disclose the methods applied in their companies. The researcher was able to determine the level of adoption

for each of the respondent companies. The results obtained from the multiple regression analysis are shown below.

4.3.1 Results from the multiple regression analysis

Table 4.7 Model summary for multiple regression analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.916 ^a	.840	.798	8.83135

The results from the regression indicate that 79.8% of the variance in the levels of adoption can be explained by changes in the independent variables. The adjusted R^2 statistic has been used since it is able to moderate the effects of adding or removing an independent variable in the multiple regression equation.

The researcher also observed the analysis of variance (ANOVA) to test the probability that the relationship between all the independent variables and the dependent variable have occurred by chance. The ANOVA is shown below in Table 4.2.

Table 4.8 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9411.503	6	1568.584	20.112	.000 ^a
	Residual	1793.833	23	77.993		
	Total	11205.336	29			

The F statistic is interpreted with the corresponding p value, in this case the value of significance. Since the p value is less than 0.05 it means that the model is statistically significant. Thus, a relationship exists between the independent variables and the dependent variable. The ANOVA also shows that the total variance can largely be explained by the results obtained from the regression analysis as shown in the column for the sum of squares. The value of the sum of squares explained by regression is 9411.503/11205.336 which is greater than the residual value of

1793.833/11205.336. Yet the results are above are still not conclusive until each independent variable is tested to determine its individual level of significance. The t test was used to test the significance of each independent variable in explaining variability in the dependent variable (the level of adoption).

Table 4.9 Tests of significance for each of the independent variables

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	-18.691	7.047		-2.652	.014		
Costs of compliance to environmental regulations	3.977	1.858	.264	2.140	*.043	.389	2.568
Age of the company	.029	.053	.054	.544	.591	.596	1.677
Size of the company	.561	1.219	.042	.461	.649	.710	1.409
Company's Return on Equity (ROE) in 2013	6.038	2.241	.431	2.694	***.013	.232	4.309
Company's level of utilization of advanced manufacturing technology (AMT)	.069	.089	.096	.775	.446	.389	2.568
Environmental strategies utilized	4.326	1.832	.269	2.361	** .027	.456	2.193

*significance of factors in explaining the extent of adoption of EMA practices

The findings from the regression equation can be summarized as follows.

$$Y = -18.691 + 0.561b + 3.977c + 0.069d + 0.029e + 4.326f + 6.038g + e$$

The first variable-the constant of -18.691 represents the predicted value of the level of adoption when all other variables are 0. This means without the influence of the identified factors, the levels of adoption of EMA practices would decrease by 18.61%. This value indicates that the influencing factors are important in explaining the levels of adoption of EMA practices.

A confidence interval of 95% was used to determine the significance of the independent coefficients. The results of the independent coefficients indicate that the size of the company, the age and the company's level of utilization of advanced manufacturing technology are not significant in explaining the varying levels of adoption of EMA practices. The significance level for size is 0.649 which is greater than the acceptable limit of 0.05. The significance levels for the use of advanced manufacturing technology and the age of the company are 0.446 and 0.591 respectively which are both greater than 0.05.

The entity's return on equity however has a p value of 0.013 which is less than 0.05. Hence, the researcher was able to conclude that 1% increase in ROE increases the level of adoption by 6.038% as shown in the unstandardized coefficients. The costs associated with compliance to environmental regulations enforced by NEMA are also significant in explaining the variances in the levels of adoption since its significance level is 0.043. This means that a unit increase in costs incurred for compliance to environmental regulations would lead to an increase in the levels of adoption of EMA practices by 3.977%. The environmental strategies utilized by the company are also significant in explaining the levels of adoption since their significance level is at 0.027 which is less than 0.05. This particular variable was used to measure an entity's proclivity to being proactive in terms of going beyond the requirements of compliance. As the results indicate, a unit increase in the environmental strategies adopted will lead to a 4.326% increase in the level of adoption. The results show that the Return on Equity is most significant in explaining the levels of adoption, followed by the environmental strategies used and finally the costs of environmental compliance.

To ensure the absence of multicollinearity, the researcher used the Variance Inflation Factor (VIF) to measure the degree of collinearity. The findings Table 4.3 show that the VIF for each of the independent variables was less than 10 meaning that the independent variables are not interrelated.

4.3.2 Results from simple regression analysis

The researcher also used simple regression analysis to analyze each individual factor against the varying levels of adoption. The findings are summarized below.

