The application of Environmental Management Accounting amongst KwaZulu-Natal's Top Businesses

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ABSTRACT

Sustainable development is often described in three dimensions, namely social, environmental and economic. Environmental Management Accounting (EMA) is a management accounting approach which brings the environmental impact of the process to the attention of the stakeholders whilst also looking at the economic aspect so as to control costs. While EMA's application has been adopted widely in developed countries, does the same apply in South Africa? Seeking to understand the level of current EMA being conducted at the corporate level will assist government and corporations in South Africa to understand the factors encouraging better accounting sustainability. The focus of this study was confined to leaders of organisations operating in the KwaZulu-Natal (KZN) province of South Africa. Quantitative research was conducted on 40 organisations that operated in KZN. The organisations sampled ranged from small to large enterprises, and operated in a number of different industries. The study centred on analysing the organisation's attitude towards environmental sustainability, the types of EMA reports generated and reasons for or against using EMA. The research revealed that the attitude by each organisation towards environmental sustainability was vital in encouraging organisations to implement EMA as a method of controlling pollution. The majority of organisations had applied some form of EMA in their KZN organisation. A major finding was that for those who chose to apply EMA, their most important reason was to control costs better. The second reason for applying EMA was legislation. Planned implementation of EMA was analysed and a number of specific industries and sizes of industries were highlighted for their implementation of EMA or lack thereof. This research is useful to the reader as it has analysed the current application of EMA to encourage sustainable development, identify the general obstacles encountered to application of EMA and recommend strategies that can be employed to overcome them. These recommendations include government involvement through education programmes to improve the understanding and attitude towards EMA. Secondly, government should pass legislation making environmental reporting a compulsory disclosure for all organisations. Organisations themselves should use advanced computerised recording systems to develop their application of EMA. Larger businesses should encourage and assist smaller organisations in their supply chains to become more active in their own environmental protection.

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ACRONYMS AND TERMS

CDP	The Carbon Disclosure Project
CEO	Chief Executive Officer
CFO	Chief Financial Officer
COP 17	The 17th Conference of the Parties
CRISA	The Code for Responsible Investing by Institutional Investors in South Africa
CSR	Corporate Social Responsibility
DEAT	The Department of Environmental Affairs and Tourism
EMA	Environmental Management Accounting
EMI	The Environmental Management Inspectorate
EMS	Environmental Management Systems
EPA	The Environmental Protection Agency
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GRI	The Global Reporting Initiative
IFAC	The International Federation of Accountants
IIRC	The International Integrated Reporting Committee
IoDiSA	The Institute of Directors in Southern Africa
IRC	The Integrated Reporting Committee
ISO	The International Organisation for Standardisation
KZN	KwaZulu-Natal
MEMA	Monetary Environmental Management Accounting
PEMA	Physical Environmental Management Accounting
SHE	Safety Health and Environmental
SMME	Small and Medium and Micro Enterprises
SPSS	Statistical Package for the Social Sciences
SRI	Socially Responsible Investment
UNDFSD	The United Nations Division for Sustainable Development

CHAPTER ONE

INTRODUCTION TO THE PROBLEM

1.1 Introduction

Sustainable development is often described in three dimensions, namely social, environmental and economic. Enhancing economic growth while still ensuring that the environmental and social aspects are not jeopardised is the great hope of the 21st century. The initiative of balancing the social, environmental and economic aspects is commonly referred to as sustainable development. The question therefore being asked is what the role of an organisation is in achieving environmental sustainability. Environmental Management Accounting (EMA) is a management accounting approach which brings the environmental impact of the process to the attention of the stakeholders. In this way decisions can be made which are more efficient for the organisation and less harmful for the environment. Sustainable development will require the cooperation of all stakeholders concerned. Specifically the accounting function needs to change from a pure bookkeeping role to one of strategic management to play a greater part in sustainable development. Chapter One presents an overview of the research undertaken in which the problem statement, motivation for the study is described. This is followed by the objectives used to address the research problem.

1.2 Problem Statement

The majority of economic growth is predicted to occur in developing countries, South Africa being one of these developing countries. With economic growth comes a potential for greater pollution of the environment through the processes adopted by organisations in converting inputs into outputs. This flippant attitude is not sustainable in the long term unless pollution is controlled. EMA has been conceived as a method to control pollution

through effective decision making. This is done through the collection, analysis, and use of environmental cost information for the purpose of supporting environmental management systems and environmental reporting to interested parties (Deegan, 2003).

According to the U.S. Environmental Protection Agency (1995) an important function of EMA is to bring environmental costs to the attention of corporate stakeholders who may be able and motivated to identify ways of reducing or avoiding those costs while improving environmental quality. The key to placing the environmental impact higher on the agenda of the decision makers is therefore to get the vast majority of organisations engaged in the process of a holistic approach to addressing corporate environmental issues. This can be done by the government through enforcement of legislation enacted or through economic incentives offered for better compliance with agreed upon norms. Alternatively this needs to be done as an initiative by the organisations through sustainable production patterns, compliance with regulations & policies and through EMA initiatives led by the decision makers.

The basis of this research will be to discover the attitude of corporate industry to EMA initiatives and to see whether it would be a better approach to encourage incentives/better education of the benefits or whether further legislation is needed as a means to develop sustainable development.

1.3 Motivation for the Study

Seeking to understand the level of current EMA being conducted at the corporate level will assist the two main players, namely government and corporate industries in South Africa, to understand the factors encouraging better accounting sustainability. Ultimately though, all stakeholders including general society will benefit through greener operations being conducted through responsible entrepreneurship.

Government will be better able to plan and implement policies or legislation to encourage or force organisations to operate in a more sustainable manner. Probably the biggest winner of the successful implementation of EMA would be the organisations, made up of

small, medium and large entities. The EMA benefits can be divided into three broad categories (International Federation of Accountants, 2005):

- Compliance efficiency: Cost-effective compliance with environmental regulations and corporate policies.
- Eco-efficiency: Simultaneous cost savings and environmental impact reductions as energy, water, and materials are used more efficiently.
- Strategic position: Developing and implementing effective and environmentally sensitive programs to ensure an organisation's long term strategic position.

Once the benefits of an effective EMA policy have been explained the corporate industries may be more willing to operate EMA in their own organisation.

A problem often encountered by organisations is that environmental costs are not always easily visible to the decision makers. They include visible disposal costs (waste handling and transport, fines, mitigation, cleaning) and less identifiable production cost inefficiencies (wasted materials, price of lost energy, and wasted capacity) (Ambe, 2008). EMA seeks to understand these costs so that they can be better managed for greater efficiency and therefore bigger profits. This goes all the way down to encouraging cleaner production, more efficient supply chain management, 'greener' procurement efforts and greener life cycles.

1.4 Focus of the Study

The focus of this study was confined to leaders of organisations operating in the KwaZulu-Natal (KZN) province of South Africa. It was reasoned that the leaders had a comprehensive oversight of the entire organisation and understood the strategic objectives of their organisation. They were also the ones guiding the organisations from the front and their attitude towards EMA would trickle down the organisation hierarchy and apply to all other departments who reported to them.

This study was centred on the concepts of their organisation's attitude towards environmental sustainability, the types of EMA reports generated and reasons for or against using EMA. The basis of this research will be to interrogate the attitude of financial leaders in corporate industry to EMA initiatives and to determine whether it would be a better approach to encourage incentives or better education of the benefits or whether further legislation is needed as a means to develop sustainable development.

1.5 Objectives

The literature review, detailed in Chapter Two, provided a sound theoretical background to the application of Environmental Management Accounting amongst KwaZulu-Natal's Top Businesses. Following the literature review, the following core objectives were explored in Chapter Three:

- To determine the organisations' awareness of the effects of EMA.
- To describe the organisations' attitudes towards the cost and benefit of EMA.
- To establish the relationship between the type of industry and their awareness of EMA.
- To establish and explain the relationship between the type of industry and their attitude towards EMA.

The objectives of this study were met through a research questionnaire being answered by the leaders of KZN organisations. The sample of organisations was made through judgmental sampling by using the 'KZN Top Business Portfolio' as a frame of organisations in KZN. The questionnaire was sent via e-mail to the Chief Financial Officer in charge of each organisation with an attached link so that the respondent could answer by means of self-completion on the questionnaire website QuestionPro. The electronic survey method was used to collect the primary data used in research analysis. The questionnaire consisted of nine open and closed questions and applied branching to ask respondents more relevant questions. The data analysis process was analysed using the Statistical Package for the Social Sciences and the information was displayed in the form

of graphs and tables. The results of the analysis were commented on in Chapter Four and conclusions and recommendations of the findings were presented in Chapter Five.

1.6 Limitations of the Study

The main constraint identified in this study was the limited scope of responses by respondents due to the nature of the scales chosen for some questions. This hampered conclusive findings in one of the objectives. Other limitations are explained in Chapter Five.

1.7 Summary

Chapter One has provided an introduction, background and overview of the study to be undertaken. This research will provide an investigation into current and intended EMA practices by organisations in KZN. This research is useful as it will conclude whether it would be a better strategy to introduce legislation or alternatively encourage incentives and education to bring about more active sustainable development in organisations. Encouraging better EMA practices will generate greater efficiencies and higher profits for the organisations and ultimately develop a greener and more sustainable environment for all. Chapter Two will focus on the literature review, which forms the basis for the empirical study.

CHAPTER TWO

THEORY AND LITERATURE REVIEW

2.1 Introduction

The purpose of this literature review is to provide a sound theoretical background to EMA through a critical review of textbooks, academic journals, periodicals and theses. It will orientate readers to key concepts referred to in matters of environmental accounting as a management tool for organisations. This chapter will focus on the relevance of EMA in the context of sustainable development. It will define the term EMA and explain how it can be applied to an organisation along with perceived benefits and challenges encountered. The literature also investigates research conducted locally in EMA's application in South Africa.

2.2 Sustainable development

Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987). The South African National Environmental Management Act (No. 107 of 1998) defined sustainable development as 'the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations' (Department of Environmental Affairs and Tourism (DEAT), 1998: 1). According to King (as cited in the Institute of Directors in Southern Africa (IoDiSA) 2009) sustainability is the primary moral and economic imperative of the 21st century both in terms of opportunities and risks for organisations.

From a theoretical perspective, sustainable development is based on deep theoretical concepts. The first theory, legitimacy theory is based on the idea that in order to continue operating successfully, organisations must act within the boundaries of what society

identifies as socially acceptable behaviour (Godschalk, 2009; Gray, Kouhy & Lavers, 1995; O'Donovan, 2002). The second theory, stakeholder theory is the concept that the stakeholder interest is critical to the continued organisation's success and any continued existence requires the support of stakeholders (Donaldson & Preston, 1995; Gray, Kouhy et al., 1995). The final theory, Porters Hypothesis states that correctly formulated environmental regulation will both protect the environment and generate innovative approaches which will lead to competitive advantage benefits for the organisation (Crotty & Smith, 2006; Godschalk, 2009; Porter & van der Linde, 1995). Gray, Kouhy *et al.* (1995) postulate that the above theories may be considered supplementary to each other.

Conventionally, sustainable development has been described in three dimensions, namely social, environmental and economic. These dimensions are not isolated but rather influence each other in many ways. The challenge is balancing environmental and social sustainability with economic profits. If there is a break in this mutual cycle ultimately all will suffer. For example if organisations focus too much on profits to the detriment of a healthy environment (i.e. pollution) this will ultimately damage the environment irreparably and therefore affect the people living in this environment. These relationships need to be understood by organisations so that all stakeholders are taken into consideration.

2.2.1 Sustainable development: the urgency of the problem

Sustainability has become a crucial business focus in developed and developing countries alike. According to the Global Footprint Network (as cited in Worthington-Smith, 2009: 3) the global community uses the equivalent of 1.3 planets to provide the resources we use, and to absorb our waste. They estimate that by the mid 2030s our global population will need the equivalent of two earths to support us.

The majority of economic growth is predicted to occur in developing countries (O'Neill, Wilson, Purushothaman & Stupnytska, 2005), South Africa being one of these developing countries. The tremendous surge in developing countries' stock markets is evidence of this tremendous growth (Mohtadi & Agarwal, 2001). The economic growth in the developing

countries creates greater pollution of the environment through the processes adopted by organisations in converting inputs into outputs (Auty, 1997; Czech, 2000; Kukla-Gryz, 2009). Therefore a carefree attitude towards environmental degradation is not sustainable in the long term unless the pollution is controlled. For example research shows that although Africa's carbon emissions are lower than developed countries, since 1990 carbon dioxide emissions in Africa have increased by about 50% (Sengul, Pillay, Francis & Elkadi, 2007). South Africa specifically has a bad reputation with its dominant use of fossil fuels. South Africa produces 40% of the emissions of the continent or 356 million tons of carbon dioxide annually (Ernst & Young, 2010). In terms of global risks environmental regulation remains one of the top ten long term issues for organisations according to research by Ernst & Young (2010).

Sustainable development demands urgent attention from all stakeholders, in particular private sector companies (World Commission on Environment and Development, 1987; Glasby, 1995). The awareness of sustainable development has begun a 'conscious cultural evolution' where taking care of the environment has become a topical issue of concern for all stakeholders (Beets & Souther, 1999; Birkin, Edwards & Woodward, 2005; Johansson & Winroth, 2010; Terry, 2008). The response from the business community to addressing sustainable development has been to gather and report information about their environmental and social activities to their stakeholders (IoDiSA, 2009). EMA emanates from environmental reporting and has been conceived as a method to control pollution through effective decision making. This is done through the collection, analysis, and use of environmental cost information for the purpose of supporting environmental management systems and environmental reporting to interested parties (Deegan, 2003).

2.2.2 Developing a strategy for sustainable development

The strategy of any organisation needs to take into account the critical issues of environmental sustainability (Yakhou & Dorweiler, 2004). In a recent survey conducted by KPMG and the Economic Intelligence Unit of 378 large and medium-sized organisations across 61 countries shows that 62% have strategies for sustainable development within their organisation and a further 11% are currently developing one

(KPMG, 2010). Clearly every organisation will have unique strategies based on their situation and vision. Hart and Milstein (2003) developed a framework to integrate sustainability into any strategy, illustrated in Figure 2.1.

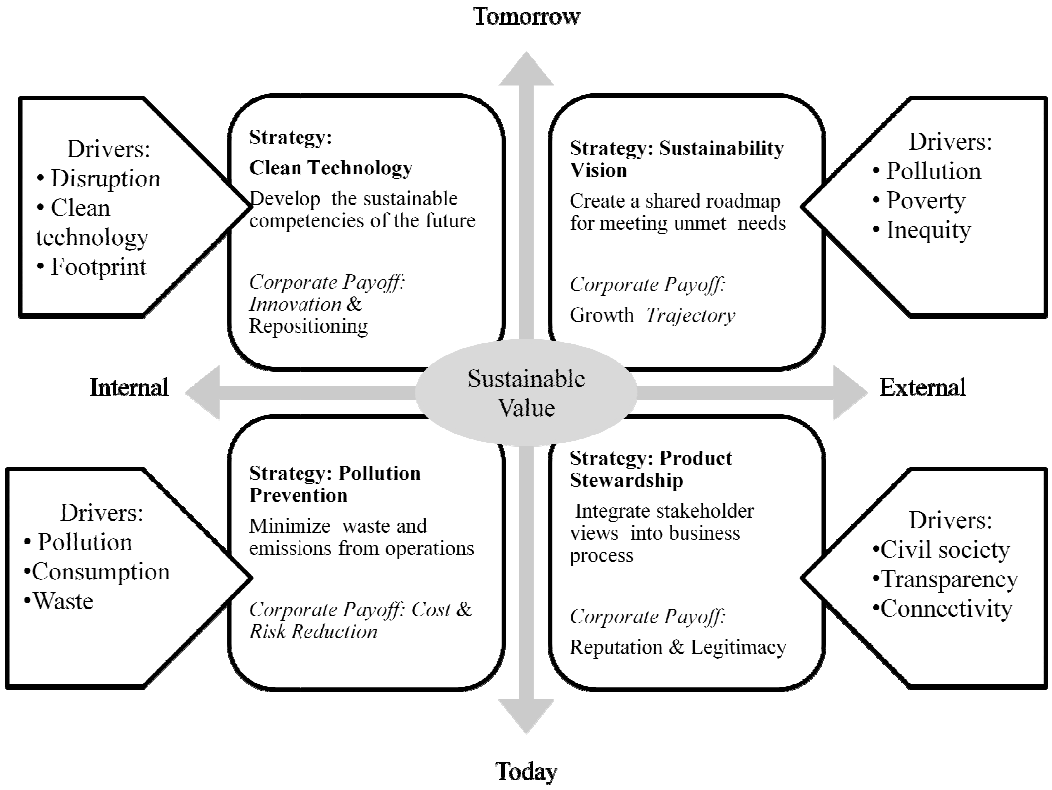

Figure 2.1 - Integrating a strategy consistent with sustainability

Source: Hart, S. L. & Milstein, M. B., 2003. Creating sustainable value. *Academy of Management Executive,* 17**,** 56-67: p 60.

According to Hart & Milstein (2003) different strategies to encourage sustainable development can be developed depending on the timeframe (today or tomorrow), focus (internal or external) and unique drivers affecting the organisation. Although many organisations concentrate on the bottom left hand quadrant, Hart and Milstein (2003) recommend a balanced portfolio sustainability strategy.

2.3 Definition of Environmental Management Accounting

EMA is defined by the International Federation of Accountants (International Federation of Accountants (IFAC), 2005) as 'the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices'. Jasch (2006: 1194) defined EMA simply as management accounting with a focus on physical information as well as monetary information related to the environment. EMA needs to be considered in the context of environmental accounting. Steel and Powel (as cited in de Beer & Friend, 2006: 549) defined environmental accounting as the 'identification, allocation and analysis of material streams and their related money flows by using environmental accounting systems'. Through environmental accounting the preparers can provide invaluable insight into the environmental impacts and associated financial effects.

Conventional monetary accounting comprises:

- Financial accounting (past oriented);
- Corporate statistics and indicators (past oriented);
- Management or cost accounting (future oriented);
- Budgeting (future oriented); and
- Investment appraisal (future oriented).

Financial accounting is a historical indicator of the profitability or success of the organisation. Management or cost accounting is the main tool of most internal management decisions using processes and techniques that focus on the most efficient use of organisational resources (Correia, Langfield-Smith, Thorne & Hilton, 2008). EMA takes place in both management accounting and financial accounting spheres (IFAC, 2005). The purpose of EMA is to accurately account for environmental costs in both spheres of accounting so that all stakeholders are able to make the best decisions.