Table 4.10 Model summary for the simple regression analysis

Factor	R	R Square	Adjusted R Square	F Statistic	Significance	T Statistic	Significance
Size of the company	0.019	0.000	-.035	0.010	0.921	.572	-.572
Age of the company	0.107	0.012	-.024	0.327	0.572	.101	.921
Level of utilization of advanced manufacturing technology (AMTs)	0.719	0.517	0.499	29.923	0.000	5.470	0.000
Company's Return on Equity	0.777	0.604	0.590	42.770	0.000	6.540	0.000
Costs of compliance to environmental regulations	0.792	0.628	0.615	47.273	0.000	6.876	0.000

Environmental strategies utilized	0.781	0.610	0.596	43.858	0.000	6.623	0.000
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The findings show that the size and age of the company are not significant in explaining the levels of adoption of EMA practices on their own. The level of utilization of advanced manufacturing technology (AMTs) is significant on its own unlike in the multiple regression equation. The adjusted R square indicates that 49.99% of the variability in the levels of adoption of EMA practices can be explained by the firm's use of advanced manufacturing technology (AMTs). The ROE, costs of compliance to environmental regulations and environmental strategies utilized by the organization still remain significant as shown in both the simple and multiple regression analyses.

4.4 Managerial perceptions on the value of EMA among manufacturing companies in Nairobi.

The researcher conducted two semi structured interviews to discover managerial perceptions regarding the business case for adoption of EMA practices. The findings were presented using narrative analysis.

Q1. What commitments has your company made in regard to preserving the environment?

Respondent 1:

“We have Ecomagination. Ecomagination is an initiative by our company designed to help protect the environment by encouraging employees to reduce our carbon footprint, energy and water use and to drive cost reductions associated with decreased consumption. This is our level of commitment to preserving the environment. We have a team of employees who focus all their facilities to make sure they achieve the goals set by ecomagination.”

Respondent 2

“Just take a walk around our factory. We have taken great lengths to create a serene environment by planting trees, maintain hedges and grass all around the plant. We also have a clear safety, health and environmental policy dedicated to the well-being of our employees, customers and other stakeholders. We conduct regular environmental health and safety training programs for our employees especially because of the nature of our operations.”

The responses from both of the respondents show that both entities have displayed some level of commitment to preserving the environment. Thus, an entity cannot focus solely on maximizing wealth at the expense of its environment.

Q2. Do you take environmental considerations into account when making managerial decisions? In particular which decisions?

Respondent 1

“For sure there are environmental issues that need to be taken into account especially when we are developing something new. We have to look at materials; we have to look at the manufacturing processes and the different components that go into manufacturing a new product. I would say for the most part that is from an Environmental Health and Safety standpoint especially because we want to ensure we are compliant. We also use EMA to make long term decisions to determine if our products will help our customers save money in the long run by looking for ways to reduce our greenhouse gas (GHG) emissions, water and energy that go into developing the product.”

Respondent 2

“Not really. To be honest environmental considerations may only feature very indirectly when making pricing, product or budgeting decisions. However we have separate environmental cost accounts for tracking various environmental costs. But we only do the bare minimum. Perhaps it is time we considered the effect environmental costs have on our cost of production.”

The first respondent stated that EMA features directly in product decisions as well as general costing decisions. Yet, the second respondent said that EMA practices are only used indirectly to support managerial decision making.

Q3. Why did you start using EMA?

Respondent 1

“At the end of the day what it comes down to for the company is making sure we continue to do well and to grow our business. We saw it as a way of almost starting a trend among businesses because I think we were one of the first companies to adopt these practices. So part of it was about “doing good” and growing our businesses. We thought that if we could look for ways to enable our customers to save money and at the same time drive down our operational costs then it would be a win for us.”

Respondent 2

“We adopted it at first to meet compliance requirements set by NEMA. We require a certificate from NEMA to operate. So we must be compliant to the rules they have set. But I don’t really understand the rationale they use when listing the requirements we must meet for compliance. However we do it because we must.”

The second respondent states that the reason behind the adoption of EMA practices is compliance to environmental regulations. However, the respondent highlights that the aim of adopting EMA practices was to grow their business and to be environmentally responsible.

Q4. What would you say was the main influencing factor that led to the adoption of EMA practices?

Respondent 1

“It has to be the need for cost reduction. We actually track the environmental costs from each of the individual products we produce. We have been able to make cost reduction decisions by simply identifying these so called ‘hidden environmental costs’ and determining products and production processes that are able to reduce the costs of manufacturing and the overall product cost for the consumer. I would also say in some ways, EMA has forced us to be more innovative which has had a positive impact on the brand. Technology plays a crucial role in ensuring we reduce our carbon foot print. We have found EMA particularly useful in product development, making health and safety decisions for the firm and compliance to local environmental regulations.”

Respondent 2

“Compliance is the motivating factor for us and most businesses I think. Recently though we have been trading with a foreign company that expects higher standards in terms of the quality of our pharmaceutical products so eventually we may be forced to go beyond local compliance and use EMA as one of the means to ensure our products meet international standards of quality. Perhaps for some businesses location would influence their adoption of EMA. I used to work for a milk processing company and I would say their level of adoption of EMA was very high because of the place their business was located.”

Both respondents are of the opinion that compliance has influenced the adoption of EMA practices. The first respondent asserts that the adoption of EMA practices has led to a better understanding of costs which has ultimately led to their consequent reduction. In their opinion, there is a clear

business case for the adoption of EMA practices. The second respondent also suggests that the location of an enterprise can influence the extent to which EMA practices are used.

Q5. What are the main benefits associated with adoption of EMA?

Respondent 1

“One of the first ones is to reduce our costs. Helping us to reduce the amount of water and energy consumed, generally the reduction of resources put into our production processes. The revenue growth we have seen and not forgetting the positive impact it has had on the brand since EMA has helped us to be more innovative in product and process development.”

Respondent 2

“I would say the main benefit would be that adoption has enabled us to avoid fines imposed because of failing to meet the requirements of the Environmental Management and Coordination Act. I don’t think there is a direct relation between the adoption of EMA and lower costs of production. I could be wrong however.”

Q6. What are the challenges your firm has experienced associated with the adoption of EMA practices?

Respondent 1

“Probably the first challenge was socializing it within the company, making sure everyone is able to see how they tie in to it. Another problem was there were no standard practices or guidelines to help us know exactly how to apply it to our business. In the end we sought consultancy from various experts within our subsector but external to the company to help us know which areas we needed to focus on. Such as how to account for and monitor environmental costs over time and so on.

Respondent 2

“Definitely the lack of uniform standards about the practice, make it difficult to know what is required for adoption. There is also lack of uniformity in terms of the extent of compliance required. NEMA says one thing; the Nairobi City Council refutes what NEMA requires and has its own set of legal requirements. It’s all very confusing. Again, this is a relatively new thing so getting people who know how it applies to our business could be another potential challenge.”

In terms of the benefits and challenges associated with adoption both respondents gave various view-points. The first respondent asserts that the reduction of costs is one of the benefits as a result of adoption. The second respondent felt the avoidance of fines imposed for non-compliance to the Environmental Management and Coordination Act was the benefit derived from adoption. When it came to the challenges experienced, both the first and the second respondents stated that the lack of uniformity on the way the practice should be adopted was a major challenge. The results from the descriptive statistics shown in Table 4.6 corroborate these findings because the descriptive statistics show that most respondents felt that lack of international accounting standards governing EMA practices was a hindrance to its implementation. In addition, the first respondent suggested that the reluctance exhibited by employees in adopting the practice was a major challenge to adoption. Table 4.6 also shows that most of the respondents from the survey also felt that one of the challenges associated with adoption could be employees' reluctance to adopt EMA practices as the mode of responses for that particular challenge was 4 which is significant.

The results from the interviews suggest that the adoption of EMA practices results in significant reduction in operational costs. Yet, the results from the survey indicated that most respondents felt that the adoption of EMA practices could not lead to consequent reduction of operating expenses (Table 4.5). Perhaps the reason for this variance in results could be the interpretation of the value of EMA practices at senior management and middle management level. These findings are consistent with those of Khalid & Dixon (2012) who stated that senior management must encourage employees to see the value in environmental accounting beyond the confines of compliance.

Both the results from the survey and interviews show that the costs of compliance to local environmental regulations directly influence the levels of adoption of EMA practices. One of the respondents strongly felt that the adoption of EMA practices had enabled a paradigm shift in the manufacturing technology used by their firm. The results from the multiple regression analysis show that the use of automated manufacturing technology does not influence the levels of adoption of EMA practices. Notably, the respondent who asserted that the use of AMTs influenced the levels of adoption of EMA practices was from a company with 84.62% level of adoption.

4.5 Conclusion

The findings from the multiple regression analysis suggest that financial performance, the costs associated with compliance to environmental regulations and the environmental strategies employed explain the variances in the adoption of EMA practices among manufacturing companies. The managerial perceptions from the interviews propose that a business case for EMA may exist since they assert that adoption of EMA practices yields significant reduction in operational costs which is also in line with the results obtained from the multiple regression analysis. The results from the regression indicate that financial performance (measured as Return on Equity) contributes to the adoption of EMA practices. Thus it is apparent that a business case exists for the adoption of EMA practices among manufacturing entities in Nairobi.