EMA is accounted in monetary and physical units (IFAC, 2005; Jasch, 2006; United Nations Division for Sustainable Development (UNDFSD), 2001). These two methods recognise both the environmental related impact on the economic situation of organisations (through monetary units) and the organisation related impacts on the

environment (through the physical units) (Cullen & Whelan, 2006). In this way EMA integrates both physical and monetary issues for stakeholders to be aware of when considering the environmental impact of the organisation (Bennett, Rikhardsson & Schaltegger, 2003). Physical and monetary EMA will be explained further.

2.3.1 Physical Environmental Management Accounting (PEMA)

PEMA tracks the material balances flow in physical units of material, water, energy and waste within a defined system boundary (UNDFSD, 2001). PEMA shows how much of the purchased materials are actually processed into sold products and how much is discharged as waste, wastewater or air emissions (Jasch, 2006). PEMA is illustrated in Figure 2.2.

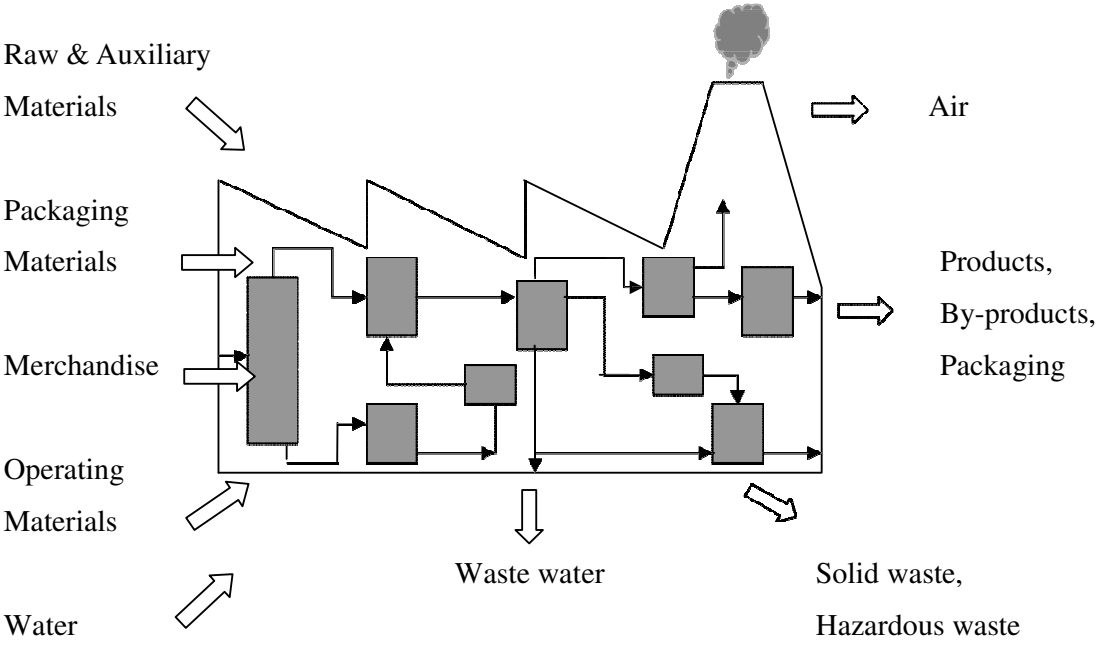

Figure 2.2 - PEMA: Materials Flow Accounting

Source: IFAC, 2005. International Guidance Document on Environmental Management Accounting. *IFAC* [Online]: p31.

With PEMA the details of material flows can be traced through all the different material management steps, such as procurement, delivery, use and shipping. This may even be extended to waste collection, recycling, treatment and disposal.

2.3.2 Monetary Environmental Management Accounting (MEMA)

MEMA tracks the environment-related costs and revenues as a result of the environmental impact of the organisation's processes (UNDFSD, 2001). MEMA can be generated for an attention to environmental costs/revenues generated from input materials, wastes generated, processing, or product costing. MEMA can also be used for the assessment of total costs generated, budgeting, controlling and investment appraisal. MEMA can even be extended to include analysing suppliers in supply chain environmental management or looking at the environmental costs included in the product life cycle (IFAC, 2005).

2.3.3 Environmental costs

One of the most important goals for an organisation therefore is to clarify the types of environmental costs that managers need to be aware of for controlling their organisation's environmental and economic performance (IFAC, 2005). The topic of accounting for costs, revenues and benefits has great importance for the financial management of any organisation. Environmental costs form a part of waste. Waste is anything that cannot be turned into a marketable product and is therefore indicative of production inefficiency (UNDFSD, 2001). Put another way, what has not left the organisation as a product is a sign of inefficient production and is therefore waste (Jasch, 2006). Knowing the cost of wastage due to environmental costs can help management make more relevant decisions so as to reduce such inefficiencies. Environmental costs are defined by the UNDFSD as 'the internal and external costs incurred in relation to environmental damage and protection'(UNDFSD, 2001). This includes waste and emission treatment, prevention and environmental management, material purchase value of non-product output, and processing of non-product output. They include all costs that have a direct financial impact to the organisation, individuals, society and to the environment (Environmental Protection

Agency [EPA], 1995) incurred to prevent, detect and report environmental impacts. Table 2.1 illustrates the different types of environmental costs incurred by organisations.

Table 2.1 - Examples of Environmental Costs Incurred by Firms

Potentially Hidden Costs		
Regulatory Notification Reporting Monitoring/testing Studies/modelling Remediation Recordkeeping Plans Training Inspections Manifesting Labelling Preparedness Protective equipment Medical surveillance Environmental insurance Financial assurance Pollution control Spill response Storm water management Waste management Taxes/fees	*Upfront* Site studies Site preparation Permitting R&D Engineering and procurement Installation Conventional Costs Capital equipment Materials Labour Supplies Utilities Structures Salvage value Back-End Closure/ decommissioning Disposal of inventory Post-closure care Site survey	*Voluntary* (Beyond Compliance) Community relations/ outreach Monitoring/testing Training Audits Qualifying suppliers Reports (e.g., annual environmental reports) Insurance Planning Feasibility studies Remediation Recycling Environmental studies Research & Development Habitat and wetland protection Landscaping Other environmental projects Financial support to environmental groups and/or researchers
Contingent Costs		
Future compliance costs Penalties/fines Response to future releases	Remediation Property damage Personal injury damage	Legal expenses Natural resource damages Economic loss damages
Image and Relationship Costs		
Corporate image Relationship with customers Relationships with investors Relationship with insurers	Relationship with professional staff Relationship with workers Relationship with suppliers	Relationship with lenders Relationship with host communities Relationship with regulators

Source: EPA, 1995. An Introduction to Environmental Accounting As A Business Management Tool: p9.

According to the EPA (1995) the different types of environmental costs incurred by organisations are:

- **Conventional Costs:** are the costs of using raw materials, labour, capital goods, and supplies. These costs are still relevant to EMA as decreased use and less waste of raw materials, labour, capital goods, and supplies are environmentally preferable, reducing both environmental degradation and consumption of non-renewable resources.

- **Hidden costs** are those that the organisation actually incurs, but that may be unknown to most managers. They may include upfront, operational, and back-end activities undertaken to comply with environmental laws (i.e., regulatory costs) or go beyond compliance (i.e., voluntary costs).

- **Contingent costs** are those that may or may not actually be incurred as a result of remedying and compensating for future costs of accidental contaminations of the environment and fines or penalties for future regulatory infractions.

- **Relationship/image costs** are subjective (though measurable) costs the organisation incurs as a result of its environmental performance (good or bad). The costs themselves are not 'intangible,' but the direct benefits that result from relationship/corporate image expenses often are.

2.3.4 Difficulty in accounting for the environmental costs and revenues

According to Jasch and Schnitzer (2002) the main problem in EMA is that there is a lack of a standard definition for environmental costs. Nevertheless, some organisations are attempting to address environmental costs as part of their environmental accounting systems (EPA, 1995). Environmental costs are often very difficult to quantify as they are not fully recorded and this leads to distorted decision making by the managers. It may not always be clear whether a cost is environmental or not as some costs fall into a gray zone which may be classified as partly environmental and partly not. Some financial accounts include environmental costs, however, they are often aggregated in a way that does not identify the specific environmental costs (UNDFSD, 2001). According to the EPA (1995) determining whether a cost is environmental is not critical. The purpose of EMA is to

ensure that relevant costs receive relevant attention. Table 2.2 illustrates the level of difficulty in assessing and measuring certain environmental costs.

Table 2.2 - Level of difficulty in assessing and measuring certain environmental costs

Conventional Costs	Hidden Costs	Contingent Costs	Relationship/ Image Costs	Societal Costs
Internal costs				External costs
Easy to measure	Less easy to measure	Difficult to measure	More difficult to measure	Very difficult to measure

Source: EPA, 1995. An Introduction to Environmental Accounting As A Business Management Tool: p14.

The scope of environmental costs range from those that include the obvious conventional costs to those that measure hidden, contingent, relationship and societal costs. Societal costs represents the cost of impacts (e.g. environmental degradation) on the environment, human beings and their welfare for which the organisation is not legally accountable (EPA, 1995). At each level the costs become more difficult to measure. Valuing societal (or external) costs is both difficult and as these costs occur outside the organisation they do not show up in its accounts. It is for this reason that the focus of EMA is not on estimating external effects and relationship/image. However, for the calculation of investment projects and savings these factors are considered (Jasch, 2003).

2.3.5 The shortcomings of traditional costing systems

Traditional costing systems have typically allocated environmental costs into 'overhead cost pools' which are then allocated across production processes, resulting in the cost of the product. Traditional management accounting systems have treated environmental expenses as overheads because tracking costs separately was technologically difficult and the environmental costs historically have been small, so the benefit of tracking the costs separately was low (Rogers & Kristof, 2003). As a result traditional overhead allocations are done on an arbitrary basis unrelated to the actual environmental impact of the product. This leads to products with lower environmental costs subsidising others with higher environmental costs. Another consequence of traditional costing was that production

managers had no incentive to reduce environmental costs (UNDFSD, 2001). A study by Gale (2006) showed that environmental costs are at least twice as high as would generally be reported using traditional costing. This emphasises the need for EMA in identifying important environmental costs as well as benefits that are 'hidden' in other accounts for better decision making.

2.3.6 Classifying environmental costs

IFAC (2005: 37) observed that in terms of accounting for the environmental costs using EMA, organisations tend to use the following four types of cost categories to analyse costs:

- Categories reflecting the type of environmental activity (such as waste control vs. waste prevention),
- Categories more representative of traditional accounting (such as materials vs. labour),
- Environmental domain categories (such as water vs. air vs. land), and
- Categories reflecting data visibility in the accounting records (such as obvious costs vs. hidden costs).

With this in mind Table 2.3 defines a set of environment-related cost categories.

Table 2.3 - Environment-Related Cost Categories

1. Materials Costs of Product Outputs Includes the purchase costs of natural resources such as water and other materials that are converted into products, by-products and packaging.
2. Materials Costs of Non-Product Outputs Includes the purchase (and sometimes processing) costs of energy, water and other materials that become Non-Product Output (Waste and Emissions).
3. Waste and Emission Control Costs Includes costs for: handling, treatment and disposal of Waste and Emissions; remediation and compensation costs related to environmental damage; and any control-related regulatory compliance costs.
4. Prevention and Other Environmental Management Costs Includes the costs of preventive environmental management activities such as cleaner production projects. Also includes costs for other environmental management activities such as environmental planning and systems, environmental measurement, environmental communication and any other relevant activities.
5. Research and Development Costs Includes the costs for Research and Development projects related to environmental issues.
6. Less Tangible Costs Includes both internal and external costs related to less tangible issues. Examples include liability, future regulations, productivity, company image, stakeholder relations and externalities.

Adapted from IFAC, 2005. International Guidance Document on Environmental Management Accounting. *IFAC* [Online]: p31.

Table 2.3 is a simple break-down of costs into environment-related categories. The columns in Appendix 1 show the assignment of these environment-related costs to their

environmental domains (air pollution, waste, waste water, noise etc.) so that the cost categories mentioned above can be further analysed by environmental domains.

2.3.7 Environmental Management Systems

Environmental Management Systems (EMS) is a further application of the EMA whereby systems are put in place to manage the environmental performance of an organisation (Correia, Langfield-Smith *et al.*, 2008). EMS assists entities and individuals in identifying, categorising and managing the environmental effects of the activities (Gibson & Martin, 2004). This systematic approach to environmental performance of an organisation includes procedures and methodologies to develop policies and plans, and then implement, identify and control the environmental impact of its operations, products or services (Arimura, Hibiki & Katayama, 2008; International Organization for Standardisation (ISO), 2004). This approach includes waste monitoring, prevention of pollution, optimal resource utilisation leading to cost reduction (Pun, Hui, Lau, Law & Lewis, 2002). The ISO 14000 series establishes the specifications of an EMS for any type of organisation (ISO, 2009).

The ISO 14001: 2004 series includes several areas such as EMS, environmental auditing, environmental investigations, environmental performance evaluation, life cycle assessment, environmental labelling, environmental aspects in product standards, terms and definitions (da Silva & de Medeiros, 2004). The intention of ISO 14001: 2004 is to provide a framework for a holistic, strategic approach to the organization's environmental policy, plans and actions (ISO, 2009). There were 406 ISO 14001 registered organisations in South Africa (Worthington-Smith, 2009). This is up from only 264 registered in 2004 (Gbedemah, 2004). ISO 50001 has just been released in 2011, which establishes a framework for organisations to manage their energy use (ISO, 2011).

2.4 The Benefits of EMA

Much emphasis has been made of the need for EMA in an organisation (Ambe, 2007; IFAC, 2005; Jasch, 2003; Porter & van der Linde, 1995; UNDSFD, 2001). The primary

incentive of any organisation is wealth creation. Organisations have to realise the increased monetary rewards of improved environmental performance (Godschalk, 2009).

2.4.1 Better information available for decision makers

Accurate product costing information is required for decisions such as volume and choice of products being manufactured. Often re-analysing the costs from an EMA point of view will help identify products which have higher environmental costs, that under the traditional costing system were being allocated less overhead costs because many of the environmental costs were hidden (Rogers & Kristof, 2003). This may have an impact on the decisions made so that the cost of the product is better understood. This analysis may make the difference between a profitable and unprofitable product line (White, Savage, Brody, Cavander & Lach, 1995).

Future-based investment project appraisal decision making is vital for any organisation. This is also known as Capital Budgeting (such as Net Present Value, Internal Rate of Return and Payback Period). With EMA incorporated into capital budgets, decision makers are more aware of the potential future environmental costs as contingency costs and other hidden costs are taken into account in the capital budget (Burritt & Schaltegger, 2001; White, Savage *et al.*, 1995). EMA is able to add value when considering Full Life-Cycle Costing in an organisation (Price & Coy, 2001).

2.4.2 Eco efficiency

IFAC (2005) details how the field of management accounting has evolved from the 1950s, where the focus was on simple cost determination up to today where the focus is on value creation through the reduction of waste and more effective use of resources. This current emphasis of management accounting emanates from the Total Quality Management philosophy in business. Keeping environmental awareness in the use of water, energy, raw materials and efficient handling of wastage can save organisational resources (EPA, 1995; Godschalk, 2009; IFAC, 2005; UNDFSD, 2001). Evidence presented in case studies by

the World Resources Institute shows that for certain products and facilities, environmental costs can account for up to 20 percent of a product's total costs (Ditz, Ranganathan & Banks, 1995). With case base research, Hart (1995) gave evidence that end-of-pipe pollution-control projects lose 16% on every dollar invested. Hart cited Buzzelli (1994) who found 'the return on pollution-prevention projects has averaged better than 60% for the past 10 years' (Hart, 1995: 993)

The benefit of EMA is that all environmental costs, previously obscured in overhead costs, are now easily identified through EMA. If the costs can be identified, then they can be linked to the revenues generated from by-products and recycling to give management an even clearer understanding of the cost-versus-benefit of reducing wastage. With EMA the environmental costs can be linked to their cost drivers. Once the costs drivers are known they can be controlled so as to reduce the environmental costs thereby decreasing the harm caused to the environment and in so doing create an eco-efficiency (IFAC, 2005). According to Jasch (2006) organisations can pay three times more for Non-Product Output (NPO) which is wasted:

- Firstly, at the time of purchase of the materials: materials are purchased and transported in,
- Secondly, during production: materials are handled, processed further, and
- Finally, during disposal: the NPO must be collected, sorted, transported out and disposed of at a cost.

If management is more aware of the costs incurred for such NPO they will certainly aim to reduce the inefficiency thereby reducing the cost. In another example, organisations are faced with two strategies to deal with curbing emissions, namely cleaner production or end-of-pipe technologies (Jasch, 2006). Cleaner production reduces resource use and/or pollution at the source by using cleaner products and production methods, whereas end-of-pipe technologies curb pollution emissions by implementing add-on measures at the end of the process (Frondel, Horbach & Rennings, 2004). The analysis of costs versus benefits for both cleaner production and end-of-pipe technologies is only possible through the use of EMA. According to research conducted by Rogers and Kristof (2003) organisations have realised large savings from eco-efficiency in the form of reduced waste disposal bills,

less energy consumed and reduced raw material purchases. In addition there is a positive correlation between environmental performance and stronger financial results both in terms of stronger share price gains and higher return on equity (Murphy, 2002).

2.4.3 Compliance with regulation

EMA ensures that an organisation can monitor cost efficiently, so as to ensure their compliance with all environmental regulation and self-imposed environmental policies (IFAC, 2005). Legislation and regulation designed by the governments and governing bodies to curb the environmental wastage can be considered in EMA. Fines and penalties can be avoided as EMA helps managers identify the potential costs and impact in every decision (Godschalk, 2009). As governments develop rules for waste minimisation, pollution prevention, energy conservation and other health issues to control the environmental damage, so organisations can use EMA and EMS as the mechanism to change the way they operate (Pun, Hui *et al.*, 2002).

Porter and van der Linde (1995) see the use of EMA and environmental regulation as an impetus for innovation as organisations seek to avoid penalties by eliminating the pollution upfront and thereby often resulting in removing costs or improving productivity as a result. Further research by Ferreira, Moulang *et al.* (2010) revealed that EMA use has a positive association with process innovation, but not with product innovation.