Chapter 5

Discussion and Conclusion

5.1 Introduction

This chapter discusses the findings from the research and gives a summary of the conclusions derived from the analysis of findings. Section 5.1 will give a detailed discussion of the results obtained from Chapter 4. Section 5.2 will summarize the results of the findings and give a conclusion. Section 5.3 will highlight the limitations of the study and propose recommendations for further research.

5.2 Discussion of the findings

5.2.1. The levels of adoption of EMA practices among manufacturing companies

This study sought to answer three research questions. The first research question asked what the level of adoption of EMA practices was among manufacturing organizations operating in Nairobi. The levels of EMA practices were determined by creating a checklist of specific practices and procedures that characterize adoption. The findings show that approximately 83% of the organizations that participated in the study have adopted EMA practices to some extent. The results indicate that most manufacturing organizations separately account for environmental costs-which is known as Environmental Cost Accounting (ECA) and quantify units of waste and energy streams involved in their production processes- known as Materials Flow Accounting (MFA). Both these methods represent the first stage of adoption called costing analysis. In particular, the high levels of adoption of the Materials Flow Accounting (MFA) method can be explained by the level of environmental costs accounted for separately as shown in Table 4.7 that indicates 100% of the respondents account for raw materials costs, 90% account for energy costs and 96.7% account for water expenditures that go into production.

IMA (1996) and UNDSO (2001) assert that EMA practices and techniques that fall into stage 1 of adoption (Table 2.1) can only be used to make costing decisions. Furthermore prior literature suggests that stage 1 companies only apply EMA practices to manage regulatory compliance (Buyse & Verbeke, 2003). In support of this conjecture, 19 of the participants-representing 63.33% separately account for the costs of environmental licenses issued by NEMA.

Only 26% of the sampled firms used EMA practices to make investment decisions. These results differ from those of Medley (1997) who proposed that organizations would consider environmental costs crucial in evaluating investment proposals. Two out of the thirty respondents (6.7%) used environmental key performance indicators to evaluate environmental performance. Both these methods represent stage 2 and stage 3 of the levels of adoption and are used for both investment and performance evaluation decisions respectively. The observations made regarding the levels of adoption show that most manufacturing businesses in Nairobi, have adopted EMA simply to meet the need for compliance. These findings are not in tandem with those of Ferreira, Moulang & Hendro (2010) and Masanet-Llodra (2006) who observed significantly higher levels of adoption among manufacturing organizations. However their research was based in Australia and Italy respectively so the context of their studies was different. Qian & Burritt (2010) observed low levels of adoption of EMA practices among the respondents in their study. Notably, their respondents were local government institutions.

The UNDSO's policy document that proposed guidelines for the use of EMA practices asserted that manufacturing organizations needed to monitor and trace environmental costs (UNDSO, 2001). As illustrated in Table 4.7, the bulk of environmental costs accounted for are expenditures that can easily and accurately be determined and measured. The levels of radiation or carbon emissions emitted by manufacturing entities are only accounted for by 13.3% of the respondents. The environmental expenditure related to expenditure for greener technologies is only provided for by 16.7% of the sampled participants. Essentially the findings show that the manufacturing sector is losing out on possible opportunities for carbon financing and cleaner production methods that could possibly drive down operational costs.

5.2.2 Factors influencing the levels of adoption of EMA practices

The second research question asked about the factors that influence the levels of adoption of EMA practices among manufacturing businesses operating in Nairobi. The researcher had identified six possible factors that could influence adoption based on the findings of prior studies as shown in Chapter 2. The first factor identified was the size of the company measured by the annual turnover of the company. The results of the multiple regression analysis show that the size does not affect the level of adoption of EMA within entities since the level of significance is greater than the acceptable level of 0.05. These findings are similar with those of Liaquat's (2006) study into Indian

manufacturing firms and their adoption of specialized management accounting methods. Contrarily Haldma and Laaats (2002) were of the opinion that larger entities would require more detailed accounting information thus they would need to adopt advanced management accounting practices.

The second factor identified was the age of the company, that is, the number of years the company had been in operation. The results obtained also indicated that age was not a significant factor in explaining the level of adoption. The findings obtained from this particular research differ with those of O'Connor, Chow & Wu (2004) who found that age of a company was positively related to the level of management accounting techniques adopted (MAPs). Their research though was looking at management accounting practices holistically whereas this research has focused on EMA practices specifically.