2.4.4 As a point of competitive advantage

According to Ngwakwe (2010) EMA is a method of analysing risks and opportunities where proactive organisations should re-strategise their business operations to minimise risk and take advantage of the opportunities. This compliments Porters Hypothesis which asserted that protecting the environment generated innovative approaches which led to competitive advantage benefits for the organisation (Crotty & Smith, 2006; Godschalk, 2009; Porter & van der Linde, 1995). EMA provides the data essential for the success of many other environmental management activities within an organisation. EMA is becoming more important, not only for environmental management decisions, but for all

types of management activities (IFAC, 2005). Parker (2000) suggests that EMA can even create an awareness that will lead to the identification of new business and market opportunities. EMA supports the strategic positioning of the organisation (IFAC, 2005). Organisations should consider Corporate Social Responsibility (CSR) as an essential element of their business. Davis (2007) argued that businesses should see social issues as fundamental to their business and must build social issues into their strategy. Social pressures can also serve as early indicators of factors essential to future corporate profitability. Organisations can turn their 'clean attitude' into a competitive advantage over other competitors to become the environmentally preferable choice (Ernst & Young, 2010; Porter, 1980). This is known as green consumerism (Hansel, 2009). Consumers' awareness of the products they are purchasing is increasing. According to Price and Coy (2001) people are increasingly condemning behaviours by corporate organisations that cause damage to the environment. Customers are beginning to purchase based on the environmental impact of their products as compared to the other competitors environmental reputation (Roarty, 1997).

In addition to the increased pressure from all stakeholders the costs of environmental impacts have risen drastically in the past decades while the cost of information management per unit have decreased substantially (Schaltegger & Burritt, 2000). EMA tools are increasingly available to assist the decision making function of organisations (Burritt, 2005).

2.5 The challenge for EMA

The biggest challenge for EMA is business itself. At a strategic level organisations may still view CSR as a philanthropic exercise that is the responsibility of the social affairs department (Terry, 2008). According to research conducted by the Global Reporting Initiative (GRI) (KPMG & SustainAbility, 2008) sustainability reporting is beginning to take a key role in reporting as sustainability issues become important to external stakeholders. Reputational management will become a critical indicator of success for any organisation as the expectations of stakeholders change and become more responsibility orientated (Terry, 2008). For any organisation to have an interest in sustainable

development there needs to be an expected financial benefit to themselves (Jasch & Lavicka, 2006).

At an operational level there are several limitations to EMA according to IFAC (IFAC, 2005). There is limited knowledge by the management accountants of the factors behind the environmental costs. The lack of communication between the management accountants and the professionals with the required information can limit the benefit of EMA. Environmental costs are hidden in overhead accounts without assigning directly to the process or the product. Without adequate tracking of the information in the costs EMA will be difficult to prepare. Most organisations lack adequate systems for measuring and managing environmental costs (Joshi, Krishnan & Lave, 2001) with managers finding it difficult to isolate and measure the hidden environmental costs (Joshi, Krishnan *et al.*, 2001). Burritt (2005) argues that relevant, reliable, low cost information is required if the impetus already stated in EMA is going to continue to gather pace. Some environmental related costs can often be overlooked as they are not identified by typical accounting systems, for example lost sales to environmentally conscious customers. Often investment decisions are made on the basis of incomplete information regarding environmental issues which results in lost revenues or additional costs not originally considered.

Although considerable research has been carried out in academia to develop and refine methodologies of environmental management accounting unfortunately the practical applications of these methodologies have not been widespread (Ambe, 2008). According to criticism by Watson and Emery (2004) organisations implementing such systems incur significant costs yet the potential benefits of 'club membership' are difficult to calculate and vary between regions. In developing countries, where EMSs, such as ISO 14000s, are less recognised than in developed countries which may not give organisations adequate market signals and so the benefit of competitive advantage is lost. Further research cited by Watson and Emery (2004) revealed that not all organisations realised returns in excess of costs incurred (cost-versus-benefit). Wegner (2003) concluded from rigorous analysis, that no significant link could be found between EMS and either environmental or economic performance. Hamschmidt and Dyllick (2001) argued that while no less than 92% of the surveyed environmental managers acknowledged that EMS introduction led to

an increase in importance of environmental topics in their companies 60 per cent of the companies experienced at least 'some decrease' in their material and energy flows in relation to turnover. Only 10 per cent reported a 'strong decrease' and 30 per cent either did not measure the changes or even experienced a worsening in efficiency. For a large majority of companies surveyed EMSs obviously were not integrated into regular planning and controlling activities.

2.6 South Africa

South Africa has enjoyed a period of sustained economic growth in recent years, with the annual growth rate of total Gross Domestic Product (GDP) averaging 5.4% from 1999 to 2008 (Camco & TIPS, 2010). South Africa is a land of opportunity, but with great challenges in sustainable development. These challenges have been forecast to have a profound impact on the future of this country (Archer, Engelbrecht, Landman, Le Roux, Van Huyssteen, Fatti, Vogel, Akoon, Maserumule, Colvin, Le Maitre, Lotter, Olwoch, Wright, Meyer, Theron, Diedericks, Maherry, Rossouw, Midgley, Davis, Stevens, Sinden, Warburton & Nkambule, 2010). Some of the factors that face South Africa in its effort to manage sustainable development in a rapidly expanding population and economy are dealt with below.

2.6.1 Energy

South Africa is currently considered the dirtiest polluter in Africa (DEAT, 2011b). Coal remains the dominant energy source for the country (DEAT, 2005) and the energy sector contributes about 15% of the country's Gross Domestic Product (Worthington-Smith, 2009). South Africa ranks as the 13th-worst country in the world measured by total CO2 emissions (Worthington-Smith & Matthews, 2011) where 90% of our energy requirements are derived from fossil fuels, mostly coal (Greenpeace, 2011). Our production of energy is not efficient either. Research by Eskom (as cited in Worthington-Smith & Matthews, 2011) show that South Africa, compared with similar countries, is more electricity

intensive by a factor of 35-65%, or for every three units of energy we consume, a competing economy would get by with only two.

2.6.2 Water

South Africa is ranked as semi-arid and is one of the 30 driest countries on the planet, with about 98% of available water resources fully utilised (World Wildlife Fund, as cited in Worthington-Smith, 2009: 33) and will exceed the limits of economically viable land-based water resources by 2050 (DEAT, 2011b). South Africa is constantly plagued with issues of water contamination from heavy industry, notably acid mine drainage in the Gauteng region of South Africa (Reichardt, 2010).

2.6.3 Waste and effluent

The rapid growth of our economy and population has led to a large rise in the waste generated. Approximately 7.7 million tons of waste are generated each year (Worthington-Smith, 2009). The capacity constraints on our waste sites have a detrimental impact on the quality of the surrounding air, land and water systems and the decomposing waste generates methane which contributes to Greenhouse Gas (GHG) emissions.

2.7 Regulation in South Africa

Traditionally, the primary source for governments to motivate environmentally responsible behaviour by its citizens has been through regulation based on government mandate (Dillard, Brown & Marshall, 2005). Lack of regulation causes confusion over rights and responsibilities of the different citizens. Regulation has other uses too. According to Porter and van der Linde (1995) regulation is required to create pressure to innovate in the creation of products and processes, improve environmental quality, educate organisations about likely resource inefficiencies and areas for improvement, and to level the playing field during the transition period to an innovation-based solution.

2.7.1 The lead up to the current regulation in South Africa

Environmental issues have remained high on the world agenda since the issue of the Bruntland Report in 1987 and the United Nations Conference on Environment and Development (UNCED) held in Rio de Janerio, Brazil, in 1992. Recently countries have assented to the Kyoto protocol and the 2009 Copenhagen climate change negotiations both aimed at reducing our impact on the environment (DEAT, 2011b). As a signatory to these and other international conventions, South Africa is obliged to adhere to all the obligations imposed on it in terms of being a party to these conventions.

2.7.2 Current legislation

South Africa's commitment to the implementation of environmental sustainability was affirmed by:

- Inclusion of environmental rights in paragraph 24 the Constitution of the Republic of South Africa 1996, (Act 108 of 1996),
- The National Environmental Management Act (Act 107 of 1998),
- The National Environmental Management: Biodiversity Act (Act No. 10 of 2004),
- The National Environmental Management: Air Quality Act (Act 39 of 2004),
- The National Environmental Management: Protected Areas Act (Act, 57 of 2004),
- The National Environmental Management: Waste Act (Act 58 of 2008),
- The National Environment Management Laws Amendment Act (Act No. 14 of 2009),
- The National Environment Management Laws Amendment Act (Act No. 15 of 2009),
- The Johannesburg Plan of Implementation (2002),
- The Minerals and Petroleum Resource Development Act (Act 28 of 2002),
- The new Companies Act (Act 71 of 2008), brought into effect in May 2011 prescribes a more stakeholder driven approach to business operation, where for example section

168 allows 'any person' to file a complaint in writing when a person has acted in a manner inconsistent with the Act, or the company's rules,

- The framework for considering market-based instruments to support environmental fiscal reform in South Africa (2006) and a Strategic Framework for Sustainable Development in South Africa (2008) amongst others (Ambe, 2008).

In October 2011 the DEAT issued their strategic paper 'National Climate Change Response White Paper' which outlined the strategy they intended to follow for the future to deal with national climate change (DEAT, 2011b). South African legislation applies a 'polluter pays' principal (DEAT, 2011b) and has already begun imposing environmental taxes, such as the plastic bag levy, electricity generation levy and levies on incandescent light bulbs. At the 2009 Copenhagen conference South Africa declared its intention to reduce GHG emissions by 34% by 2020 and 42% by 2025 below the business as usual scenario (Hemraj, 2010). On 17 February 2010 a carbon tax was announced in the budget speech, whereby passenger vehicles with CO_2 emissions above 120 g/km were taxed at R75 per g/km (Sustainability SA, 2011a). The following environmental taxes will also be investigated by South African taxation legislators in the future (Sustainability SA, 2011a):

- A waste water discharge levy in terms of the Water Act ,
- Pollution charges in terms of the new Air Quality Act,
- Levies on the waste streams of various products,
- A landfill tax at municipal level,
- Traffic congestion charges.

In December 2010 South Africa released a discussion paper title 'Reducing Greenhouse Gas Emissions: The Carbon Tax Option.' The paper recommended options to curb Greenhouse Gas emissions such as a carbon tax imposed directly on all measured emissions of carbon dioxide. These carbon taxes would create adequate incentives to encourage behavioural changes in organisations to operate in a cleaner manner (National Treasury, 2010; Walsh, 2011). In this regard EMA would be indispensable in tracking emissions and the costs thereof for measurement or monitoring.

The government currently also encourages sustainable development within the Income Tax Act (Act 58 on 1962) (Sustainability SA, 2011a):

- Section 12B Deduction in respect of certain machinery, plant, implements, utensils and articles used in framing or production of renewable energy,
- Section 37B Deductions in respect of environmental expenditure,
- Section 37C Deductions in respect of environmental conservation and maintenance,
- Section 11D Deduction for research and development costs,
- Section 12 K Exemption for Certified Emission Reductions,
- Section 12 L Special Allowance for Energy Efficiency Savings.

2.7.3 The Denmark approach

Other countries require businesses to disclose EMA in their financial reports to stakeholders. In Denmark for example, legislation made the issuing of environmental reports accounting for the physical flows of pollutants and resource efficiency mandatory for many companies. Results of research by Thy (2003) into more than 500 Danish companies revealed that as a result of the legislation requiring the disclosure of the green accounts showed that 41% of companies believed they had achieved environmental improvements through savings in energy, water and waste.

2.8 The King Code and the Socially Responsible Investment Index

The King code of Governance for South Africa is a well respected set of principles issued by the IoDiSA since 1993 (IoDiSA, 2009). It is encouraged for application in all organisations but those listed on the Johannesburg Stock Exchange (JSE) are required to comply with the King III report, which requires these companies to issue an integrated report on sustainability issues or explain why not for their financial years starting on or after 1 March 2010 (IoDiSA, 2009). King II, issued in 2002, also required the listed organisations to disclose a narrative on their triple bottom line but in more than a few

instances it has been done half-heartedly ‘with millions spent on reports that are not much more than glossy marketing brochures dressed up in hemp’ (Trialogue, 2010a). King III has changed all of that, with boards of organisations applying all of the code or being forced to explain why they did not to their stakeholders. Consequently, long term strategy will now take input from a broader range of stakeholders, and must consider important issues in the social and environmental too. The important principals relating to sustainability in the King III report are summarised in Table 2.4.

Table 2.4 Important King III principles that relate to sustainability

1.1	The board should provide effective leadership based on an ethical foundation
1.2	The board should ensure that the company is and is seen to be a responsible corporate citizen
1.3	The board should ensure that the company's ethics are managed effectively
2.2	The board should appreciate that strategy, risk, performance and sustainability are inseparable
3.4	The audit committee should oversee integrated reporting
3.5	The audit committee should ensure that a combined assurance model is applied to provide a coordinated approach to all assurance activities
5.2	Information Technology should be aligned with the performance and sustainability objectives of the company
8.1	The board should appreciate that stakeholders' perceptions affect a company's reputation
8.2	The board should delegate to management to proactively deal with stakeholder relationships
8.3	The board should strive to achieve the appropriate balance between its various stakeholder groupings, in the best interests of the company
8.5	Transparent and effective communication with stakeholders is essential for building and maintaining their trust and confidence
9.1	The board should ensure the integrity of the company's integrated report
9.2	Sustainability reporting and disclosure should be integrated with the company's financial reporting
9.3	Sustainability reporting and disclosure should be independently assured

Source: Trialogue, 2010a. All hail the King (III). *Trialogue Review: The quarterly review of Sustainability in South African business.* Cape Town, South Africa: Trialogue: p8

Investors also want to invest in better, more sustainable organisations. In this regard a Code for Responsible Investing by Institutional Investors in South Africa (CRISA) was released in July 2011 (Trialogue, 2011). The JSE also issues a Socially Responsible Investment (SRI) index which rates its listed companies based on criteria related to their environmental, social and governance practice. The intention of the index is both to encourage companies to operate responsibly and to prompt investors to consider these

factors when evaluating potential investments. Already large investors have placed their weight behind the SRI and support CRISA (le Roux, 2010; Trialogue, 2011). While the first priority of the organisation is the quality of the products or services, the second priority is the trust and confidence that the stakeholders have in the organisation (IoDiSA, 2009). EMA assists in providing accurate information in both of these regards.

2.9 Response to environmental sustainability by organisations in South Africa

South African organisations are becoming well aware of the potential impact of their organisation in the context of sustainable development (Walsh, 2011). In addition to the rules above, there are a range of principals, codes, guidelines and standards designed to assist organisations in managing environmental sustainability.

- Large South African organisations and investors have responded well to environmental sustainability initiatives such as sustainability reporting (King, 2010), listing on the JSE SRI (le Roux, 2010), applying CRISA in investing in sustainable South African organisations (Ashton, 2011) and complying with the King III code on corporate governance (IoDiSA, 2009). South African organisations have been very responsive to sustainable reporting (i.e. triple bottom line reporting) in their annual reports (KPMG, 2008). The King III Report on good corporate governance has entrenched the trend to disclose the behaviour in large organisations with regards to sustainable development (IoDiSA, 2009). According to the KPMG International Survey of Corporate Responsibility Reporting (KPMG, 2008: 93), 86% of the top 100 companies in South Africa include some level of sustainability reporting in their annual reports.

- The Global Reporting Initiative (GRI) is an initiative to raise the stature of sustainability reporting to the same level as financial reporting, by creating a widely used reporting framework for triple bottom line reporting. Approximately 1112 organisations in 56 countries use the GRI guidelines, with South Africa being the fifth largest reporter with 58 organisations reporting using the GRI guidelines (Worthington-Smith, 2009). The International Integrated Reporting Committee (IIRC) brings together leaders from corporate, investment, accounting, securities, regulatory, academic, civil society and standard-setting sectors to develop a new approach to reporting, with the focus on reaching a consensus among governments, business,

investors, and standard setters for the best strategy in tackling the challenges of integrated reporting (International Integrated Reporting Committee, 2011).

- The Carbon Disclosure Project (CDP) is an international initiative which aims to provide information on corporate carbon emissions of over 1 550 of the world's multinational organisations, including those locally listed on the JSE top 100. Disclosure is voluntary but of the 74 South African listed respondents, 94% disclosed their GHG emissions for 2010. Of those who responded 31 have adopted GHG emission targets in their organisations (National Business Initiative & Incite Sustainability, 2010).

- ISO 14001: 2004 is gaining ground in its application in South African organisations (Worthington-Smith, 2009). The intention of ISO 14001: 2004 is to provide a framework for a holistic, strategic approach to the organization's environmental policy, plans and actions (ISO, 2009). ISO 50001 has just been released in 2011, which establishes a framework for organisations to manage their energy use (ISO, 2011).

The media has also brought more attention on issues of sustainability and the environment. According to Trialogue & Media Tenor Institute of Media Analysis (2011) about 16% of all corporate coverage by the media in the first half of 2011 focused on issues relating to sustainability (based on 1 381 431 media statements analysed, of which 237 209 related to sustainability). About 0.5% of corporate coverage by media focused on issues relating to Environmental coverage in media has increased from 0.15% in 2006 (Trialogue & Media Tenor Institute of Media Analysis, 2011). The Department of Trade and Industry released the second version of its Industrial Policy Action Plan which aims to promote green and energy-efficient industries (Trialogue, 2010b).

2.10 EMA in South Africa

According to Ngwakwe (2010) very little attention has been given to environmental management accounting research in developing countries in Africa. While contemporary concepts such as environmental cost allocation may seem ubiquitous in the developed world, in Africa EMA is considered unimportant to organisations.

Research on South African organisations show that while EMA is gaining increasing awareness, its application is still at its infancy (Ambe, 2007; KPMG, 2001; Mohr-Swart, Coetzee & Blignaut, 2008). During 2001 KPMG surveyed 19 companies. The research found that although awareness was growing, application of EMA was very low with only 37% generating any environmental cost savings reports. The survey attributed this to the lack of formal environmental accounting systems (KPMG, 2001). Current research by Ambe (2008) on 37 South African companies found strong evidence of PEMA, driven by legislative conventions and sustainability reporting. It was found conversely that MEMA was mixed (low-to-high) and very polarised according to certain industries (e.g. mining and petrochemical) that were required by legislation to record environmental provisions and other restoration costs. However, there was little evidence of any formalised EMS in place at any of these companies (Ambe, 2008).

2.11 The role players in EMA

The long term potential of EMA is about industry transformation towards sustainable development (Gale, 2006). Accountants play a very critical role in the organisation (Yakhou & Dorweiler, 2004). With increasing focus on the environment sustainability accounting fills an expectation role, that of measuring the organisation's environmental performance. With regard to EMA the accounting function needs to work closely with non-accounting colleagues to ensure that the environmental information is correct (Jasch, 2006). Jasch (2006) further recommends that people involved in EMA should include the production manager, environmental manager, material's manager and at least one member of the financial accounting and cost accounting department. The organisation itself cannot work in isolation either. Ambe (2008) has developed a framework in Figure 2.3 depicting the roles of the different parties impacting the success of EMA.