Third, the next factor that could potentially influence adoption was the financial performance of the manufacturing firm. The results obtained from the multiple regression show that a company's financial performance as measured by its return on equity (ROE) contributes to the firm's level of adoption of EMA practices. Wagner, Schaltegger & Wehrmeyer (2001) and Mir & Rahaman (2010) proposed that financial performance could have a positive effect on a company's environmental performance. The adoption of EMA practices contributes to improving environmental performance thus a positive relationship between the two variables is plausible. However, most of the participants were neutral about the influence of financial performance on the levels of adoption as shown in Table 4.10.

Compliance to environmental regulations was also significant in explaining the levels of adoption of EMA practices among local manufacturing organizations. The results are similar to studies carried out by Khalid & Dixon (2012) and Jalaludin, Sulaiman & Ahmad (2011) who discovered that regulatory pressure significantly influenced the adoption of EMA. The results obtained from the interviews also suggest that compliance to local environmental laws plays a significant role in the level of adoption of EMA practices in Kenyan manufacturing firms.

The level of sophistication in the type of manufacturing technology employed was also identified as a possible influencing factor. The findings from the study indicate otherwise as the level of significance was more than 0.05. Though various studies such as those of Drury & Tales (1994),

Ferreira, Moulang & Hendro (2010) and Gundawardana (2006) have found a positive relationship between the level of manufacturing technology used and the level of adoption of management accounting practices, their studies were based in developed economies.

The last influencing factor identified by the researcher was the level of environmental strategies employed by manufacturing businesses. From the results obtained, it is apparent that proactive companies, that is, companies that have employed strategies such as resource efficiency and cleaner production strategies into their production processes are characterized by higher levels of adoption. The results from the multiple regression equation indicate that the level of environmental strategies used explain the variances in adoption levels.

The results from the semi-structured interviews complement the results of the quantitative research by suggesting compliance to environmental regulations is a major factor that influences adoption of EMA practices. However, Respondent 1 clearly showed that their company has used EMA beyond the requirements set by the law to achieve the twin aim of conserving the environment and growing the business. Studies by Schaltegger & Burritt (2010) and Jasch (2001) have also shown that implementing EMA achieves the double aim of lowering a corporation's negative environmental impact and reducing operational costs.

In terms of the challenges associated with adoption, most of the participants felt that the complexity of the methods used and obtaining personnel experienced in environmental accounting were impediments to adoption. One of the respondents felt that the challenge they experienced when adopting EMA practices was showing employees how important it was to the company and the role the employees played to ensuring its success.

5.3 Conclusion

As Kenya aims to transition to a green economy by 2030, several reforms must be put in place in all sectors of the economy. The manufacturing industry contributes 10% to the country's GDP. UNEP's Green Economy Assessment Report for the year 2014, states that Kenya's manufacturing sector is a key pillar for economic growth. Hence, public policies are needed to encourage investment in resource efficient and cleaner production (RECP), recycling and production of green products if Kenya is to achieve its goal (UNEP, 2014).

The adoption of EMA practices is one of the ways the local manufacturing sector can contribute towards transitioning to a green economy. The implementation of EMA practices has helped businesses to recognize the environmental effects of their operational decisions and to make critical managerial decisions (Hansen & Mowen, 2005). The results of the study show that there are companies that have adopted EMA practices beyond the requirements of legal compliance such as seeking investments in cleaner production technology, lowering costs of production, product development among other reasons. Yet, it seems that low levels of adoption of EMA practices are prevalent among manufacturing businesses in Nairobi. The conclusions drawn from the Debnath, et al., (2012) are similar as they discovered that the environmental accounting practices used by organizations in various contexts hinged on legitimacy theory. Their results suggested that companies would only use EMA practices to appear credible to external stakeholders. Very few companies in their studies used EMA because they found it useful.

On the other hand, there are still companies that are environmentally proactive and have applied EMA practices beyond regulatory requirements (Buisse & Verbeke, 2013). Such entities regard regulatory requirements of little significance in the way they conduct their business. One of the respondents from the semi-structured interviews showed that though they considered compliance an important factor in influencing adoption, their company had experienced other benefits such as growth in the business and product innovation. Evidently there is a business case for the adoption of EMA practices as prior studies have shown (Buisse & Verbeke, 2013; Burritt & Saka, 2006; Bartolomeo, Heydkamp, James, & Wolters, 2000; Chang, 2013; Cohen, Fenn, & Naimon, 1997) there is a business case for the adoption of EMA practices. In Kenya though, it seems that companies are yet to fully appreciate the advantages associated with considering the interaction between their production activities and its effect on the environment.