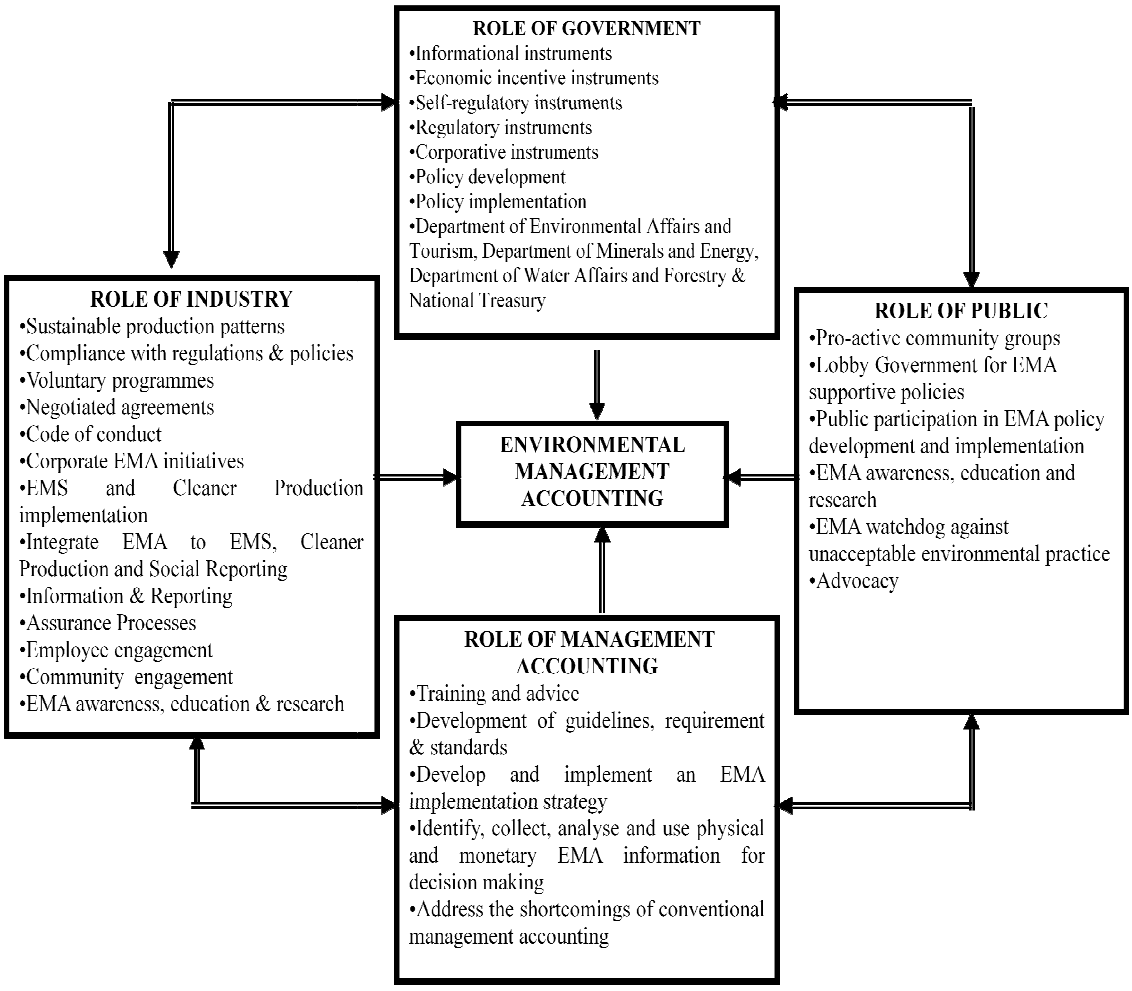

Figure 2.3 - model for role players involved in the successful implementation of EMA

Source: Ambe, C. M. 2008. Corporate Environmental Management Accounting in South Africa. *SAAA conference paper.* Johannesburg, RSA: p16.

The model depicts that a successful fully integrated implementation of EMA will require close cooperation between government, industry, accountants and the public. This model also provides additional guidelines and action plans for government in supporting the promotion and implementation of EMA in South Africa.

2.13 Background to the economy of KwaZulu-Natal

KZN is located on the North-East side of South Africa, covering 92100 square kilometres of land and with a population in excess of 10 645 400 people or 21% of the total population of South Africa (Statistics SA, 2010). KZN is a province with a good supply of minerals, energy, water and land. Its proximity to the sea and the interior creates valuable links to regional and global markets. Its abundance of industries include aluminium, automotive, transport, warehousing, textiles and petro-chemicals (Adlam, 2011). The contribution to the country's GDP was at a steady average of 16.4 % in the period between 1995 and 2009 (Adlam, 2011). According to Adlam (2011) KZN's manufacturing sector is the second largest in South Africa, after the Gauteng Province and generates 20% of provincial employment. Nearly a third of South Africa's manufactured exports are produced in KwaZulu-Natal.

2.14 Summary

This chapter clearly shows that EMA has a crucial role to play in promoting the sustainable development of organisations by providing decision makers both physical and monetary environmental impacts of their operations. EMA aims to bring all 'hidden' environmental costs to the attention of the role players who are able to then identify ways of reducing or avoiding those costs thereby reducing the environmental impacts by the organisation. Environmental protection can be done by the government through enforcement of legislation enacted or through economic incentives offered for better compliance with agreed upon norms. Alternatively this can be done as an initiative by the organisations themselves. Organisations therefore need to see the benefit of EMA in the form of lower costs or increased efficiency before they may be willing to invest sufficiently in any major EMA program. There is little evidence of research done in South Africa into the application of EMA in South African organisations. Finally, there are also conflicting results internationally regarding the attitude towards EMA, specifically the perceived cost-versus-benefit of EMA. The literature review has not found any evidence

of the analysis of the perceived cost-versus-benefit of EMA in South African organisations.

The next chapter, Chapter Three, sets out the research methodology employed for this study. This will include the aims and objectives of the study, participants and location of the study, data collection strategies, research design and methods utilised, and tests used to analyse the data.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The preceding chapter defined the problem and provided ample justification for further research to be conducted on EMA attitudes and application in KZN. The aim of this research is to gain an appreciation of the attitudes, awareness and actions of the business leaders and financial managers towards environmental sustainability in their organisation and identify the use of EMA systems in their organisations.

This chapter focuses on the nature and objectives of the study, the research methodology employed and the construction of the questionnaire. Quantitative and qualitative research methods are discussed briefly and the decision to choose quantitative research is explained. The statistical technique, participants, location of the study, data collection strategies, research design and methods utilised, and tests used to analyse the data are justified in detail in this chapter. This chapter further describes how reliability and accuracy were achieved throughout the research process.

3.2 Aim and objectives of the study

It is important that the research objectives are clear and achievable and that they will assist in answering the research question (Polonsky & Waller, 2011). In order to gain an understanding into the use of EMA for sustainable development in KZN the following core objectives will be explored:

- To determine organisations' awareness of the effects of EMA.
- To describe organisations' attitudes towards the cost and benefit of EMA.
- To establish the relationship between the type of industry and their awareness of EMA.

- To establish and explain the relationship between the type of industry and their attitude towards EMA.

3.3. Data Collection Strategies

There are differences in the approach to data collection which are important to understand before choosing the correct approach to test the population. Without selecting the correct data technique the research would undoubtedly become overloaded with unnecessary information. Therefore data collection must be well planned and managed. This will be explained and applied below.

3.3.1 Primary versus secondary data collection

Data collection can be broken up into two main sources of data (Lancaster, 2005; Polonsky & Waller, 2011; Saunders, Lewis & Thornhill, 2003):

- Primary data: this is data originated by the researcher for the specific purpose of addressing the research problem.
- Secondary data: this involves analysing existing data that was collected for a purpose other than the research problem at hand.

In this study there was no secondary data available from which to glean information on the attitudes, awareness and actions of business leaders towards EMA. Therefore the data needed to be collected as primary data from the source.

3.3.2 Quantitative versus Qualitative research

Primary data can be qualitative or quantitative in nature. Qualitative data is defined as data in the form of descriptive accounts of observations or data which is classified by type,

whereas quantitative data defined as data which can be expressed numerically or classified by some numerical value (Ghosh & Chopra, 2003).

Qualitative research involves gathering a large amount of information from a small number of subjects (Polonsky & Waller, 2011). In qualitative research the focus is on increasing the understanding into a particular issue. These are usually the 'why?' or 'how?' questions (Maylor & Blackmon, 2005). Qualitative methods are important because research in business management deals not only with the organisations but also to the people within and these people can ascribe their feelings, thoughts and meanings to a situation which they find themselves (Maylor & Blackmon, 2005). Qualitative research includes unstructured interviews, observation, focus groups, projective techniques and observational techniques (Maylor & Blackmon, 2005; Polonsky & Waller, 2011).
Contrasted against this, quantitative research is designed to generate the information which represents the population as a whole. These are usually the 'what?' questions (Maylor & Blackmon, 2005). The benefit of quantitative research over qualitative research is that quantitative research is based on observations which are easily converted into discrete units which are easily comparable. Quantitative research includes surveys, observation and experimentation (Polonsky & Waller, 2011). Table 3.1 highlights the distinctions between quantitative and qualitative data.

Table 3.1 – Distinctions between quantitative and qualitative data

Quantitative data	Qualitative data
• Based on meanings derived from numbers	• Based on meanings expressed with words
• Collection of results in numerical and standardised data	• Collection results in non-standardised data requiring classification into categories
• Analysis conducted through the use of diagrams and statistics	• Analysis conducted through the use of conceptualisation

Source: Saunders, M., Lewis, P. & Thornhill, A. 2003. *Research Methods for Business Students,* Essex, England, Prentice Hall.

3.3.3 Justification for quantitative research

The debate around the usefulness of qualitative versus quantitative data research is never ending. In the book by Miles & Huberman (1994: 40) Kerlinger is quoted as saying, "There's no such thing as qualitative data. Everything is either 1 or 0." Whereas another researcher, Campbell (1974, as cited in Miles & Huberman, 1994: 40) is later quoted as saying "All research ultimately has a qualitative grounding". Miles & Huberman conclude that numbers and words are both needed if we are to understand the world (1994: 40). Quantitative research has different strengths over qualitative research. It can allow for greater objectivity in the research as the researcher's personal bias can be avoided. The sample selected in the quantitative study is far greater than qualitative research and this enhances the generalisation of the results (Rugg & Petre, 2006). With quantitative research the accuracy of the results is guaranteed as the research can be replicated and compared with similar studies across time (Kruger, 2003). However, quantitative research is also criticised for producing superficial data. It is difficult to get the 'real meaning' of an issue by looking at numbers of the quantitative research. In addition preset answers will not necessarily reflect how the respondent really feels about the subject and the answer might just be 'the closest match' for that respondent.

Each methodology is based on a different conceptual framework (Pellissier, 2007). Quantitative research could be considered a science with defined parameters of scope, whereas qualitative research tends to be a craft of interpreting (Pellissier, 2007). According to Polonsky and Waller (2011) 'the type of method to be used (i.e. quantitative or qualitative) will depend on the research question being asked.' As explained above qualitative research typically asks the 'why?' or 'how?' questions and quantitative research the 'what?' questions. In quantitative research, structured interviews and questionnaire research tends to predominate, while with the qualitative research the semi-structured interview predominates (Bryman, 2006).

The decision has been taken to concentrate on research through quantitative application as the aim is to understand the attitudes, awareness and actions of the general population of business leaders towards environmental sustainability in their organisation. In this regard, the findings should add a more balanced dimension to the existing body of knowledge.

Due to the social, political and economic importance of environmental sustainability to South Africa, there may be contrasting perspectives relating to the financial management of environmental issues in private organisations and it is hoped that this research will highlight the differences of opinion.

3.4 Participants and Location of the Study

Once the aims and objectives have been defined and the decision has been taken to analyse the primary data quantitatively, then the next process is selecting the right individuals as representatives of the entire population. This is known as sampling.

3.4.1 Sample frame

The sample frame is defined as a list of all the units in a population (Maylor & Blackmon, 2005). The population is any group that is the subject of research interest (Goddard & Melville, 2005: 34). In order to achieve the aims and objectives of the research the population needs to be tested according to pre-determined questions. However, it is often impracticable to survey the entire population due to limited budgets, time or other factors that constrain the ability to reach the entire population (Saunders, Lewis *et al.*, 2003). In addition is not necessary to select the entire population as selecting the entire population may not necessarily produce more useful results than a well planned sample survey (Saunders, Lewis *et al.*, 2003: 151). The sampling method can be justified as an efficient alternative to a population census. However, the selection of the sample is a key factor for the success of the survey research (Maylor & Blackmon, 2005).

There are two general sample types, namely probability and non-probability sampling (Pellissier, 2007; Saunders, Lewis *et al.*, 2003). In probability sampling the units are drawn randomly from the known population as a representative of that population whereas in non-probability sampling the units are systematically or purposefully selected, based on the judgment of the researcher (Maylor & Blackmon, 2005).

Probability sampling is most commonly used when the population can be quantified and the sample is reflective of the complete list. Under this method all samples selected from the population have equal probabilities of being chosen. In this way a level of confidence can be gained that the sample is reflective of the population. Examples include variations of random sampling, systematic sampling, stratified sampling and cluster sampling (Saunders, Lewis *et al.*, 2003). However, there may be circumstances where it is not feasible or practical to do probability sampling. Probability sampling would not be appropriate for this research study as the elements and size of the individual organisations varied considerably and a database of all organisations in KZN does not exist.

Non-probability sampling selects samples, not based on any rationale but rather based on the researcher's subjective judgement. There are a number of non-probability sampling techniques (Pellissier, 2007; Polonsky & Waller, 2011):

- Convenience sampling: creates a sample from the most convenient respondents at hand
- Judgemental sampling: the sample is created purposefully from the judgement of the researcher based on known characteristics that the researcher is seeking
- Quota sampling: a similar method to judgemental sampling, where the quotas to be selected are decided by the judgement of the researcher
- Snowball sampling: the researcher will rely on the initial group of respondents to refer other respondents to answer the research question too.

Non-probability sampling was selected for this research. The business industry in KZN was chosen as the population. Organisations in the public sector, parastatals and municipalities were specifically ignored from the sample selected. This was because they were not privately controlled but were rather organised through government policies and strategies. Judgemental sampling was chosen as the sample could be chosen using the researcher's judgement. This did increase the risk of creating a sample that was not subjective and may not be generalised. To avoid any bias, as explained in the risk above, the sampling technique was applied to the list generated in the KZN Top Business Portfolio publications of 2009-2011. This list is generated as part of a well-respected

annual publication of the top organisations in KZN. Although the candidates were placed in the publication as a result of their sponsorship in the publication, the list was considered reflective of the type of organisations present in KZN. The list was therefore considered to be reliable in generating a list of the top organisations in KZN. In total, 63 organisations were chosen from this list. The researcher also used his own judgement in adding 16 limited organisations which he considered to also be top ranking organisations in KZN.

3.4.2 Obtaining the data

The decision was taken to conduct the quantitative research through questionnaires. This was due to the perceived simplicity of questionnaires by the respondents and ability to reach a large number of respondents very quickly and cost effectively (Lancaster, 2005).

The questionnaire was aimed at the financial managers in the top financial position at these organisations. Therefore gatekeeper's letters for each organisation were not required as these members had the required authority by virtue of their seniority in the organisation to speak on behalf of their organisation.

The questionnaires were personally administered to each respondent in the sample, through names of Chief Financial Officers listed in the KZN Top Business Portfolio publications. This is because it is understood that these respondents are very busy and as such they may tend to just delete a random or unreferenced questionnaire e-mailed to them. Therefore a personally e-mailed questionnaire was perceived to have a higher success rate.

3.4.3 Limitations of the data

The research questionnaire may have limitations such as:

- The sample selected may not be representative of organisations in the entire private business sector. In addition, not all stakeholder groups would be accessible by such a data collection technique as they are overloaded with work or may not be

authorised to make policy statements or communicate in an official capacity with the public.

- Due to the nature of the Top Business Portfolio, the sample will mainly be based in the metropolitan areas of KZN i.e. mainly the areas around Durban
- Participants selected may not have the capacity to answer the questionnaire and the feedback obtained may not be an accurate reflection of the private organisations in South Africa

These limitations were compensated by the sample selected which was assumed to be reflective of the top business community of KZN and the fact that the participants being questioned are financially literate and understand the magnitude of the questions being posed.

3.5 Research Design and Methods

The design of the research instrument is important in ensuring that the correct questions were asked so that the results met the objectives of the study. The first section describes the construction of the questions planned for the respondents and the second section focuses on testing of the reliability and validity of the questionnaire.

3.5.1 Description and Design of questionnaire

The decision was taken to prescribe questionnaires as the best applicable approach to primary data collection. According to Lancaster (2005) the researcher must consider the key aspects in designing the research questionnaire. Notably these include the range and scope of questions, question structure, wording, order, content and whether to choose open or closed questions. Gallup (1947) classified the five levels of depth which can be built into questions:

- Filter or information: these questions seek to understand if the respondent is aware of an issue.

- Open or free answer: these questions seek to understand what the respondents feelings are on the issue.

- Dichotomous or specific issue: these questions seek to understand what are the respondents answers to a specific part of the issue and usually ask for a "yes" or "no" answer.

- Reason why: these questions seek to understand why the respondent thinks the way they do as to specific issues.

- Intensity: these questions seek to measure the intensity with which these opinions are held.

As many of the respondents were answering in their capacity as financial leaders for their organisation it was thought that they would not be able to answer questions seeking to understand the intensity of feelings by their organisations or the reason why the organisation did what it did.

The questionnaire (Appendix 2) was designed as follows, so as to answer the aim and objectives:

Section one: Questions 1 and 2:

- This section was aimed at obtaining biographical information such as type of organisation, the size of the organisation.

Section two: Questions 3 and 4

- This section was aimed at gaining an understanding of the respondent's level within the organisation and their organisation's current attitude towards environmental sustainability.

Section three: Questions 5 to 9

- This section was aimed at understanding if the respondents were aware of the environmental reports that their financial management/costing system provided them with. If the respondent was aware of an EMA system being applied, then they were asked to determine what physical and monetary environmental information was being recorded and why. If the respondent was not aware of an EMA system being applied, then the reasons for the decision not to use EMA was ascertained and the question was also asked as to their future intentions to implement such a system.