The adoption of EMA practices needs to be encouraged so that businesses are able to apply the practice beyond compliance. The government can introduce tax incentives to companies that exhibit high levels of adoption of EMA. In addition, there needs to be proper alignment of the requirements for environmental compliance. NEMA, KNCPC and the Nairobi City Council must work together with international bodies such as UNEP to come up with a clear outline of best environmental practices for each subsector of the manufacturing industry since their manufacturing processes are different. In addition, a carbon trading scheme could be created by

the local government to encourage the use of carbon financing especially since the findings indicate that very few of the respondents seemed to account for their carbon emissions. Finally, the KNCPC needs to create awareness among manufacturing companies about the services they provide especially the trainings conducted so that more companies sponsor their employees to receive training in EMA practices. This initiative would solve some of the challenges related to adoption, in particular the difficulties involved with identifying personnel experienced in the practice of EMA.

5.4 Recommendations

Future research into EMA practices could attempt to investigate other possible determinants of adoption such as stakeholder pressure and institutional pressure. Furthermore the adoption of EMA practices could be examined in other industries or institutions such as universities, financial institutions, etc. Specifically, future research is required to explore EMA practices in waste management industries (Burritt & Saka, 2006). In Kenya, research into the way EMA is practiced in the Nairobi City Council could be a step towards reforming the way waste is managed within Nairobi. In addition, there is no international consensus on the practices that should be encapsulated within EMA. Since the practice is relatively new, the accounting methods used are heavily based on conventional accounting practices. For example, Environmental Cost Accounting (ECA) which is a subset of EMA is heavily based on Activity Based Costing (ABC). The major difference is in EMA, the environment is used as a cost driver (Qian, Burritt, & Monroe, 2011). This research has shown financial performance influences the levels of adoption of EMA. Hence, further research can be used to determine whether the levels of adoption of EMA practices may influence financial performance of an entity.

5.5 Limitations of the study

One of the limitations of this particular study was because it was cross sectional due to time constraints. Moreover, the researcher was unable to receive responses from three subsectors of the manufacturing industry. In particular, motor vehicle assembly, electrical and electronics and leather products and footwear. Furthermore, other possible determinants of EMA practices such as the location of the business (as suggested in the semi-structured interview) were not measured empirically.

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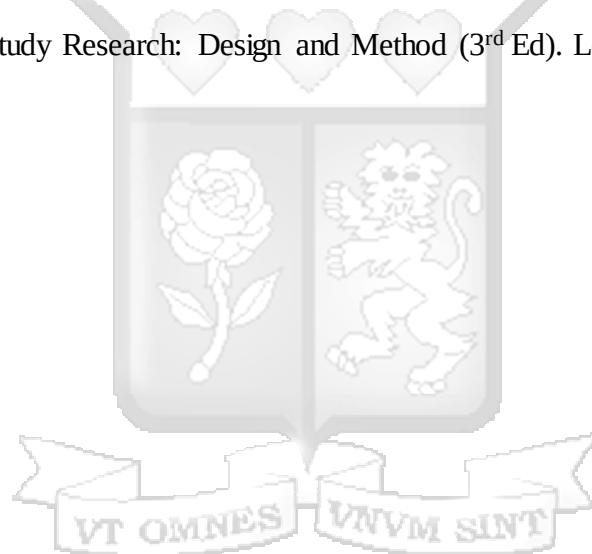
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Appendices

Appendix 1: Classes of environmental costs

Category	
1. Materials costs of product outputs	Raw and auxiliary materials Packaging materials Water
2. Materials costs of non-product outputs	Raw and auxiliary materials Packaging materials Operating materials Water Energy
3. Waste and emissions control costs	Equipment depreciation Operating materials Water and Energy Fees, taxes and permits/licenses Insurance
4. Preventive and other environmental management costs	Equipment depreciation Operating materials External services (e.g. consultation)
5. Research and Development costs	Research on potential toxicity of raw materials used, production processes, etc. Research on the development of energy efficient products
6. Less tangible costs	Clean up costs Legal costs Non-compliance fines Property damage Personal injury

Modified from IFAC (2005)

Appendix 2: EMA methods and techniques

Description of method
Allocation of environmental costs to production activities responsible for those costs
Conducting environmental management training programs for employees
Estimation of long term and short term effects of a company project on its location's environment
Estimation of environmental costs of a product to determine its selling price
Identification of environment related expenditures
Inclusion of environmental costs in investment appraisals
Utilization of environmental key performance indicators
Analyzing physical flows of materials and energy moving through the production system
Identification of opportunities for reduction of environmental impact caused by products
Quantification of environmental costs over a product's life
Incorporation of environmental goals into business strategy
Estimation of potential environmental contingencies
Creation of environmental cost accounts