3.5.2 Construction of the Instrument for data collection

The aim was to ensure the questionnaire was user-friendly and simple for the respondents to understand. The majority of the questions were closed (or pre-coded) questions, allowing respondents to choose only one option while some open questions required respondents to choose the options most applicable to their organisation. The survey was conducted by means of a self-completion questionnaire utilising QuestionPro online survey software, as a research tool, so that it could easily be attempted by all respondents. The respondents answered the questions by ticking electronic checkboxes set up on the QuestionPro questionnaire. The sequencing of items used in the QuestionPro questionnaire used the technique of branching of questions. By branching, the respondent was directed to more relevant questions relating to his/her more relevant scenario. This would also mean that some of the questions were unanswered but these would have been irrelevant to the respondent in any event.

The type of response format chosen will have implications for statistical analysis of the results of the questionnaire. A scale is a tool by which individuals are distinguished as to how they differ on the variables of interest in a study (Sekaran & Bougie, 2010).

There are four types of scales, namely nominal, ordinal, interval and ratio (Sekaran & Bougie, 2010):

- Nominal scale: this separates the responses into mutually exclusive groups (e.g. male or female). It is good for highlighting the differences by classifying the objects into groups. This is the simplest form of the scales,
- Ordinal scale: this ranks the responses in order of preferences (e.g., first, second, third and so on),
- Interval scale: calculates the magnitude of the response, whilst also ranking the object (e.g., from strongly agree to strongly disagree), and
- Ratio scale: like interval scale, measures the proportion of the differences in responses but also taps the proportions in absolute figures (e.g. 0-10 employees, 11-20 employees etc). This is the most information-rich form of information.

For this research the rating scales chosen for the type of questions presented in the study are tabulated in Table 3.2:

Scale	Question no.
Nominal scale	1; 3; 5; 6; 7; 8; 9
Ordinal scale	-
Interval scale	4
Ratio scale	2

Table 3.2 – List of the scales chosen

Once the variables have been defined and different scales have been selected, the next step is to ensure that the research instrument used to measure the objectives did indeed accurately measure that objective. This was achieved through pretesting of the reliability and validity of the questionnaire.

3.5.3 Reliability and Validity of the data

The key to quality data is to have data which is reliable as this provides the basis of the information required to meet the aim and objectives of the research. Thus the research must produce results that are scientific and reproducible (Lancaster, 2005). Validity and reliability testing are conducted in the pretesting stage to detect weaknesses in the design of this research instrument.

3.5.3.1 Validity testing

Validity is defined as the absence of self-contradiction (Ghosh & Chopra, 2003). Terre Blanche, Durrheim & Painter (2006) define measurement validity as 'the degree to which a measure does what it is intended to do.' There is no one single indicator to test the validity of the questionnaire (Pallant, 2011). Testing of validity involves a number of

theoretical and empirical tasks that are summarised under the following three broad areas (Pallant, 2011; Terre Blanche, Durrheim *et al.*, 2006):

- Criterion-related validity concerns the degree to which a measure between the scale scores is related to some other standard measured criterion. This is further broken down into predictive validity which measures the usefulness of the test in predicting some future performance or event, and concurrent validity which refers to the degree to which a new measure is related to the other measures of known validity.

- Content validity refers to the adequacy with which a measure selected has sampled from the intended domain of the content.

- Construct validity involves testing a measure, not against a single criterion but between different theoretically associated constructs.

Although the three types of validity have been discussed separately above they tend to complement each other in practice (Terre Blanche, Durrheim *et al.*, 2006). An accumulation of evidence from a number of validity tests will provide reliance on the validity of the construct. Content and construct validity were predominantly considered in testing the questionnaire as detailed in the pretesting section.

3.5.3.2 Pretesting

In order to ensure that the research measures what it is supposed to measure a pilot study was conducted to ensure that the instructions and wording of the questionnaire were understandable and clear to the respondent. The pilot study was conducted on 10 respondents. These respondents were all financially literate but ranged in careers, from managers to academics. A few spelling and grammatical errors were raised by some respondents. These mistakes were corrected. Furthermore discussions were held with the respondents to ensure that they could understand what the purpose of the questionnaire was. Their response was positive and they believed that the questionnaire sought to understand their use of the EMA in the organisation and their attitude towards sustainability issues.

From the feedback of the research supervisor and respondents to the pilot study the researcher was satisfied that the observed response of the questionnaire had adequately covered the objectives of the research study and the tests of content validity were met.

3.5.3.3 Reliability testing

Reliability refers to the dependability of a measurement in testing the extent to which the instrument will yield the same results on different occasions (Lancaster, 2005; Terre Blanche, Durrheim *et al.*, 2006). This indicates how free the test is from the possibility of random error, due to random disturbances, and systematic error, which is the non-random bias that impacts on the reliability (Terre Blanche, Durrheim *et al.*, 2006). Clearly the concern for a researcher is the systematic error.

A simple method to test the reliability is the test-retest (temporal stability) method where the same questionnaire is administered to the same individual on two different occasions and the results are compared. High test-retest correlations indicate a reliable scale (Terre Blanche, Durrheim *et al.*, 2006). The reliability of the measurement can also be tested for systematic error through considering the internal consistency coefficient of reliability or correlation analysis by using the Chronbach's alpha test (Pallant, 2011). The Chronbach's alpha test correlates one item with each of the other items in a construct. The nature of the results from the pilot study did not lend itself towards testing using the Chronbach's alpha to test reliability.

3.5.4 Administration of the Questionnaire

The questionnaire was personally sent via an e-mail to financial managers in the top financial positions at the selected organisations, who then gained access to the questionnaire via an attached link to the QuestionPro website. A description of the study being conducted by the researcher and an explanation of the purpose of the research was included as a covering page on the QuestionPro website. Instructions were given on how to complete the questionnaire as well as an assurance of confidentiality for the respondent

and all respondents had to agree to the questionnaire in order to enter the questionnaire page. The electronic informed consent form was setup as a check box on the first page of the questionnaire and the respondent was not allowed to proceed to the questionnaire until this had been read and agreed.

As the respondents completed the questionnaire their responses were anonymously recorded on the QuestionPro website. Once the required sample had been collected information was downloaded into a Statistical Package for the Social Sciences (SPSS) for further data analysis.

3.6 Analysis of the Data

QuestionPro provided a simple interface for creating online surveys and automatically capturing the data when respondents completed the questionnaire. This data, obtained through the online questionnaire was then exported from the QuestionPro database to the SPSS programme in a coded format for further analysis of the variables. The characteristics of interest in a research study are called variables which are measurable quantities that vary among or within individuals over time (Larson, 2006). SPSS is a program which is designed to perform statistical data analysis, including descriptive statistics and inferential statistics to analyse these variables.

3.6.1 Descriptive Statistics

The primary goal of statistics is to summarise data so that it is easily understandable for comparison and evaluation of relationships between the numbers (Sonnad, 2002). Descriptive statistics refer to the collection of methods for classifying and summarising a set of numerical data (Mendenhall, Beaver & Beaver, 2008). Descriptive statistics present the results by means of percentages, frequencies and measures of central tendency or dispersion. Lancaster (2005) refers to descriptive statistics as the simplest level of quantitative analysis.

Pallant (2011) stated that descriptive statistics have a number of uses, including:

- Describing the characteristics of the sample.
- Checking the variables for any violation of the assumptions underlying the statistical techniques chosen to address the research question.
- Addressing specific research questions.

Frequency statistics are the main descriptive statistics used with discrete variables. Frequencies are a calculation of the number of times various subcategories of a certain phenomenon occur (Sekaran & Bougie, 2010). From these frequencies we can calculate the percentage and the cumulative percentage of their occurrences. These include absolute frequencies (raw counts), relative frequencies (proportions or percentages of the total number of observations), and cumulative frequencies (for successive categories of ordinal variables) (Larson, 2006; Sonnad, 2002).

Measures of central tendency is the single value that is most representative of the collected data (Manikandan, 2011). Measures of central tendency include the mean, median and mode (Sekaran & Bougie, 2010). According to Sekaran & Bougie (2010) the mean is the average response, the median is the central item when the distribution is sorted in ascending order, and the mode is the most frequently occurring value.

The Measures of central tendency are useful but can also be misleading if there is no information about the variability or spread of the data (Sonnad, 2002). Therefore, measures of dispersion provides us with an index of the variability that existed in the set of observations (Sekaran & Bougie, 2010). The three measurements of dispersion are the range, the variance and the standard deviation. The range refers to the extreme values in the set of observations. The variance is the average squared deviation from the mean, and the standard deviation is the square root of the average squared deviation from the mean. Both the variance and the standard deviation are an indication of the average distance of all observations from the mean (Sekaran & Bougie, 2010; Sonnad, 2002).

3.6.2 Inferential Statistics

With inferential statistics the objective is to make inferences, or come to conclusions about population characteristics that extend beyond the immediate data set (Lind, Marchal & Wathen, 2010; Mendenhall, Beaver *et al.*, 2008; Sekaran & Bougie, 2010). Examples of such tests that the researcher could perform to ascertain the reliance on the data are t-tests, f-tests, chi square, regression coefficient, analysis of variance and analysis of covariance techniques. Wilson (as cited in Terre Blanche, Durrheim *et al.*, 2006) summarised the inferential statistics as :

- T-test: to test the differences between the means of two groups of data.
- F-test: to test between the effects of differences between the means of more than two types of groups.
- Chi square: to test for the association between two nominal variables.
- Correlation test: to test the strength of the relationship between two variables.

Although the majority of the testing chosen by the researcher related to descriptive testing, some forms of inferential statistics were also applied to the data.

3.6.3 Data screening and cleaning

An important factor to remember even before the data can be analysed using SPSS is that it is essential to analyse the data for errors. This is known as screening and cleaning the data (Pallant, 2011). The data screening process involves a number of steps:
Step 1: Checking for errors. Check each variable for scores that are out of range.

Step 2: Finding out where the error in the data file has occurred and correcting or deleting the value (Pallant, 2011).

This was done to the entire data set by the researcher before any further analysis took place. No mistakes were discovered therefore the researcher continued with the analysis of the variables as evidenced in Chapter Four.

3.7 Summary

This chapter described the research methodology that was applied in this study. Various research methods have been described and the logical choices were discussed. The research instrument, its administration, data collection and analysis of data have also been described in this chapter. In Chapter Four the data will be presented in the form of bar graphs and tables to allow for visual presentation and clear understanding of the data presented.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents the data that was collected from leaders of the participating organisations. The results are presented in the form of graphs (figures) and tables and have been broken down into different sections in order to satisfy the main objectives listed in Chapter Three. The presentation and interpretation of the results are discussed according to the objectives of the study and are discussed with reference to relevant literature pertaining to the objectives of the study. It is recognised that the results obtained from this study may not be generalised to the entire population of organisations in KZN, however, the findings show a trend that exists among the respondents.

4.2 Findings

Of the 46 respondents that started the survey, only 40 completed the questionnaire, representing a completion rate of 87%. Data received from incomplete surveys was analysed only for the questions that were answered both correctly and accurately and still proved valuable in meeting the objectives. The average time taken to complete the survey was 4 minutes which was lower than the predicted time of 10 minutes.

Most of the data were presented in a diagrammatic and tabular format to make the interpretation of the information more understandable. Dichotomous, single response, multiple choice and Likert rating scales were analysed using descriptive statistics such as percentages and frequencies so as to ascertain a complete picture of respondents' choices. This included cross-tabulations to understand any unique characteristics of the data. Open-ended responses were not coded into the data set as they were too few. These responses were discussed where applicable. All percentages have been rounded off to a full number.

4.2.1 Demographics

The demographic profile of the respondents included the type of organisation, size and the position held by the respondent. Race groups were not analysed as the respondents were being asked to respond in their professional capacity as office bearers of the organisation they were answering for. The demographic data is illustrated in Table 4.1.

Table 4.1. Demographic data

Description	Percentage
Industry	
Other manufacturing	19%
Manufacture of chemical and petroleum products	17%
Manufacture of textiles/apparel	14%
Other (including hospitality and retail industry)	12%
Agriculture, forestry and related services	10%
Manufacture of food products, beverages and tobacco	7%
Manufacture of machinery and equipment	5%
Manufacture of paper and wood products;	5%
Manufacture of motor vehicles, trailers	2%
Construction	5%
Transportation	5%
No of employees	
1-10	5%
11-50	5%
50-100	12%
100-500	29%
500-4999	29%
5000+	21%

Table 4.1 Continued

Respondent's position in the organisation	
Manager	33%
Chief Financial Officer (CFO) (or similar)	31%
Chief Executive Officer (CEO) (or similar)	14%
Other (including Safety Health and Environmental (SHE) specialists)	21%

The majority of the respondents were in other manufacturing fields (manufacturing of items not clearly specified in the list above as they were unique in nature), followed by chemical and petroleum products and then textiles. This is consistent with the major industries which are hosted in KZN, especially around the greater Durban area. There was a good spread of respondents by different industry types as represented by the different industries in KZN.

The size of the organizations represented by the respondents was evenly spread between the 100-500 and the 500-4999 mark, followed by organisations above 5000 employees. This means that most of the respondents represented larger type organisations in heavily intensive manufacturing organisations.

Most questionnaires were answered by managers, closely followed by the CFO. This is understandable as the researcher contacted the CFOs or CEOs at each organisation to complete the questionnaire but in many cases the CFO may have passed the questionnaire onto the manager in charge of operations or alternatively the Chief SHE specialist to complete the questionnaire on the organisation's behalf.

It can be concluded that the responses are accurately representative of the population of organisations conducting operations in KZN. It can be relied upon that the questionnaires were answered by representatives who had sufficient knowledge on the key questions being asked.

4.3 Objective 1: the organisations' awareness of the effects of EMA

To determine the organisations' awareness of the effects of EMA the organisations were analysed by asking a range of questions specifically aimed at their perceptions of the importance of environmental sustainability in the organisation, whether they implemented EMA and the type of reports generated by each EMA system.

4.3.1 Attitude by the organisations towards environmental sustainability

The extent to which respondents saw environmental sustainability as relevant to their organisation is depicted in Figure 4.1.

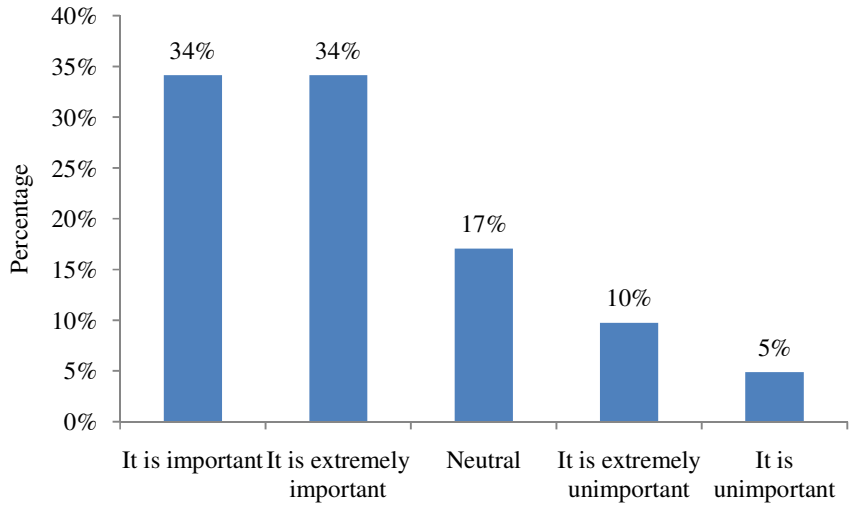

Figure 4.1. Attitudes towards environmental sustainability

According to Figure 4.1 the majority of all respondents considered environmental sustainability as 'important' to 'very important.' This finding is important given the current emphasis on triple bottom line reporting in South Africa (King, 2010; Trialogue, 2010a) and the increasing awareness by all organisations of the environmental impact people have on the environment (KPMG, 2010). This research can be linked to a survey by Vazquez Brust and Liston-Heyes (2010) of 536 Argentinean firms in polluting industries. Vazquez Brust and Liston-Heyes found that organisations led by those who

cared about the environment, (for ethical, profits, or legal grounds) have more developed EMA systems than organisations who treated the environment as a low priority issue. Also organisations that developed a culture of promoting ethical business practices had a tendency of applying more EMA (Miles, Munilla & McClurg, 1999).

4.3.2 Percentage of organisations using EMA to account for environmental costs

The respondents were all asked whether their current financial management/costing system provided them with the data required to analyse environmental costs. This is illustrated in Figure 4.2.

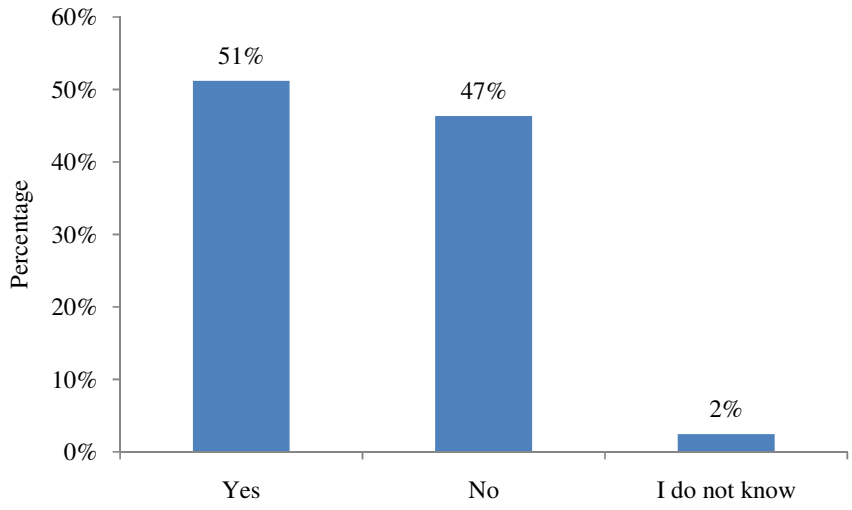

Figure 4.2. Does the organisation's current financial management/costing system provide the data required to analyse environmental costs?

According to Figure 4.2, the majority (51%) of the respondents had some form of financial management/costing system provided them with the data required to analyse environmental costs. There has been a marked increase in the number of organisations who now use EMA compared to research conducted by KPMG a decade ago on similar organisations in South Africa. The research then found that application of EMA was very low with only 37% generating any environmental cost savings reports (KPMG, 2001).The

KPMG survey attributed this to the lack of any formal environmental accounting system (KPMG, 2001).