Source: Modified from IMA (1996); UNDSO (2001)

Appendix 3: Types of Advanced Manufacturing Technologies (AMT)

Manufacturing function	Technology
1. Processing, fabrication and assembly	High speed machining Rapid prototyping systems Programmable logic control machines or processes
2. Handling of materials	Automatic storage and retrieval systems (bar coding) Automatic material handling system
3. Inspection and testing	The use of automated systems to inspect and/or test final products
4. Design and engineering	Computer Aided Design (CAD) Implementation of simulation technology
5. Manufacturing information systems	Resource Planning Systems
6. Integration and control	Computer integrated manufacturing Use of Just In Time (JIT)

Source: EU Thematic Draft report-Advanced Manufacturing Systems (2010)

Appendix 4: Subsectors within Kenya's manufacturing industry

Food, Beverages & Tobacco	Building & Construction
Textiles & Garments	Plastics & Rubber
Metal & Allied	Pharmaceutical & Medical equipment
Leather products & Footwear	Motor vehicle assembly
Paper and Paperboard	Electrical & Electronics
Timber & Products	Chemical & Allied

Source: Kenya Association of Manufacturers

Appendix 5: Classification of Kenyan manufacturing companies based on size

Class	Number of employees
A	5-19
B	20-49
C	50-99
D	100-199
E	200-499
F	Over 500

Source: Kenya Directory of Manufacturers Industries, 3rd Ed. 1997.

Appendix 6

Questionnaire

Section A: Background information

1. Name of the organization
2. In which year did the company commence operations?
3. What subsector in the manufacturing industry does the company belong to? Tick where appropriate.

☐ Food, Beverages and Tobacco	☐ Building and Construction
☐ Textiles and Garments	☐ Plastics and Rubber
☐ Metal and Allied	☐ Pharmaceutical and Medical Equipment
☐ Leather products and Footwear	☐ Motor vehicle assembly
☐ Paper and Paperboard	☐ Electrical and Electronics
☐ Timber and Products	☐ Chemical and Allied

4. How many employees work for this organization?

- ☐ Less than 5
- ☐ 5-19
- ☐ 50-99
- ☐ 100-199
- ☐ 200-499
- ☐ Over 500

Section B: This section of the questionnaire seeks to identify the levels of adoption of Environmental Management Accounting (EMA) practices and the factors influencing adoption. EMA is the identification and measurement of environmental related financial information to support business decision making.

5. Below are various classes of environmental costs (expenses in relation to environmental preservation and degradation). Kindly indicate those that are separately accounted for by your company. Tick where appropriate.

☐ Raw material costs	☐ Waste prevention costs
☐ Maintenance of operating materials costs	☐ Environmental licenses e.g. emissions license
☐ Packaging costs	☐ External services for environmental management
☐ Energy costs	☐ Fines and penalties (related to environmental laws)
☐ Water costs	☐ Research expenditures incurred to reduce env. costs
☐ Waste disposal costs	☐ Provisions for clean-up costs
☐ Carbon emissions	

Other environmental costs?

6. Listed below are the techniques used in EMA. Kindly indicate the methods used by the company. Tick if the method is used.

Description of method	✓
Allocation of environmental costs to production activities responsible for those costs	
Conducting environmental management training programs for employees	
Estimation of long term and short term effects of a company project on its location's environment	
Estimation of environmental costs of a product to determine its selling price	
Identification of environment related expenditures	
Inclusion of environmental costs in investment appraisals	
Utilization of environmental key performance indicators	
Analyzing physical flows of materials and energy moving through the production system	
Identification of opportunities for reduction of environmental impact caused by products	
Quantification of environmental costs over a product's life	
Incorporation of environmental goals into business strategy	
Estimation of potential environmental contingencies	
Creation of environmental cost accounts	
Others?	