It is important to note that the questionnaire applied branching at this point. All respondents who used EMA were asked to answer different questions to those who did not use EMA in their organisation. The responses to the respondents who used EMA are documented in 4.3.3 and 4.4.1 whereas the responses to the respondents who did not use EMA are documented in 4.4.2 and 4.4.3

4.3.3 Types of physical and monetary environmental cost information generated by the organisations

Of the 21 (51%) respondents who used EMA to provide them with the data required to analyse environmental costs, they were further asked which types of physical and monetary environmental information in respect inputs and outputs were generated and record by their organisations. This is depicted in Figure 4.3 for the physical reporting analysis. The respondents could select more than one option if applicable so each variable is as a percentage of how many of the 21 respondents generated such a report in their organisation.

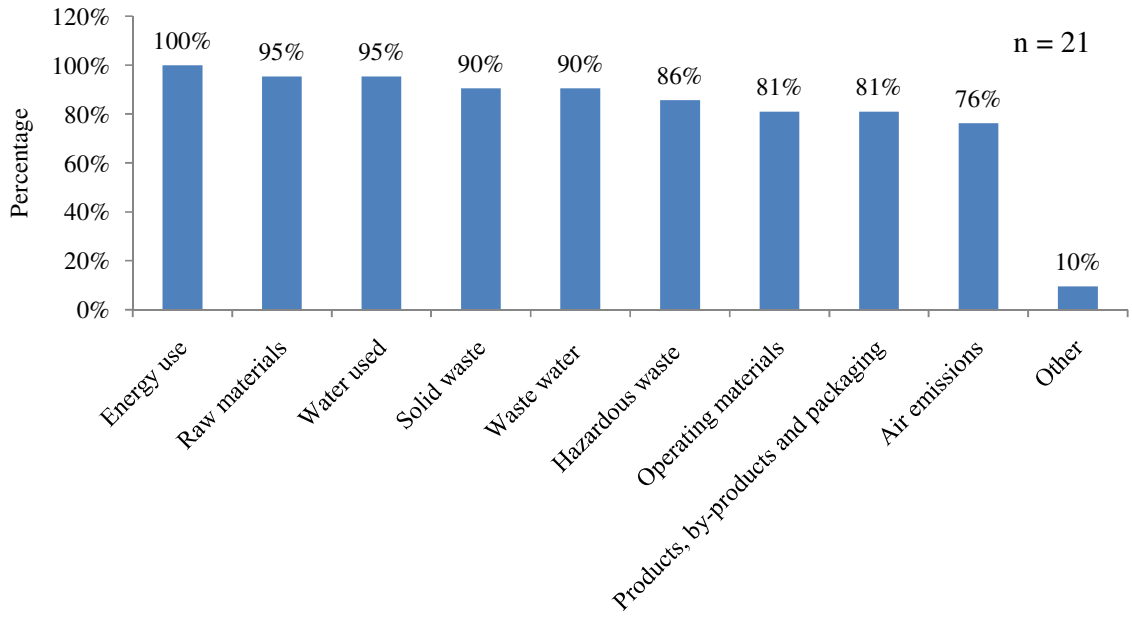

Figure 4.3. Analysis of types of reports generated by EMA relating to physical environmental information

As is clearly evident from Figure 4.3 above for those respondents who used EMA, they all generated physical data on energy use. The rest of the reports generated on physical inputs and outputs were also very high. This can be attributed to the fact that organisations who implemented EMA or ISO 14001 systems which were designed to report on all physical inputs and outputs relevant to the organisation. This encompassed the entire spectrum of options listed above which many of the organisations ticked as being generated by them. Those who chose 'other' listed physical reports such as carbon management reports and ground water analysis as other reports generated. The findings are consistent with research by Ambe (2008) who found strong evidence of physical information of EMA being generated by the 31 South African companies questioned in this regard. This may also be attributed to the fact that certain 'high pollution' industries in KZN whose emissions are closely monitored by the Department of Environmental Affairs and Tourism (DEAT) and local government authorities (e.g. the eThekwini Environmental Enforcement Forum) (DEAT, 2011a). It is therefore in each organisation's interests to monitor its physical emissions so as to ensure that no government official is able to withdraw its permit to operate.

The different reports generated for the purposes of monetary reporting analysis are depicted in Figure 4.4. The respondents could select more than one option if applicable so each variable is shown as a percentage of how many of the 21 respondents generated such a report in their organisation.

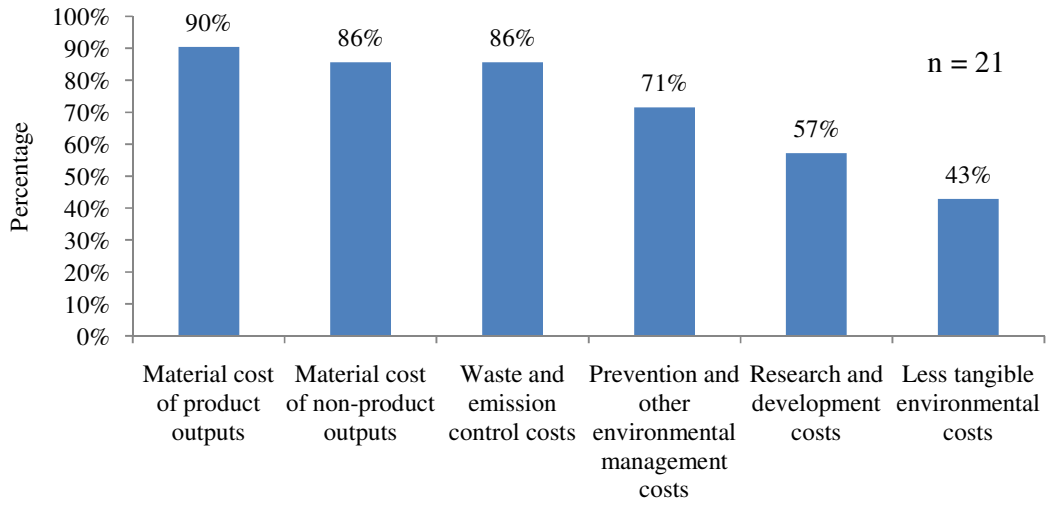

Figure 4.4. Analysis of types of reports generated by EMA relating to monetary environmental information

As is clearly evident from Figure 4.4 a large percentage of the respondents who used EMA generated monetary data on material costs of product outputs. This is logical as almost every manufacturing concern controls costs of the products manufactured through detailed costing reports. It was interesting to note that almost the same number of respondents generated waste and emission control cost reports as those who generated reports on the material cost of non-product output as discussed in Table 2.1.

A lower percentage of the respondents generated monetary data on prevention, research and development and the less tangible costs. This is logical as not all organisations would spend large budgets on research and development, and very few of the respondents may have understood what less tangible environmental costs actually were.

The reports generated for monetary effects of environmental information are lower than those generated for physical effects of environmental information. This is also consistent

with research by Ambe (2008) on South African organisations who found the application of MEMA 'low to somewhat high.' The average number of reports generated by each EMA producing organisation as a percentage of available options generated is illustrated in Table 4.2. This table illustrates clearly that reports generated for monetary effects of environmental information are lower than those generated for physical effects of environmental information.

Table 4.2. Average reports generated of PEMA versus MEMA by those who generate EMA reports

Type of reports generated	Average no of reports generated from the options given
PEMA reports (average number of reports generated by each EMA producing organisation as a percentage of available options)	80%
MEMA reports (average number of reports generated by each EMA producing organisation as a percentage of available options)	72%
	n = 21

4.3.4 Cross tabulation of importance of environmental sustainability and percentage of organisations with EMA in place

The importance of environmental sustainability was cross tabulated against the response for whether the organisation currently had an EMA system in place. This is depicted in Table 4.3.

Table 4.3. Cross tabulation of importance of environmental sustainability and percentage of organisations with EMA in place

		Does your current financial management costing system provide you with the data required to analyse environmental costs			
		Yes	No	I do not know	Total
How important is environmental sustainability to your organisation?	It is extremely unimportant	7%	2%		10%
	It is unimportant	2%	2%		4%
	Neutral	0%	15%	2%	17%
	It is important	15%	20%		35%
	It is extremely important	27%	7%		34%
Total		51%	47%	2%	100%

Logically, a large majority of those who considered environmental sustainability as 'extremely important' applied some form of EMA to their organisation. However, it was interesting to note that a higher percentage did not implement any EMA of those who ranked environmental sustainability as 'important.' All of those who ranked environmental sustainability as 'neutral' were not aware of any type of EMA at all in their organisation. The reasons for a lack of awareness of EMA will be analysed in objective 2. These findings can be compared against research by Vazquez Brust and Liston-Heyes (2010) who found that organisations that were led by individuals who saw environmental deterioration as a costly but solvable problem were more likely to show pro-environmental intentions than those who felt less empowered and/or did not recognise environment sustainability as a solvable problem. Although not statistically significant it was interesting to note that those who considered environmental sustainability extremely unimportant had high responses for awareness of EMA in their organisation.

4.3.5 Discussion of objective 1: the organisations' awareness of the effects of EMA

Although a large percentage of the organisations were aware of the importance of environmental sustainability a lower number actually were aware of EMA (physical or monetary) currently being used in their organisations. For organisations where respondents were aware of their organisation using EMA, their emphasis was on PEMA reporting

rather than MEMA. Finally, it was shown that those who considered environmental sustainability as 'very important' had more chance of EMA in their organisations, but there was chance of this in organisations who only considered it as important or were neutral on environmental sustainability.

4.4 Objective 2: The organisations' attitudes towards the cost and benefit of EMA

To determine the organisations' attitudes towards the cost and benefit of EMA the organisations were analysed by asking a range of questions specifically aimed at understanding the organisations' reasons for implementing, wanting to implement or not desiring to implement EMA. It is important to remember that the questionnaire applied branching. All respondents who answered 'Yes' to having EMA currently in their organisation were asked to answer different questions to those who answered 'No' to the above question.

4.4.1 Organisation's reason for recording the above listed environmental costs

Of the 21 (51%) respondents who had an EMA system, they were further asked their reasons for recording their environmental costs. The respondents could select more than one option if applicable therefore each variable is shown as a percentage of how many of the 21 respondents agreed with the reasons for recording the above listed environmental costs. Their response is summarised in Table 4.4.

Table 4.4.Organisation's reason for recording environmental costs

What is your reason for recording the above listed environmental costs?	
It will assist the organisation to control costs better	86%
It will help us to comply with present/future environmental legislation	81%
Protecting the environment is the right thing to do	76%
It presents a positive image of the company	71%
It can help innovation in the production process	52%
Other	14%
	n = 21

It is evident that the primary reason for organisations currently implementing EMA is to control costs. Most organisations are profit centred and the proactive organisations see this as the next way of controlling their unnecessary expenses is through controlling their costs associated with environmental pollution. Case studies by IFAC (2005), Godschalk (2009), Gale (2006) Jasch (2006; 2003), Jasch & Lavicka (2006), and Tomomi (2010) showed clearly that numerous organisations across the globe achieved both cost and environmental savings through applying EMA in the day-to-day business of the organisation. A case study by Ambe (2007) gave evidence of the cost savings experienced by a large South African organisation after applying EMA. Research on large multinational organisations by Khanna and Anton (2002) found that "both the high costs of existing and anticipated regulations, the opportunities for winning the goodwill of the public and of stakeholders as well as gaining a competitive advantage globally are driving corporate environmental management."

It was also interesting to note that the 'cost control' reason is followed by the reason of 'complying with current or future environmental legislation.' Legislation has become very important for many manufacturers in KZN. For example, since April 2010 various sections of the National Environmental Management: Air Quality Act (39 of 2004) have been enforced by the South African government (Gore & Tucker, 2010). This Act specifies permissible amounts, volumes, emission rates and concentrations of particular substances that may be emitted (DEAT, 2010). It must be applied immediately for new plants and existing plants must comply by 31 March 2015 (Gore & Tucker, 2010).

In August 2011, the new National Environmental Management Laws Amendment Bill, 2011 was released for public comment which intends to update the provisions of the National Environmental Management Laws. This includes section 28A of National Environmental Management Act (107 of 1998) which increases the penalty for any person who unlawfully or negligently commits any act or omission which causes pollution or degradation of the environment, a fine of up to R5 million and imprisonment for up to 5 years for the first offence and double that for a repeat offender. In addition, organisations may have relevant permits revoked for contravention of the National Environmental Management Acts (DEAT, 2011a).

Many manufacturing organisations in KZN are aware that the DEAT and local government municipalities (including the eThekwini municipality where most respondents were based) are actively monitoring their emissions (DEAT, 2009). The DEAT has, under the provisions of an amendment to the National Environmental Management Act (Act 107 of 1998) instituted the Environmental Management Inspectorate (EMI), popularly known as the 'Green Scorpions.' Their mandate includes routine inspection, investigation, enforcement and administrative powers (DEAT, 2011a). The presence of the EMI may be encouraging more organisations to objectively monitor and control their emissions of pollutants through EMA.

4.4.2 The reasons for not recording environmental costs

Of the 19 (46%) respondents who did not currently have an EMA system, these respondents were further asked their reasons for not wanting to record their environmental costs. The respondents could select more than one option if applicable and so each variable is shown as a percentage of how many of the 19 respondents agreed with the reasons for not recording the environmental costs. Their response is summarised in Table 4.5.

Table 4.5. Reasons for not applying EMA to record environmental costs

If you do not record and follow up on environmental costs, why not?	
It is just too hard to identify the environmental costs as they are so hidden in other cost accounts	42%
There are always other priority issues facing the organisation	37%
Other stakeholders (e.g. government, customers, suppliers) buy-in into such environmental initiatives are low	21%
The cost of generating the system outweighed the benefits	11%
Other	16%
Too hard to change the computer system to extract these costs	11%
Implementation will be difficult due to the training required	11%
We do not see the benefit to our organisation	11%
	n = 19

It is evident that the biggest factor was that of the separate identification of the environmental costs, followed closely by the fact that the organisations had other priority issues facing their organisation which they considered more urgent. This is consistent with research by Joshi, Krishnan *et al*. (2001) which found that managers seriously underestimate the magnitude of hidden environmental costs. The same managers in the study cited reasons why the accounting system did not identify all environmental costs, such as the complexity in separating the environmental portion of the incremental costs of production.

4.4.3 The urgency of implementation of EMA by the organisations who do not yet record environmental costs

Of the 46% respondents who did not use EMA, these respondents were further asked if they could implement a system to record the environmental costs separately, how soon would they like to implement it. The respondents could only select one option for this question. Their intentions for future implementation is depicted in Figure 4.5.

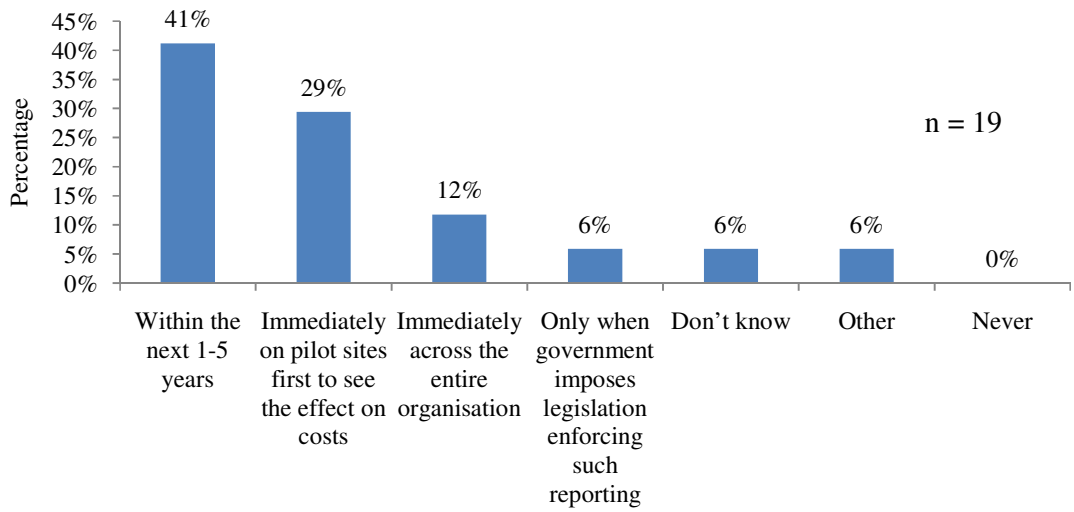

Figure 4.5.Intended implementation date of EMA by organisations who did not yet have an EMA system in place

The largest percentage of the organisations had intentions of implementing EMA within the next 1-5 years. Some respondents chose 'other' with the explanation that they would only implement EMA when the magnitude of such costs would actually require separate tracking and control. The most interesting finding was that the option of implementation only when government imposed legislation enforcing such reporting was ranked very low by the respondents who did not yet have an EMA system in place. It is encouraging to note, therefore, that more organisations would be willing to implement EMA of their own accord rather than be forced by legislation. This will be further explored in the cross tabulation of attitude towards environmental sustainability and the urgency for implementing an EMA system.

4.4.4 Cross tabulation of attitude towards environmental sustainability and reason for recording environmental costs

The importance of environmental sustainability and the reason for recording environmental costs were cross tabulated in Table 4.6.

Table 4.6. Cross tabulations of attitude towards environmental sustainability and reason for recording environmental costs

		Reason for recording the above the environmental costs					
		It will assist the organisation to control costs better	It will help us to comply with present/future environmental legislation	Protecting the environment is the right thing to do	It presents a positive image of the company	It can help innovation in the production process	Total
Importance of environmental sustainability to the organisation	It is extremely unimportant	3%	1%	3%	3%	3%	13%
	It is unimportant	1%	1%	1%	1%		4%
	Neutral						0%
	It is important	8%	4%	4%	5%	5%	26%
	It is extremely important	12%	8%	14%	10%	13%	57%
Total		24%	14%	22%	19%	21%	100%
							n = 21

It was interesting to note three points. Firstly, for those who ranked environmental sustainability as 'important', the principal reason was for better cost control. Secondly, for those who ranked environmental sustainability as extremely important, their principal reason was a sense that protecting the environment was the right thing to do. Although this was not the only reason as all options ranked highly for those who ranked environmental sustainability as 'extremely important.' Finally, for those who ranked environmental sustainability as either 'important' or 'extremely important', the reason of compliance with present/future legislation was the lowest of all reasons chosen. These findings can be compared to research by Tomomi (2010) on similar Japanese organisations. Tomomi concluded that organisations applied EMA not in response to social pressure, but rather because they considered environmental management offered opportunities for their business activities and the competitive advantage it could offer. Similarly it was found in

this study that legislative pressure was not an important factor in deciding to apply EMA to the organisation.

4.4.5 Cross tabulation of attitude towards environmental sustainability and reason for not recording the environmental costs

A cross tabulation was performed between the importance of environmental sustainability and reason for not recording the environmental costs, however, the results were spread out with little evidence of correlation. The data was only reported on if it was significant.

4.4.6 Cross tabulation of attitude towards environmental sustainability and the urgency for implementing EMA

The importance of environmental sustainability and urgency for implementing EMA were cross tabulated in Table 4.7.

Table 4.7. Cross tabulations of attitude towards environmental sustainability and urgency for implementation

		Intended implementation date of EMA (by organisations who did not yet have EMA in place)						
		Immediately across the entire organisation	Immediately on pilot sites first to see the effect on costs	Within the next 1-5 years	Only when government imposes legislation enforcing such reporting	Don't know	Other	Total
Importance of environmental sustainability to the organisation	It is extremely unimportant		6%					6%
	It is unimportant				6%			6%
	Neutral		12%	6%		5%		23%
	It is important	12%	6%	29%				47%
	It is extremely important		6%	6%			6 %	18%
Total		12%	30%	41%	6%	5%	6 %	100%
								n =19

It was interesting to note two points. Firstly, for those who ranked environmental sustainability as important, the majority (29%) would look to implement EMA within the next 1-5 years. The second interesting observation was that only organisations who ranked environmental sustainability as unimportant would wait for legislation first before they considered implementing EMA. These findings add to research by López-Gamero, Molina-Azorín and Claver-Cortés (2010) who found that when environmental regulation came from legislation its influence on managerial perception and proactive environmental management was not effective. However, when environmental regulation came from voluntary norms, its effect was more positive. Research by Arimura, Hibiki *et al*.(2008) suggest that governments can use legislation and voluntary approaches concurrently to most effectively encourage and promote adoption of ISO14001.

Only those who were neutral on environmental sustainability did not have any clear idea on when they would be implementing EMA. Therefore it may be postulated that organisations who rank environmental sustainability as important would be willing to implement an EMA system in the near future without any government intervention necessary.

4.4.7 Discussion of objective 2: The organisations' attitudes towards the cost and benefit of EMA

The primary reason for organisations implementing EMA of those who already applied EMA to their organisation, was to control costs. For those who did not apply EMA to their organisation as yet, the biggest reason for not doing so was the difficulty in identifying the environmental costs separately from the rest of the costs of the organisation. A large majority of those respondents intended to implement EMA into their organisation within the next 1-5 years. In this regard, government legislation was not the largest factor encouraging/forcing any planned application of EMA in the future.

In analysing cross tabulations, those organisations that ranked environmental sustainability as 'important' were interested primarily in the cost-saving benefit. The general feeling was positive towards implementing EMA in the near future for organisations that did not yet have EMA, especially organisations who ranked environmental sustainability as 'important.'

4.5 Objective 3: the relationship between the type of industry and their awareness of EMA

The respondents were analysed by sector (i.e. type) and then by size to understand if there was any relationship between either the sector or the size of the industry and their awareness of EMA. To determine the specific organisations' awareness of EMA the different types of organisations and different sizes were compared to those who generated EMA reports to understand if there was any correlation between implementation of EMA and the type of industry. The different industries were also cross tabulated to the types of

reports they generated to understand if there was any correlation between the type and size of the industry and their integration of EMA in their industry.

4.5.1 The use of EMA by type of organisation

To determine the organisations' awareness of the effects of EMA the different types of organisations were cross tabulated against whether the organisation had EMA. This is depicted in Table 4.8.

Table 4.8.Cross tabulation of use of EMA by type of organisation

		Does your current financial management costing system provide you with the data required to analyse environmental costs?			
		Yes	No	I do not know	Total
Industry	Agriculture forestry and related services	8%	2%		10%
	Manufacture of food products beverages and tobacco		8%		8%
	Manufacture of textiles/apparel	5%	8%	2%	15%
	Manufacture of paper and wood products	5%			5%
	Manufacture of chemical and petroleum products	12%	6%		18%
	Manufacture of machinery and equipment	2%	2%		4%
	Manufacture of motor vehicles trailers	2%			2%
	Other manufacturing	13%	7%		20%
	Construction	2%	2%		4%
	Transportation	2%	2%		4%
	Other (including hospitality and retail industry)		10%		10%
Total		51%	47%	2%	100%

It was interesting to note that a majority of chemical and petroleum manufacturers had applied EMA. 'Other manufacturing' also had applied EMA. None of the manufacturers of food & beverages and other (including hospitality and retail industry) applied any form of EMA in their organisation. Also for those in the textile industry, the majority chose not to generate any EMA reports. These observations may relate to the fact that high polluting industries have to monitor their pollution levels as they themselves are monitored by

members of the EMI. After an extensive search no similar analysis has been performed so it was impossible to compare the findings to other research.

4.5.2 The use of EMA by size of organisation

The different types of organisations, based on size were cross tabulated against whether the organisation used EMA. This is depicted in Table 4.9.

Table 4.9.Cross tabulation of use of EMA by size of organisation

		Does your current financial management costing system provide you with the data required to analyse environmental costs?			
		Yes	No	I do not know	Total
Size of organisation	1-10	2%	2%		4%
	11-50		2%		2%
	50-100	7%	5%		12%
	100-500	10%	20%		30%
	500-4999	22%	8%		30%
	5000+	10%	10%	2%	22%
Total		51%	46%	2%	100%

It was interesting to note that the majority of the organisations with 100-500 employees did not apply EMA whereas the majority of those larger than this (500-4999) did apply EMA. These findings can be compared against international research in this area. Miles, Munilla & McClurg (1999) analysed early adopters of ISO 14000 who they said will tend to be larger, more mature, with technical orientations, and especially those operating in competitive global markets. Miles, Munilla & McClurg (1999) also found that while the costs of ISO 14000 for large multinational organisations was manageable, Small and Medium and Micro Enterprises (SMMEs) will not necessarily have the internal resources for ISO 14000 adoption. They also forecast that these large multinational organisations will ultimately require that their suppliers, including SMMEs move toward adopting the same ISO 14000 standards (Miles, Munilla *et al.*, 1999). Johnstone and Labonne (2009) also found that there were differences across different sizes of organisations with cost factors being most important for smaller organisations. The largest organisations (those above 250 employees) found benefit that EMA served as a 'signalling device', informing others that they were managing their environmental impacts efficiently.

4.5.3 Cross tabulation of EMA reports generated by type and size of organisation

A cross tabulation was performed of the types of EMA reports that each type of industry generated, however, the results were spread out with little evidence of correlation. A similar cross tabulation was performed of the types of EMA reports that each size of industry generated, however, the results were also spread out. The data was only reported on if it was significant.

4.5.4 Discussion of objective 3: the relationship between the type of industry and their awareness of EMA

The research found that the majority of unspecified manufacturing and chemical or petroleum manufacturers applied EMA whereas none of the manufacturers of food/beverages and other (including hospitality and retail industry) applied any form of EMA in their organisation. With regard to size, the majority of SMME organisations with less than 500 employees did not have any EMA whereas the majority of those larger than 500-4999 did apply EMA. Cross tabulations of the different EMA reports generated analysed by type and size of the organisations were inconclusive.

4.6 Objective 4: The relationship between the type of industry and their attitude towards EMA

The respondents were analysed by sector (i.e. type) and then by size to understand if there was any relationship between either the sector or the size of the industry and their attitude towards EMA. The attitude towards EMA was analysed firstly by cross tabulating the importance of environmental sustainability by industry and then by size.
To determine the specific organisations' attitudes towards the cost and benefit of EMA the different types and sizes of organisations were cross tabulated against the reasons for and then the reasons for not recording environmental costs. Finally the different industries' attitude towards the urgency of EMA was tested to understand if there was any correlation between the type of industry and the attitude towards future EMA.

4.6.1 The importance of environmental sustainability compared by industry

A cross tabulation was performed of the importance of environmental sustainability by each type of industry. The results that each type of industry generated are presented in Table 4.10.

Table 4.10.Cross tabulation of importance of environmental sustainability by type of organisation

		Importance of environmental sustainability to the organisation					
		It is extremely unimportant	It is unimportant	Neutral	It is important	It is extremely important	Total
Industry	Agriculture forestry and related services		2%		4%	3%	9%
	Manufacture of food products beverages and tobacco			2%	4%		6%
	Manufacture of textiles/apparel			10%		4%	14
	Manufacture of paper and wood products				3%	2%	5%
	Manufacture of chemical and petroleum products	3%			3%	12%	18%
	Manufacture of machinery and equipment				3%	3%	6%
	Manufacture of motor vehicles trailers					3%	3%
	Other manufacturing	3%	3%		10%	4%	20%
	Construction	2%			3%		5%
	Transportation			3%	2%		5%
	Other	2%		2%	2%	3%	9%
Total		10%	5%	17%	34%	34%	100%

It was interesting to note that Manufacturers in the textiles industry were all neutral on their attitude towards environmental sustainability. This is poor compared to similar industries around the world. Research by Hitchens, Trainor, Clausen and Thankappan (2003) found that pro-environmental attitudes were high in the textiles industry in the United Kingdom (60%), Germany (45%) and Italy (70%). Another interesting observation was that those in the chemical and petroleum industry all ranked environmental sustainability as 'very important' while those in other manufacturing also ranked environmental sustainability as 'important.'

4.6.2 The importance of environmental sustainability compared by size of industry

A cross tabulation was performed between the importance of environmental sustainability and the size of industry. The results that each size of industry generated were analysed in Table 4.11.

Table 4.11.Cross tabulation of importance of environmental sustainability by size of organisation

		Importance of environmental sustainability to the organisation					Total
		It is extremely unimportant	It is unimportant	Neutral	It is important	It is extremely important	
Size of organisation	1-10			3%	3%		6%
	11-50	3%					3%
	50-100	7%	3%			2%	12%
	100-500			2%	17%	10%	29%
	500-4999		2%	2%	7%	17%	28%
	5000+			10%	7%	5%	22%
Total		10%	5%	17%	34%	34%	100%

Clearly the larger the organisation, the more important that environmental sustainability became to the organisation. The poor attitude amongst SMMEs is a concern given the potential volume of SMMEs in South Africa. In 2003 South African SMMEs provided more than 55 per cent of all jobs and 22 per cent of GDP in 2003 (Kauffmann, 2005).

This is also clearly seen in the review of literature where for example Gadenne, Kennedy & McKeiver (2009) concluded that despite SMMEs having a positive environmental outlook, only a minority of businesses committed to implementing environmentally sustainable practices.

Large organisations are still important for consideration as they accounted for 64 per cent of GDP in South Africa in 2003 (Kauffmann, 2005). The positive corporate attitude towards environmental sustainability in large organisations is possibly due to the fact that the larger respondents were those listed on the JSE and were therefore guided by the good principals of the King III code and/or saw the value in their organisations being perceived by the public as good ambassadors.

4.6.3 Cross tabulations performed by type and size of industry

A cross tabulation was performed of the type of industry and reason for recording the environmental costs. It was also performed by the size of the industry and reason for recording the environmental costs. However, both results were spread out with little evidence of correlation. In a similar test a cross tabulation was performed of the type of industry and reason for not recording the environmental costs. It was also performed by the size of the industry and reason for not recording the environmental costs. However, both results were spread out with little evidence of correlation. Finally, a cross tabulation was performed of the type of industry and the urgency in implementing EMA. It was also performed by the size of the industry and the urgency in implementing EMA. However, both results were spread out with little evidence of correlation. The data was only reported on if it was significant.

4.6.4 Discussion of objective 4: The relationship between the type of industry and their attitude towards EMA

The relationship between the type of industry and their attitude towards EMA was explored. It was identified that certain industries had a more positive attitude towards environmental sustainability whereas others had a more neutral attitude. Also the larger

the organisation was, the more positive its attitude was towards environmental sustainability. However, besides these facts there was little or no correlation between the type of industry and their attitude towards EMA. This was due to the choice taken by the researcher of using multiple tick boxes for many of the responses which provided relevant information for objectives 1 – 3 but rather limited information in this objective. This will be mentioned in the limitations in Chapter Five.

4.7 Summary

The results obtained from the data have revealed several interesting findings. Generally organisations considered environmental sustainability important but only 51% of all organisations actually implemented EMA. Organisations generated more PEMA reports than MEMA and the reason for generating these EMA reports was primarily for cost control. Those who did not record any EMA justified this because the costs were so hidden in other cost accounts they were not worth recording separately. However, the majority of these organisations would like to implement an EMA system within 5 years. Based on the findings, conclusions have been made from which recommendations are suggested. The limitations of the study have been identified and recommendations for further research are described in Chapter Five.

CHAPTER FIVE

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 Introduction

Environmental sustainability has received much attention in SA business and politics in recent times. It is argued that unless the issue of sustainable development by all organisations is not properly entrenched through practices such as EMA techniques, the South African government will never meet their goals in reducing pollution to manageable levels. This chapter focuses on the conclusions drawn from this study, limitations identified, recommendations based on the findings and recommendations for further research.

5.2 Outcomes of this study

The objectives set for this study were chosen with the aim of gaining an understanding into the use of EMA for sustainable development in KZN. The research was intended to meet the four objectives. Three of the four objectives were clearly met by the results of the findings. The last objective could not be concluded in any conclusive manner and was therefore mentioned in the limitations and recommendations for further research.

5.3 Conclusions, implications and recommendations based on the research performed

Several conclusions may be drawn from this study. It is emphasised that the conclusions represent the opinions and characteristics of the respondents and cannot be generalised to the entire population of all organisations in KZN. The findings, however, suggest a trend that exists among the population surveyed.

5.3.1 Organisations' awareness of the effects of EMA

It was interesting to note that even though more than 68% of the respondents considered environmental sustainability as important a far lower percentage (51%) actually had any form of EMA in place. Of those who did not have EMA, 41% intended to implement an EMA system in the next 5 years and a further 41% intended to implement an EMA system immediately across the entire organisation or on pilot sites. Of those who generated EMA reports, the results were broken down into PEMA and MEMA reports generated. On the PEMA side, organisations reported primarily on energy (electricity), water and raw materials used. On the MEMA side organisations reported primarily on material costs of product outputs (cost of generating finished goods), material cost of non-product outputs (costs of wasted products) and waste or emission costs. On analysis, organisations generated slightly more PEMA reports than MEMA reports in their EMA reporting. This research concurred with previous studies on EMA in South African organisations by Ambe (2008) and showed an increase from KPMG (2001).

5.3.2 The effect of attitude towards environmental sustainability and the implementation of EMA

It was noted that the attitude towards environmental sustainability strongly influenced the awareness of the effects of EMA as none of those who were 'neutral' on their attitude towards environmental sustainability used EMA, whereas the percentage applying EMA increased in those who thought it was 'important.' Almost all of those who thought it 'very important' used EMA at their organisation. One can thus conclude that the better the organisations attitude towards environmental sustainability the more likely they are to implement EMA at their organisation.

5.3.3 Organisations' attitudes towards the cost and benefit of EMA

The most important finding was that for those who chose to apply EMA, their most important reason was to control costs better. Only second most important was legislation. Furthermore, those who thought environmental sustainability was 'important' or 'very

important' had complying legislation as the lowest of all reasons selected. Thus one can conclude that if government wants to encourage environmental sustainability in organisations they may have more success in encouraging the potential cost savings from applying EMA than from forcing the issue of complying with legislation. There is currently an increased awareness of environmental sustainability issues in South Africa as a result of the 17th Conference of the Parties (COP 17) being held in Durban in November and December 2011. The South African government can therefore turn this positive awareness into motivation by conducting local case studies to reveal the potential cost savings achieved by individual organisations. This may encourage even more organisations to apply EMA to their organisations.

The main reason observed for organisations not wanting to apply EMA was the difficulty perceived in identifying environmental costs hidden in other costs. With the advent of more advanced computerised recording systems it may be possible for proactive organisations to analyse costs in more detail in the future. In addition as larger industry organisations expand their application of EMA and EMS they may begin to demand that their suppliers develop a 'green supply chain' so that the entire process is more environmentally sustainable (Green, Morton & New, 1998).

5.3.4 Planned implementation date for organisations who do not yet have any EMA

An overwhelming majority of the respondents who did not have EMA in place yet planned to implement an EMA system within the next 1-5 years, immediately across the entire organisation or on pilot sites first. One can thus conclude that within 5 years many more organisations in KZN would have applied EMA to help control their costs and in turn promote environmental sustainability.

It was also interesting that only those who thought environmental sustainability was 'unimportant' would actually wait for legislation to force them into applying EMA. Thus one could conclude that if the organisations' attitude could be changed to a more positive one then perhaps the remaining organisations would be more willing to accept EMA as a strategy to achieve environmental sustainability.

5.3.5 The relationship between the type of industry and their awareness of EMA

From this analysis it was interesting to note that a majority of the textile industry and the food & beverage industry and the 'other' industry (including hospitality and retail) did not apply any EMA. It was also noted that the textiles industry, the food & beverage industry and 'other' industry (including hospitality and retail) had a generally 'neutral' attitude towards environmental sustainability. One could thus conclude that if, through strategic intervention, the 'neutral' attitude be changed to a more positive attitude then the textile industry, the food & beverage industry and the 'other' industry would apply more EMA into their organisation. This would then encourage environmental sustainability.

It was pleasing to note that a majority of the other manufacturing and chemical & petroleum industry did apply EMA to the organisation. They could also be linked with a more positive attitude towards environmental sustainability by each of these organisations. This finding also supports the above conclusion of getting more organisations to apply EMA by encouraging a more positive attitude towards environmental sustainability.

5.3.6 The relationship between the size of industry and their awareness of EMA

It was noted that the larger the organisation the greater the probability of the organisation using EMA. This can be linked with the fact that as organisations grow they develop more advanced and detailed systems to control costs, with EMA being one of these effective systems. Secondly, larger organisations produce more pollution (by volume) than smaller organisations and therefore remain in 'the public eye' so they become very conscious of their impact on the environment so as to avoid public scrutiny by society. The growth of organisations is a natural progression as the firm performs well economically. It is therefore pleasing to note that as size increases the organisations become more aware of environmental sustainability, as was also evidenced in a cross tabulation between the size of the organisation and the importance of environmental sustainability by the organisation.

5.3.7 The relationship between the type of industry and their attitude towards EMA

Attitudes by industry towards environmental sustainability were analysed and assisted in reaching the conclusion above. Unfortunately there was no clear conclusion reached on the industries unique attitude towards EMA. All cross tabulations of reasons for and against EMA by organisation gave results that were inconclusive as they produced very average results. This was due to the choice taken by the researcher of using multiple tick boxes for many of the responses in the attitude questions. This provided very relevant information for objectives 1 – 3 but rather limited information in this objective. In this regard a ranking scale would have been more ideal in analysing the industries attitudes towards EMA. This will be mentioned in the limitations.