7. Does your company use automated manufacturing processes?

☐ Yes

☐ No

If yes, indicate the technologies used to automate the manufacturing processes in the company and rate them on a scale of 1 to 4 where

Most used (4) Moderately used (3) Least used (2) Rarely used (1)

Automated Manufacturing process	1	2	3	4
High speed machining				
Rapid prototyping systems				
Programmable logic control machines				
Simulation technology				
Automatic storage and retrieval systems				
Computer Aided Design				
Resource Planning Systems				
Computer integrated manufacturing				

8. Listed below are some of the factors that influence the adoption of EMA practices. On a scale of 1 to 5 rate each of the following factors where:

Strongly agree (5) Agree (4) Neutral (3) Disagree (2) Strongly disagree (1)

Influencing factors	1	2	3	4	5
EMA is adopted to reduce operational costs					
EMA has been adopted to ensure compliance to local environmental regulations enforced by NEMA					

Reduce costs of litigation and fines imposed by non-compliance to environmental regulations					
EMA has been adopted because the firm actively uses an Environmental Management System					
Utilization of advanced manufacturing technology has contributed to the use of EMA					
EMA has been adopted to enable the use of cleaner production methods/techniques					
EMA has been adopted to enable the production of green products					
EMA is used to evaluate investments in green technologies/processes					
Management has initiated environmental training programs for employees in EMA					
EMA has been integrated into company policy					
EMA has been adopted to ensure internal compliance to the firm's environmental health and safety policy					
EMA has been adopted to ensure compliance to international statutes and/or regulations followed by the firm					
The utilization of EMA has contributed to improving financial performance					
EMA has been used by our company because of the type of business we are in					
The company's production activities have a significant impact on the environment					
Others?					

9. Listed below are various classes of environmental management strategies. Kindly tick the ones that have been applied in your organization.

Environmental strategy	✓
Written environmental and health and safety policy	
Use of an Environmental Management System (e.g. ISO 14000)	
Conduction of environmental training programs for employees	
Use of Resource Efficient and Cleaner Production methods (conducted by KNCPC)	
-recycling of waste/effluent produced	
-use of water catchment areas (to save water)	
-monitoring levels of carbon emissions	
-use of renewable sources of energy (e.g. solar power)	
Use of measurable environmental objectives (To measure environmental performance)	
Others?	

10. Listed below are the benefits associated with the application of EMA. On a scale of 1-5, kindly rate the benefits to your company where:

Strongly agree (5) Agree (4) Neutral (3) Disagree (2) Strongly disagree (1)

Benefits	1	2	3	4	5
Reduced operational costs					
Improved company reputation					
Business process innovation					
Product innovation or modernization					
Enhanced product pricing decisions					
Improved financial performance					
Others?					

11. Below are the challenges related to the adoption of EMA . On a scale of 1-5, kindly rate the challenges experienced by your company where:

Strongly agree (5) Agree (4) Neutral (3) Disagree (2) Strongly disagree (1)

Challenges	1	2	3	4	5
Complexity of techniques and methods used					
Resistance from employees					
Lack of management commitment					
Absence of international accounting standards on the practice of EMA					
Difficulties in obtaining personnel experienced in EMA					
Others?					

12. What was the company's return on equity for the last financial year (2013)?

Where $ROE = \text{Profit after tax} / \text{Shareholders equity}$

- ☐ Less than 5%
- ☐ 10-15%
- ☐ 15-20%
- ☐ 20-25%
- ☐ Over 25%

13. What was the annual turnover for the company in 2013?

- ☐ Up to Kshs 50 million
- ☐ Kshs 51 million to 500 million
- ☐ Kshs 501 million to 1 billion
- ☐ Kshs 1.1 billion to 5 billion
- ☐ Kshs 5.1 billion and above

14. What percentage of revenue is spent on meeting environmental regulatory compliance?

- a. Less than 5%
- b. 5-10%
- c. 10-15%
- d. 15-20%
- e. 20-25%
- f. More than 25%

Appendix 6

Semi-structured interview

Name of the organization

1. What commitments has your firm made in regard to preserving the environment?
2. Do you take environmental considerations into account when making managerial decisions? In particular which decisions?
 - ☐ Budgeting decisions
 - ☐ Costing decisions
 - ☐ Investment decisions
 - ☐ Product pricing decisions
 - ☐ Others? Please specify
3. Why did you start using EMA?
 - ☐ Educational background-where did you learn about EMA?
 - ☐ Elevated environmental consciousness
 - ☐ Need to comply with regulations (e.g. as stipulated in the Environmental Management and Coordination Act)
 - ☐ Other reasons?
4. What would you say was the main influencing factor that led to adoption of EMA practices?
5. What are some of the challenges you experienced when adopting EMA practices?
 - ☐ Lack of international accounting standards for EMA
 - ☐ Employee resistance/reluctance in adoption
 - ☐ Complexity of methods used
 - ☐ Others?
6. What are the benefits you've experienced as a result of adoption of EMA practices?
 - ☐ Improved financial performance
 - ☐ Enhanced reputation (product brand; company image)
 - ☐ Reduced operational costs
 - ☐ Others?