5.4 Recommendations arising from this study

The research objectives of this study were satisfied as certain trends were clearly observed with respect to attitudes, awareness and application of EMA by organisations in KZN. The findings were significant as they provided empirical evidence to show that certain strategies needed to be applied to encourage sustainable development by organisations. From the research and the conclusions above it is suggested that the following recommendations be considered:

- Clearly the attitude by each organisation towards environmental sustainability was vital in encouraging organisations to implement EMA as a method of controlling their pollution. Therefore the South African government should take cognisance of this fact and in light of the recent attention brought to the issue of environmental sustainability by COP 17 being held in Durban, consider strategies to educate organisations of their role in environmental sustainability. This could be through published works proving the merits of environmental sustainability, education drives, case studies, focus groups, and attention being placed on the gross offenders in this regard. This initiative may require additional involvement by chambers of commerce, trade unions, environmental organisations, media houses and passionate individuals.

- It was an important finding that for those who chose to apply EMA, their most important reason was to control costs better and only second most important was

legislation. It is recommended that the South African government take cognisance of this fact and try to encourage organisations to see the benefit of applying EMA in their organisations before the South African government starts to threaten the organisations with fines and punishment as a result of not complying. There is merit for legislation that forces companies to report on their environmental impact such as legislation in Denmark which whose Environmental Accounts must include information on energy and water use, emissions, environment taxes and subsidies (Danish Environmental Protection Agency, 2003; Pedersen, 2003). But as was noted in the findings organisations would be willing to adopt EMA of their own accord and so in conclusion the 'carrot' approach will be far more successful than the 'stick' approach.

- The main reason observed for organisations not wanting to apply EMA was the difficulty perceived in identifying environmental costs hidden in other costs. With the advent of more advanced computerised recording systems it may be more possible in the future for organisations to analyse costs in more detail. In this regard education of the organisations is necessary so that they are aware of the benefits of applying EMA and can understand better the information required for a successful implementation of PEMA and MEMA. This could be achieved through focus groups, conferences, training workshops and periodicals that assist organisations to see what costs they should be analysing and how to best obtain the information from their current computerised systems.

- Larger organisations could be used to encourage smaller supplier organisations to comply with EMA in both organisations so that the entire supply chain is 'green.' As a recommendation such 'peer pressure' could be encouraged through government intervention very effectively by promoting all government suppliers to generate a 'green scorecard' much in the same way as government promotes Broad-Based-Black economic empowerment. As larger industry organisations expand their application of EMA and EMS they will begin to demand that their suppliers develop a 'green supply chain' so that the entire process is more environmentally sustainable

- Currently there is no requirement for a standard format of the EMA report. This leads to a lack of awareness of the potential benefits of cost savings and pollution control and compliance with legislation. In this regard the standard setters need to move forward in instituting a standard format of report which becomes generally accepted as

the norm. As a practical example, South Africa sits on the London Group on Environmental Accounting, whose role is defining international best practices in environmental accounting within the framework of the System of National Accounts (United Nations Statistics Division, 2011). On a local level South Africa launched the Integrated Reporting Committee (IRC) whose mandate was to develop guidelines on good practice in integrated reporting. Major South African organisations sit on this committee namely, the Association for Savings & Investment South Africa, Business Unity South Africa, the IoDiSA, the JSE, the South African Institute of Chartered Accountants, Banking Association South Africa, the Chartered Secretaries Southern Africa, the Principal Officers Association and the Government Employees Pension Fund (Sustainability SA, 2011b). With such influential players sitting on this committee, recommendations would definitely be followed by action from many organisations. This committee could be tasked with the additional mandate of developing a standard environmental report required by all organisations. This would have the effect of encouraging all organisations to use EMA to constantly monitor their environmental sustainability for the purposes of disclosing the numbers in their integrated report. On a global level, the IIRC is also in the process of designing an internationally accepted framework for an integrated report and has, in September 2011, released a discussion paper to establish a global consensus on the direction in which reporting needs to evolve (IIRC, 2011). It must be encouraged that one of their objectives must be encouraging environmental sustainability through tangible reports such as those generated by EMA. This would also assist in generating a standard for recording environmental costs as one of the biggest factors observed for organisations not wanting to apply EMA was the difficulty perceived in identifying environmental costs hidden in other costs.

- Finally, it was noted that the textiles industry, the food & beverage industry and other industry (including hospitality and retail) had a generally 'neutral' attitude towards environmental sustainability and did not generally implement EMA in their organisations. The South African government could institute targeted initiatives in these sectors to encourage a better attitude towards environmental sustainability. Examples would be issues on environmental topics or benefits of EMA being placed in textiles publications and an awareness being created in the South African Textile Industry Export Council (SATIEC) and by the trade unions.

5.5 Limitations of the research

It is important for the researcher to identify the limitations of the study which can provide guidelines for further research. The ways in which the limitations may be overcome are discussed under recommendations for further studies.

5.5.1 Sampling method employed and lack of responses by leaders

The findings of the study could not be generalised to the entire population of organisations in KZN due to the sampling design chosen and small sample size which was selected using the judgement technique. Not all respondents selected chose to respond and this further limited the scalability across the entire KZN province. Although the sampling method employed for this study was appropriate for the purposes of this study, non-probability judgment sampling is the least reliable in terms of generalisability.

The study did not show many significant variances between some of the cross tabulations conducted by different types of industries. This is an anomaly which is due to the small sample size selected using judgemental sampling. As research on environmental management evolves, more extensive surveys can be used to identify and develop industry specific dimensions of EMA which may be fruitful in deriving an understanding of this field of study.

5.5.2 Limited scope

This study focused on attitudes and application of EMA in KZN organizations. However, there are many more factors that could be considered which may have an impact on the application of EMA. It is recommended that for future studies done on the application of EMA that other aspects are also explored.

5.5.3 Format of the questionnaire

The objective of using multiple tick boxes in this study was somewhat limited, given the fact that the respondents could tick many options rather than using a Likert rating scale to answer many of the questions. It is recommended that for future studies a Likert rating scale be used for questions relating to attitudes towards EMA as this will greater assist understanding of attitudes towards EMA.

5.5.4 Available current and local literature

Due to the emerging nature of EMA and the lack of any formal approach towards it, EMA is an area of study that has very limited academic literature and therefore it was difficult to obtain information on this topic. Adding to this there is the fact that the analysis of EMA has no relevant literature which has been conducted into organisations in KZN. This made it impossible to compare results of the findings. For future studies, it is recommended that all published sources of information be referenced including books, journals, dissertations, e-books, newspaper articles, and online editorials and findings.

5.5.5 Social desirability bias

In applying a social desirability bias, it may be postulated that certain leaders may have just been paying 'lip service' to their organisation's attitude towards environmental sustainability and their future intentions to implement EMA projects into the organisation. This would have impacted the outcomes of this research as much of the survey centred on the attitude towards environmental sustainability. It is possible that the level of environmental attitudes and the activities/practices of the KZN leaders may be overstated in the results of this study.

5.5.6 Definition and understanding of EMA

The lack of a universal definition of EMA reporting may hinder comparability by different organisations, where two different organisations may answer the same question differently

where they actually apply the same procedure. It is recommended that for future studies a standard definition of what comprises EMA is attained and that this definition is clearly understood by all respondents before attempting any questionnaire.

5.5.7 Limitation in achieving objectives

Unfortunately there was no clear conclusion reached by the researcher on the industries unique attitude towards EMA. All cross tabulations of reasons for and against EMA by organisations produced results that were inconclusive and very average. This was due to the choice taken to use multiple tick boxes for many of the responses in the attitude questions. This provided very relevant information for objectives 1-3 but rather limited information in this objective. As research on environmental management evolves efforts to identify and develop Likert rating scales for multiple dimensions of environmental management may be fruitful in deriving more understanding from the respondents.

5.5.8 Lack of practical case studies

This research was limited as a result of treating certain industries as one homogeneous group which effectively ignored the many sub-groups within the sector. As a result some respondents ticked ‘other manufacturing’ which led to a somewhat distorted result in the analysis. It is recommended that future research breaks down the industry sectors even further for a better understanding of each unique industry.

5.5.9 Lack of practical case studies

A final limiting factor is that there was limited practical application of any current EMA currently being applied in South Africa. Although this was not the objective, in- depth case studies may also help validate and extend this research further, especially with regard to additional aspects such as the impact of new environmental regulations and carbon tracking practices.

5.6 Recommendations for further research

The recommendations for further research are based on the findings and limitations identified in this study. This study is the only one identified that specifically addressed the issue of the use of EMA for sustainable development within KZN organisations. Despite its limitations, the present study does provide for further research within this field. Recommendations for further research include:

- In this study, the sampling frame used was the top organisations in KZN. It also excluded public entities from the sample frame. Some results were inconclusive due to the relatively small sample size. It is recommended that this study be repeated on a larger scale and based on probability sampling. In this way a wider sample of organisations from all organisations would be included. This would provide a more comprehensive picture of the actual status of EMA within KZN.
- A major limitation was that the questionnaire used multiple tick boxes in assessing the reasons for and against applying EMA in the organisations. It is recommended that future studies should use more Likert rating scales in assessing the respondents' attitudes towards EMA. In this way the level of attitude towards different reasons can be assessed and compared with more accuracy.
- While the survey meets the objectives, there is a general lack of in-depth information obtained from the respondents. It is recommended that a further study be performed using qualitative analysis techniques as this will help to achieve a deeper understanding of the core issues behind environmental sustainability in organizations.
- There is a lack of academic literature in the field of EMA within South Africa. Few studies have been found to specifically address the levels of application of EMA in organisations. It is recommended that further research is conducted, especially in the form of case studies and qualitative research so that the unique aspects of organisations attitudes towards environmental sustainability and application of EMA can be better understood.
- A limiting factor identified was that this research may be somewhat distorted as a result of treating certain industries as one homogeneous group which effectively ignored the many sub-groups within the sector. It is recommended that the future

research breaks down the industry sectors even further for a better understanding of each unique industry.

- Future research topics should include:
    - Extending the research to other provinces of South Africa, so that accurate comparison can be made of the application of EMA across South Africa.
    - Extending the research to concentrate on an industry predominantly based in KZN, such as the textile industry based largely in KZN.
    - Analysing the differences in the awareness and attitude towards environmental sustainability through the use of EMA by comparing light-polluting industries and heavy-polluting industries in KZN.
    - A qualitative study of the motivating or discouraging factors organisations perceive in their future application of EMA, compared against actual factors encountered in EMA by those who have already applied it to their organisation.
    - A case study of EMA currently being conducted on the heavy polluters in the South Durban Basin, located in KZN. This is currently very topical as there has been much current debate relating to strategies to reduce their air emissions.
    - A study into the level of detail to which management is currently analysing their EMA reports being generated and how stringently they are being controlled.
    - A detailed review of the successful implementation of EMA globally and internationally accepted best practices in EMA.

5.7 Summary

The aim of this study was to understand the use of EMA for sustainable development by looking at four main objectives. The objectives were to understand the organisations' awareness of the effects of EMA and their attitudes towards the cost and benefit of EMA. The type of industries were also examined to understand if there was a group awareness of the effects of EMA and a group attitude towards the costs and benefits of EMA. The data collected answered the questions for the first three objectives and confirmed that most

organisations applied EMA or were willing to apply EMA as a cost saving technique. The findings of this study have revealed several interesting facts about the nature of organisations in KZN and their attitude toward environmental sustainability and application of EMA in their organisation. Although there were limitations in the research, this study proved to be beneficial by quantifying and analysing the use of EMA by KZN organisations. In addition further recommendations for future studies were made.

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APPENDIX-1

THE ASSIGNMENT OF THE ENVIRONMENT-RELATED COSTS TO THEIR ENVIRONMENTAL DOMAINS

Summary of Environment-Related Costs by Environmental Domain: ENVIRONMENTAL DOMAIN ENVIRONMENT-RELATED COST CATEGORIES	Air & Climate	Waste Water	Waste	Soil, Surface & Groundwater	Noise & Vibration	Biodiversity & Landscape	Radiation	Other	Total
MATERIAL COSTS OF PRODUCTS									
Raw and Auxiliary Materials									
Packaging Materials									
Operating Materials									
Water									
MATERIAL COSTS OF NON-PRODUCT OUTPUTS									
Raw and Auxiliary Materials									
Packaging Materials									
Operating Materials									
Water									
Energy									
Processing Costs									
WASTE AND EMISSION CONTROL COSTS									
Equipment Depreciation									
Operating Materials									
Water and Energy									
Internal Personnel									
External Services									
Fees and Taxes									
Fines									
Insurance									
Remediation & Compensation									
PREVENTIVE AND OTHER ENVIRONMENTAL MANAGEMENT COSTS									
Equipment Depreciation									
Operating Materials, Water, Energy									
Internal Personnel									
External Services									
Other									
Research and Development costs									
LESS TANGIBLE COSTS									

Source :(IFAC 2005: 55)

APPENDIX-2

QUESTIONNAIRE

UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS

MBA Research Project
Researcher: Timothy Keit (082 5677214)
Supervisor: Prof A Singh (031 260 7061)
Research Office: Ms P Ximba 031-2603587

Dear Respondent,

I, Timothy Keit, an MBA student, at the Graduate School of Business, of the University of KwaZulu-Natal invite you to participate in a research project entitled "The application of Environmental Management Accounting amongst KwaZulu-Natal's top businesses." The aim of this study is to gain an understanding into the use of Environmental Management Accounting (EMA) for sustainable development in South Africa

Through your participation I hope to understand organisations' awareness of the effects of EMA, attitudes towards the cost and benefit of EMA and determine if there is any relationship between the type of industry and their awareness and attitudes towards EMA.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey/focus group. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business, UKZN.

If you have any questions or concerns about completing the questionnaire or about

participating in this study, you may contact me or my supervisor at the numbers listed above.

The survey should take you about 10 minutes to complete. In this questionnaire, you are asked to indicate what is true for you, so there are no "right" or "wrong" answers to any question. Work as rapidly as you can. If you wish to make a comment please write it directly on the booklet itself. Make sure not to skip any questions.
I hope you will take the time to complete this survey. Thank you for participating.

1. Type of organisation
   - o Agriculture, forestry and related services
   - o Mining and quarrying
   - o Manufacture of food products, beverages and tobacco
   - o Manufacture of textiles/apparel
   - o Manufacture of paper and wood products;
   - o Manufacture of chemical and petroleum products
   - o Manufacture of machinery and equipment
   - o Manufacture of motor vehicles, trailers
   - o Other manufacturing
   - o Construction
   - o Wholesale trade
   - o Transportation
   - o Public administration
   - o Other

2. No of employees at your organisation
   - o 1-10

- 11-50
- 50-100
- 100-500
- 500-4999
- 5000+

3. Your position in the organisation
   - Manager
   - Chief financial officer (or similar)
   - Chief Executive Officer (or similar)
   - Other

4. How important is environmental sustainability to your organisation?
   - It is extremely unimportant
   - It is unimportant
   - Neutral
   - It is important
   - It is extremely important

5. Does your current financial management/costing system provide you with the data required to analyse environmental costs?
   - Yes
   - No
   - I do not know

Branching:

If you answered yes then please answer question 6 and 7 below.

If you answered no then please answer question 8 and 9 below.

6 a. Does your organisation generate and record physical environmental information (such as records of kilograms; litres or kilowatt hours used/produced in the manufacturing process) in respect of the following inputs and outputs? (Select more than one if applicable)

- Raw materials (input materials that become part of an organisation's final product)
- Operating materials (input materials that do not become part of the tangible product delivered to a customer)
- Water used
- Energy use (e.g., electricity, gas, coal, fuel oil, solar, wind, water)
- Products, by-products and packaging (tangible products created by the organisation)
- Solid waste (non-hazardous waste in solid form, such as waste paper or non-hazardous solid scrap product)
- Hazardous waste (hazardous waste materials which could be infectious, flammable, toxic or carcinogenic)
- Waste water (water which also contain contaminants of some kind)
- Air emissions including radiation and noise
- Other

6b. Does your organisation generate and record monetary environmental information (such as records of direct costs incurred to dispose waste matter from the manufacturing process) in respect of the following inputs and outputs? (Select more than one if applicable)

- Material cost of product outputs (Includes the purchase costs of natural resources such as water and other materials that are converted into products, by-products and packaging.)
- Material cost of non-product outputs (Includes the purchase costs of energy, water and other materials that become waste and emissions.)
- Waste and emission control costs (The handling, treatment and disposal of Waste and Emissions; remediation and compensation costs related to environmental damage; and any control-related regulatory compliance costs.)
- Prevention and other environmental management costs (Includes the costs of preventive environmental management activities such as cleaner production projects. Also includes costs for other environmental management activities such as environmental planning and systems, environmental measurement, environmental communication and any other relevant activities.)
- Research and development costs (The cost of research and development projects related to environmental issues)
- Less tangible costs (Includes both internal and external costs related to less tangible issues. Examples include liability, future regulations, productivity, company image, stakeholder relations and externalities.)
- Other

7. What is your reason for recording the above listed environmental costs? (Select more than one if applicable)

- It will assist the organisation to control costs better
- It can help innovation in the production process
- It will help us to comply with present/future environmental legislation

- It presents a positive image of the company
- Protecting the environment is the right thing to do.
- Other

8. If you do not record and follow up on environmental costs, why not? (Select more than one if applicable)

- The cost of generating the system outweighed the benefits
- It is just too hard to identify the environmental costs as they are so hidden in other cost accounts
- There are always other priority issues facing the organisation
- Too hard to change the computer system to extract these costs
- Implementation will be difficult due to the training required
- Other stakeholders (e.g. government, customers, suppliers) buy-in into such environmental initiatives are low
- We do not see the benefit to our organisation
- Other

9. If you could implement a system to record the environmental costs separately, how soon would you like to implement it?

- Immediately across the entire organisation
- Immediately on pilot sites first to see the effect on costs
- Within the next 1-5 years
- Only when government imposes legislation enforcing such reporting
- Never
- Don't know

- Other

APPENDIX-3

ETHICAL CLEARANCE.

UNIVERSITY OF
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15 March 2011

Mr TK Keit (205507053)
Graduate School of Business
Faculty of Management Studies
Westville Campus

Dear Mr Keit

PROTOCOL REFERENCE NUMBER: HSS/0107/011M
PROJECT TITLE: The Application of Environmental Management Accounting amongst KwaZulu-Natal's top businesses.

In response to your application dated 3 March 2011, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.
PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....

Professor Steven Collings (Chair)
HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE

cc. Supervisor - Prof A Singh
cc. Mrs Christel Haddon